Appendix A

Correspondence

October 11, 2006

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, Nevada 89009

Re: **Tronox LLC (TRX)**
NDEP Facility ID #H-000539
Nevada Division of Environmental Protection Response to:
Quality Assurance Project Plan (QAPP)
dated August 2006 (received September 29, 2006)

Dear Ms. Crowley,

The NDEP has received and reviewed Tronox's report identified above and provides comments below.

1. Section A8.2, please note that NELAP accreditation is not a substitute for Nevada certification although NELAP accreditation is helpful is expediting the certification process.
2. Laboratory QA Manuals, Section A, please note that the laboratory QA manuals should be included as an appendix to the QAPP.
3. Filtering of Samples, Section B.2, filtering of aqueous samples is not discussed in Section B.2. SOP 7130-04020 states (Section 4.10), "If filtration is required …" The QAPP should clarify if and when filtration will be performed.
4. Database Fields, Section B.10, Section B, page 8 specifies "At a minimum, the database will contain the following fields:" This list should also include the Reporting Limit, Dilution Factor, Qualifier(s) and Reason Code(s).
5. Data Validation, Section D, general comment, it is requested that when data are qualified due to spike recovery issues, including MS, surrogates, and LCS, that the qualifier include a direction of potential bias. Use of + and – signs with the qualifier (e.g. J+) is required. It is also required that the data validation reports include summary tables that contain the <u>percent recovery</u> and <u>RPD</u> values for the applicable samples so that it is clear of the potential bias for each qualified sampled. For example, data qualified due to matrix spike issues should contain a percent recovery for the analyte that exceed the recovery criteria (low or high) and the associated sample to which this qualifier applies.

6. Data Validation, Section D.1.3, partial review should also include Chain-of-Custody items including sample integrity, and cooler/sample temperature.
7. Tables, general comment, a number of tables contain superscripts that appear to refer to a footnote, yet none of the footnotes are provided. Examples include Table A-2, page 10 of 24, reference to "(3)" and Table B-2, page 15 of 24, reference to "(1)."
8. Hexavalent Chromium Holding Time for Soils, Table B-1, page 13 of 24, the correct holding time for soils prepared via EPA Method 3060A for hexavalent chromium is 4 days from digestion to analysis. This specification is consistent with the discussion held with Tronox on 8/22/2006 and captured in the meeting minutes.
9. Radiochemical Analysis, Tables B-2, pages 16 and 17 of 24. Table B-2 lists two different types of radiochemical methods for Radium 226 and Radium 228. The aqueous methods that are listed include 903.1 (alpha) and 904.0 (beta), the listed soil methods are both 901.1/EML HASL 300 (gamma spectroscopy). Please clarify if the intent is to use different radiochemical analyses for the soil and aqueous samples. The alpha and beta methods are also listed in Table B-3. If gamma spectroscopy is planned the appropriate QC checks for the method should be provided in Table B-3.

The QAPP should be revised and resubmitted. It is expected that these comments will be addressed as part of the implementation of the Phase A Scope of Work and that the revision of the QAPP shall not delay the implementation of the Phase A Scope of Work. Please provide a revised QAPP as soon as possible. Please advise the NDEP when this revised document can be expected. If there are any questions please do not hesitate to contact me.

Sincerely,

Brian A. Rakvica, P.E.
Supervisor
Bureau of Corrective Actions
Special Projects Branch
NDEP-Las Vegas Office

CC: Jim Najima, NDEP, BCA, Carson City
Jeff Johnson, NDEP, BCA, Carson City
Shannon Harbour, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Barry Conaty, Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1333 New Hampshire Avenue, N.W., Washington, D.C. 20036
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Rob Mrowka, Clark County Comprehensive Planning, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BEC, 875 West Warm Springs Road, Henderson, Nevada 89015
Craig Wilkinson, TIMET, PO Box 2128, Henderson, Nevada, 89009-7003
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nick Pogoncheff, PES Environmental, 1682 Novato Blvd., Suite100, Novato, CA 94947
Lee Erickson, Stauffer Management Company, 1800 Concord Pike, Hanby 1, Wilmington, DE 19850-5437
Chris Sylvia, Pioneer Americas LLC, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 3846 Estate Drive, Stockton, California 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
David Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544

Attachment A
Tronox Response to NDEP October 11, 2006 Comments
on Quality Assurance Project Plan dated September 28, 2006

NDEP Comment
1 Section A8.2, please note that NELAP accreditation is not a substitute for Nevada certification although NELAP accreditation is helpful is expediting the certification process.

Response

The section will be revised to state, "In the absence of Nevada certification, National Environmental Laboratory Accreditation Program (NELAP) may be considered acceptable until Nevada offers certification for the parameter of interest. The laboratories must submit the necessary IDC and PE data to obtain certification from NDEP, Bureau of Water Quality Planning (BWQP) for all project parameters of interest and methods of interest that Nevada will certify."

Tronox has required that the laboratories performing sample analyses for the Henderson facility be either already certified in Nevada for each parameter/matrix combination or have submitted all the necessary IDC and PE data to obtain certification from BWQP, if the certification is available.

NDEP Comment
2 Laboratory QA Manuals, Section A, please note that the laboratory QA manuals should be included as an appendix to the QAPP.

Response

When final laboratory selection is made for each upcoming investigation the lab QA manuals will be included as an appendix to the QAPP on file at the time of sampling.

NDEP Comment
3 Filtering of Samples, Section B.2, filtering of aqueous samples is not discussed in Section B.2. SOP 7130-04020 states (Section 4.10), "If filtration is required …". The QAPP should clarify if and when filtration will be performed.

Response

In general Tronox will not filter collected water samples, however if filtration is needed for specific sampling events Tronox will provide information in the project specific workplans about field filtration. For the Phase A Source Area Investigation Tronox plans to filter only the groundwater grab samples from the soil borings if the apparent turbidity is high. Both filtered and unfiltered samples will be collected for the analysis of metals and radionuclides. All other analyses of the soil boring groundwater grab samples will be performed on unfiltered samples. The monitor well water analyses will be performed on unfiltered samples.

NDEP Comment
4 Database Fields, Section B.10, Section B, page 8 specifies "At a minimum, the database will contain the following fields:" This list should also include the Reporting Limit, Dilution Factor, Qualifier(s) and Reason Code(s).

Response

These fields are included in the database and Tronox will add the field description to the QAPP.

NDEP Comment
5 Data Validation, Section D, general comment, it is requested that when data are qualified due to spike recovery issues, including MS, surrogates, and LCS, that the qualifier include a direction of potential bias. Use of + and – signs with the qualifier (e.g. J+) is required. It is also required that the data validation reports include summary tables that contain the percent recovery and RPD values for the applicable samples so that it is clear of the potential bias for each qualified sampled. For example, data qualified due to matrix spike issues should contain a percent recovery for the analyte that exceed the recovery criteria (low or high) and the associated sample to which this qualifier applies.

Response

When data are qualified by validators and a direction of potential bias is clear, based on results in the data set, then + or – signs will be added to indicate the possible bias. Summary tables with percent recovery and RPD data indicating the need for data qualification will be included with the data validation memos.

NDEP Comment
6 Data Validation, Section D.1.3, partial review should also include Chain-of-Custody items including sample integrity, and cooler/sample temperature.

Response

These items are included in the partial review and will be described in the QAPP.

NDEP Comment
7 Tables, general comment, a number of tables contain superscripts that appear to refer to a footnote, yet none of the footnotes are provided. Examples include Table A-2, page 10 of 24, reference to "(3)" and Table B-2, page 15 of 24, reference to "(1)."

Response

The superscripts and footnotes for the tables will be corrected.

NDEP Comment
8 Hexavalent Chromium Holding Time for Soils, Table B-1, page 13 of 24, the correct holding time for soils prepared via EPA Method 3060A for hexavalent chromium is 4 days from digestion to analysis. This specification is consistent with the discussion held with Tronox on 8/22/2006 and captured in the meeting minutes.

Response

The 7 day leachate holding time was derived form EPA 3060A Sec. 6.4, however the holding time will be changed to 4 days based on the meeting minutes cited above.

NDEP Comment
9 Radiochemical Analysis, Tables B-2, pages 16 and 17 of 24. Table B-2 lists two different types of radiochemical methods for Radium 226 and Radium 228. The aqueous methods that are listed include 903.1 (alpha) and 904.0 (beta), the listed soil methods are both 901.1/EML HASL 300 (gamma spectroscopy). Please clarify if the intent is to use different radiochemical analyses for the soil and aqueous samples. The alpha and beta methods are also listed in Table

B-3. If gamma spectroscopy is planned the appropriate QC checks for the method should be provided in Table B-3.

Response

Tables B-2 and B-3 will be adjusted to reflect Tronox's intent to require gamma spectroscopy for the analysis of Ra-226 and Ra-228 in soil and EPA 903.1 for Ra-226 and EPA Method 904.0 for Ra-228 in water. The laboratories performing the radiochemical analyses have advised us that the analysis of Ra-226 and Ra-228 in water by gamma spectroscopy is technically not appropriate and insufficiently sensitive to meet the project DQLs, respectively.

FINAL

Meeting Minutes

Project: Tronox (TRX)
Location: Conference Call
Time and Date: 9:30 AM, Thursday, April 02, 2009
In Attendance: NDEP – Brian Rakvica, Shannon Harbour
Neptune –Paul Black, Dave Gratson (for NDEP)
Environmental Answers – Keith Bailey (for TRX)
Crowley Environmental – Susan Crowley (for TRX)
AECOM –Robert Kennedy (for TRX)
Laboratory Data Consultants - Rich Amano (for TRX)

CC: Jim Najima

1. The meeting was held to discuss electronic data deliverable (EDD) and data validation (DV) questions.
2. Historically TRX (BMC) has reported non-detects for organics on the adjusted quantitation limit (QL) and inorganics based on an adjusted method detection limit (MDL). Note an MDL is a lower value than a QL.
3. TRX will need to provide adjusted QL and adjusted MDL in the DVSR database. The MDLs should be sample specific to account for items such as dilutions, and percent moisture (solid samples).
4. NDEP stated that non detects, both inorganic and organic, should be reported down to the sample specific MDL (SQL) in future reports. This is consistent with NDEP's Supplemental Guidance for Data Validation dated March 18, 2009
5. TRX agreed to use the terms SQL for sample specific MDL and PQL for sample specific QL but will provide explicit descriptions in the DVSRs as to how these are derived.
6. TRX stated that they were concerned about false positives with current rules. NDEP stated that profession judgment is allowed and should be used in the case of potential false positives.
7. NDEP stated that for risk assessment half the detection limit (DL) should be used in the case of NDs.
8. NDEP stated that these new validation rules for blanks do not apply for estimated detection limits (EDLs) for high resolution mass spectroscopy methods.
9. TRX's EDD for asbestos results should provide the raw fiber count in the results field and the asbestos sensitivity value in the sensitivity field. Fiber type is accounted for by chemical name as follows: total (both short and long) chrysotile, long chrysotile, total amphibole, long amphibole.
10. TRX stated that the field names in the Equis database could not be modified; however, the generated Access database files could have modified field names.
11. NDEP stated that the NDEP prefers the two sigma error for radionuclide results be based on the total error reported but that the two sigma error may also be based on the counting error only as long as it is clarified in the DVSR. Also, the DVSR should be clearly state if the error provided is not two sigma.
12. NDEP stated that there is a field specified for the minimal detectable activity (MDA) in the EDD design as discussed in the February 27, 2009 Guidance on Uniform Electronic Data Deliverables.

13. AECOM stated that the February 27, 2009 Guidance on Uniform Electronic Data Deliverables had not been reviewed. NDEP will provide this guidance to AECOM via email. **ACTION ITEM.** (NDEP noted that any comments to this Supplemental Guidance should be submitted to the NDEP by April 10, 2009.)
14. TRX stated that the contract between AECOM and TRX for future environmental services had not been finalized.
15. In response to TRX's concern with the rejection criteria for pesticide and Aroclor laboratory control sample (LCS) recovery actions and Internal Standards validation. NDEP clarified that professional judgment is allowed with proper justification and/or description in the DVSR.
16. TRX stated that a modified Quality Assurance Project Plan (QAPP) would be submitted by the end of the month. The modified QAPP would contain SOPs for Organic Acids and 1668 PCBs in addition to revisions on data validation based on this conference call.
17. NDEP requested that TRX incorporate the "stages" terms found in EPA's latest Superfund Guidance (EPA 540-R-08-005, Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use). TRX agreed to incorporate this language and to additionally provide a redline-strikeout version of the modified QAPP to expedite NDEP review.
18. NDEP stated that the modifications to the QAPP should not delay field implementation of the Phase B Source Area Investigation.

June 1, 2009

Susan Crowley (Contractor)
C/O Tronox LLC
PO Box 55
Henderson, NV 89009

Re: **Tronox LLC (TRX)**
NDEP Facility ID #H-000539
Nevada Division of Environmental Protection (NDEP) Response to:
Quality Assurance Project Plan, Tronox LLC Facility, Henderson, Nevada
Dated: May 26, 2009

Dear Ms. Crowley,

The NDEP has received and reviewed TRX's above-identified Quality Assurance Project Plan (QAPP) and provides comments in Attachment A. A revised QAPP or errata should be submitted based on the comments found in Attachment A. Please advise the NDEP **by June 8, 2009** regarding the schedule for this resubmittal. TRX should additionally provide an annotated response-to-comments letter as part of the revised submittal.

Please contact the undersigned with any questions at sharbour@ndep.nv.gov or (702) 486-2850 extension 240.

Sincerely,

Shannon Harbour, P.E.
Staff Engineer III
Bureau of Corrective Actions
Special Projects Branch
NDEP-Las Vegas Office
Fax: 702-486-5733

SH:bar:sh

CC: Jim Najima, NDEP, BCA, Carson City
Brian Rakvica, NDEP, BCA, Las Vegas
Keith Bailey, Environmental Answers LLC, 3229 Persimmon Creek Drive, Edmond, OK 73013
Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr, Henderson NV 89014
Mike Skromyda, Tronox LLC, PO Box 55, Henderson, NV 89009
Barry Conaty, Holland & Hart LLP, 975 F Street, N.W. Suite 900, Washington, D.C. 20004
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Ebrahim Juma, DAQEM, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Mark Paris, Landwell, 875 West Warm Springs, Henderson, NV 89011
Craig Wilkinson, TIMET, PO Box 2128, Henderson, Nevada, 89009-7003
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nick Pogoncheff, PES Environmental, 1682 Novato Blvd., Suite100, Novato, CA 94947
Lee Erickson, Stauffer Management Company, P.O. Box 18890, Golden, CO 80402
Michael Bellotti, Olin Corporation, 3855 North Ocoee Street, Suite 200, Cleveland, TN 37312
Curt Richards, Olin Corporation, 3855 North Ocoee Street, Suite 200, Cleveland, TN 37312
Paul Sundberg, Montrose Chemical Corporation, 10733 Wave Crest Court, Stockton, CA 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Dave Gratson, Neptune and Company, Inc., 1505 15th Street, Suite B, Los Alamos, NM 87544

Attachment A

1. Section A.1, page 1 of 14, 2nd paragraph, the reference to the Field Sampling and Analysis Plan (FSAP) should be updated. The Basic Remediation Company (BRC) Standard Operating Procedures (SOPs) have been periodically updated since then. TRX should also include a reference to the most current SOPs in Section E.
2. Section A.7.a, page 11 of 14, 5th paragraph, TRX should consider using collision cell ICP/MS (or another suitable method) for the metal analyses that are subject to interferences.
3. Section B.2.2, page 1 of 9, TRX states that field filtration may be required if the turbidity exceeds 10 NTU. TRX should review the BRC SOP-5: Water Sampling and Field Measurements and revise this section for consistency with this SOP.
4. Section B.4, table, page 5 or 9, PTS Laboratories are listed in this table; however, no Quality Assurance (QA) manual from this laboratory was provided in Appendix B. Please forward their QA Manual for review and inclusion in this QAPP or revise this Section accordingly.
5. Section E, reference NDEP 2009(e), TRX should note that this guidance has been updated with *Unification of Electronic Data Deliverables (EDD), NDEP-Required EDD Format* (NDEP guidance letter, May 20, 2009).
6. Figure A-1, TRX should provide an update to this organization chart Figure as follows:
   a. Northgate Environmental Management, Inc. is providing project oversight for the environmental investigative activities and AECOM is no longer providing any services at the Site.
   b. Susan Crowley is no longer directly employed by TRX.
7. Table A-1, Distribution List, NDEP has the following comments:
   a. Todd Croft, NDEP, should be removed from the distribution list.
   b. Joanna Otani-Fehling is incorrectly listed as associated with Neptune and Company.
8. Table B-1, pages 19-22 of 37, NDEP has the following comments:
   a. General comment, this table appears to have two sections: soil sampling requirements and groundwater sampling requirements. Please revise this table to clarify this.
   b. Page 19 of 37, the number "1" is used in two separate instances to reference a footnote. The first is for the "Container" heading (this footnote reference is on all four pages on the Table) and the second is for the preservative for hexavalent chromium. There are two number 1 footnotes listed on this Table: on page 20 and on page 22. Please revise this Table for clarity.
9. Table B-3, page 28 of 37, the Control Limits for Organic Acids - Method Blanks uses the term MRL. It is likely this should this be replace with the term is PQL. If not, please justify why MRL is being used.

Tronox LLC (TRX)
NDEP Facility ID #H-000539
Nevada Division of Environmental Protection (NDEP) Response to:
Quality Assurance Project Plan, Tronox LLC Facility, Henderson, Nevada
Dated: June 18, 2009

Response to Comments

Comment

1. Section A.1, page 1 of 14, 2nd paragraph, the reference to the Field Sampling and Analysis Plan (FSAP) should be updated. The Basic Remediation Company (BRC) Standard Operating Procedures (SOPs) have been periodically updated since then. TRX should also include a reference to the most current SOPs in Section E.

Response

1. *The text in Section A.1, page 1 of 14 is amended to include the reference of the Revised Phase B Site Investigation Work Plan, (AECOM, December 2008), this document reference and the updated BRC SOPs dated December 2008 were added to Section E.0 Reference, page 1 of 3.*

Comment

2. Section A.7.a, page 11 of 14, 5th paragraph, TRX should consider using collision cell ICP/MS (or another suitable method) for the metal analyses that are subject to interferences.

Response

2. We have reviewed the analytical benefits of ICP/MS collision cell technology to reduce the matrix interference during the groundwater analysis of arsenic and selenium. The text in Section A.7.3, page 11 of 14, 5th paragraph, is amended to reflect this change, along with the associated method reference note in Table B-2, the amended MDLs and PQLs in Table A-2, and the addition of Table A-2 note (No. 5).

Comment

3. Section B.2.2, page 1 of 9, TRX states that field filtration may be required if the turbidity exceeds 10 NTU. TRX should review the BRC SOP-5: Water Sampling and Field Measurements and revise this section for consistency with this SOP.

Response

3. *The text in Section B.2.2, page 1 of 9 is amended to reflect the field filtration requirements as stated in the BRC SOP-5, as follows:*

   Soil, soil gas, and groundwater sampling procedures are discussed in Section 3.0 of the FSAP. SOPs are included as separate documents. Field filtration of water samples for metals and radiochemical analyses may be required on a work plan-specific basis; however, in general routine groundwater samples will not be filtered prior to analysis. In general, field filtration is required when turbidity exceeds 10 nephelometric turbidity units (NTUs) indicating the presence of suspended sediment. As indicated in the FSAP for the Source Area investigation, both filtered and non-filtered samples will be collected for the groundwater grab samples because they are expected to be cloudy. Comparison of the filtered versus non-filtered analytical results will provide data relative to the effect of field filtering

Comment

4. Section B.4, table, page 5 or 9, PTS Laboratories are listed in this table; however, no Quality Assurance (QA) manual from this laboratory was provided in Appendix B. Please forward their QA Manual for review and inclusion in this QAPP or revise this Section accordingly.

Response

4. *Appendix B is revised to include the Quality Assurance (QA) manual for PTS Laboratories, Inc..*

Comment

5. Section E, reference NDEP 2009(e), TRX should note that this guidance has been updated with *Unification of Electronic Data Deliverables (EDD), NDEP-Required EDD Format* (NDEP guidance letter, May 20, 2009).

Response

5. *The updated NDEP Guidance document is amended to Section E, References and added to Appendix C.*

Comment

6. Figure A-1, TRX should provide an update to this organization chart Figure as follows:

a. Northgate Environmental Management, Inc. is providing project oversight for the environmental investigative activities and AECOM is no longer providing any services at the Site.
b. Susan Crowley is no longer directly employed by TRX.

Response

6. *The text in Section A.4.1, page 2 of 14 is amended to the reflect the current Tronox project organization, along with the revised Figure A-1, of the Northgate Project Team Organization Chart. The revised Section A.4.1 text is shown below.*

Tronox Program Manager

The Tronox Program Managers, Susan Crowley and Dr. Keith Bailey are primarily responsible for project direction and decisions concerning technical issues and strategies, budget and schedule. Ms. Crowley is a Nevada-Certified Environmental Manager (CEM # 1428, expiring March 8, 2011) and is the person who serves as the primary point of contact for regulatory and environmental issues pertinent to the Site. She is located at the Tronox Henderson Facility. Her telephone number is (702) 651-2234. Ms. Crowley and Dr. Bailey will be supported by Tronox technical specialist Mr. Tom Reed (hydrogeologist).

Consultant Project Manager

AECOM's consultant project team withdrew from the Tronox Henderson project affect May, 15 2009. Northgate staff has replaced AECOM for the continuation of the Phase B Site Investigation. Figure A-1 presents the Northgate project team organization chart.

Comment

7. Table A-1, Distribution List, NDEP has the following comments:
    a. Todd Croft, NDEP, should be removed from the distribution list.
    b. Joanna Otani-Fehling is incorrectly listed as associated with Neptune and Company.

Response

7. *The Distribution List, Table A-1, was amended by removing Todd Croft from the NDEP, amending Joanna to Joanne Otani-Fehling and removing her association with Neptune and Company.*

Comment

8. Table B-1, pages 19-22 of 37, NDEP has the following comments:
    a. General comment, this table appears to have two sections: soil sampling requirements and groundwater sampling requirements. Please revise this table to clarify this.
    b. Page 19 of 37, the number "1" is used in two separate instances to reference a footnote. The first is for the "Container" heading (this footnote reference is on all four pages on the Table) and the second is for the preservative for hexavalent chromium. There are two number 1 footnotes listed on this Table: on page 20 and on page 22. Please revise this Table for clarity.

Response

8. Table B-1, pages 19-22 of 37 are amended as follows:
    a. The table is amended to show the associated matrices of aqueous or soil at the top of each page and the font size was enlarged for clarity.
    b. The hexavalent chromium footnote on page 19 of 37 was amended to number "4" and all footnotes are located on the last page of Table B-1.

Comment

9. Table B-3, page 28 of 37, the Control Limits for Organic Acids - Method Blanks uses the term MRL. It is likely this should this be replace with the term is PQL. If not, please justify why MRL is being used.

Response

9. Table B-3, page 28 of 37, the Organic Acids, method blank reference to the MRL is amended to reflect the PQL.

Appendix B

Laboratory Quality Manuals

Alpha Analytical, Inc.

Sparks, NV

Alpha Analytical, Inc.

Sparks, NV

QC Limits May 2009

Analyte	PQL	LCS	LCSD	MS	MSD	RSD
Dimethyl phosphorodithioic acid	2.5	50-150	50-150	50-150	50-150	20
Benzenesulfonic acid	0.5	60-140	60-140	60-140	60-140	20
Phthalic acid	0.5	60-140	60-140	60-140	60-140	20
Diethyl phosphorodithioic acid	0.5	60-140	60-140	60-140	60-140	20
4-Chlorobenzenesulfonic acid	0.5	60-140	60-140	60-140	60-140	20

QUALITY ASSURANCE MANUAL
VOLUME I

Section 1

Identification Form

QUALITY ASSURANCE MANUAL IDENTIFICATION FORM

Document Title:	Quality Assurance Manual for Alpha Analytical Inc.
Organization Title:	Alpha Analytical, Inc.
Address:	Alpha Analytical, Inc. 255 Glendale Ave., Ste. 21 Sparks NV 89431
Responsible Officials:	Roger L. Scholl, Ph.D. Laboratory Director Phone No: (775)-355-1044 ext 127 Randy Gardner Laboratory Manager Phone No: (775)-355-1044 ext 157 Walter J. Hinchman Quality Assurance Officer Phone No.)775)-355-1044 ext 119
Prepared By:	Walter J. Hinchman Quality Assurance Officer Alpha Analytical, Inc. 255 Glendale Ave., Ste. 21 Sparks NV 89431
Plan Coverage:	This is a document describing Alpha Analytical's Quality Assurance Plan (QAP). The plan covers analytical chemistry data generated from samples submitted to Alpha for analysis. The coverage in this plan will be as resources and priorities allow.

Laboratory Approval:

(1) Signature: Roger Scholl Date: January, 2009
Name: Roger L. Scholl, Ph.D.
Title: Laboratory Director

(2) Signature: Randy M Date: January, 2009
Name: Randy Gardner
Title: Laboratory Manager

(3) Signature: Walter Hinchman Date: January, 2009
Name: Walter Hinchman
Title: Quality Control Officer

QUALITY ASSURANCE MANUAL
VOLUME I

Section 2

Table of Contents

TABLE OF CONTENTS
QA PLAN ELEMENTS
VOLUME I

TABLE OF CONTENTS
QA PLAN ELEMENTS
VOLUME II

QUALITY ASSURANCE MANUAL
VOLUME I

Section 3

Statement of Policies

ALPHA ANALYTICAL, INC.
QUALITY ASSURANCE MANUAL

3.0 INTRODUCTION

3.0.1 The quality assurance manual describes our quality systems incorporating laboratory activities to provide our clients with data of known quality with which to demonstrate regulatory compliance and for other decision-making purposes.

3.0.2 This system includes the description of analytical methods, how methods are continuously monitored and evaluated and how their performance is documented.

3.0.3 Our quality assurance program is designed to meet the requirements established in the use of Performance Based Measurements Systems (PBMS) in environmental testing and to provide the foundation for PBMS implementation of these standards.

3.0.4 References

The following references provides the foundation of this Quality Assurance Manual (QAM) to include the standardization and organization while provided guidance on the implementation of our quality systems.

3.0.4.1 National Environmental Laboratory Accreditation Conference's (NELAC) Chapter 5 Quality System, Version 5, June 2003.

3.0.4.2 National Environmental Laboratory Accreditation Conference's (NELAC) Chapter 2 Proficiency Testing, Version 5, June 2003.

3.0.4.3 Quality Systems Manual (QSM) for Environmental Laboratories, Department fo Defense, Final Version 3, January 2006.

Note: NELAP and DOD incorporated the requirements of ISO 9001 and ISO 9002 that are relevant to the scope of environmental testing services into their quality systems documents.

Therefore, by complying with NELAC and DOD/QSM, Alpha's quality system have been established in accordance with ISO 9001 and ISO 9002.

3.1 STATEMENT POLICY FROM MANAGEMENT

3.1.1 It is Alpha's policy and commitment from top management to perform all activities under good professional practices and to produce quality analytical data while servicing our clients under the guidelines of NELAC as described in this Quality Assurance Manual.

3.1.2 It is Alpha's policy and commitment from top management to define and document our quality assurance policies, systems, programs, procedures and instructions to the extent necessary to assure the quality of the test results.

3.1.3 It is Alpha's policy and commitment from top management to provide the necessary guidance and to require all personnel concerned with testing activities to throughly familiarize themselves with the quality system and to implement the policies and procedures in their work.

3.1.4 It is Alpha's policy and commitment from top management to ensure the quality systems are communicated to, understood by, available to and implemented by the appropriate personnel.

3.1.5 This commitment includes Alpha's CEO, President, Laboratory Director, Laboratory Manager and QA Officer.

3.2 PURPOSE

The purpose of the QA program is to:

a) Provide a consistent framework for the generation of analytical data in support of the programs enforced by various regulatory agencies;

b) Establish standard practices which permit inter-laboratory comparison of data; and,

c) Establish procedures for demonstrating that analytical systems are in control.

3.3 OBJECTIVES

More specifically, the objectives of the QA program are to:

a) Provide a uniform basis for sample handling, instrument conditions, methods control, performance evaluations, and analytical data generation and reporting that will provide legally defensible results in a court of law;

b) Estimate the quality of each analytical system, which includes Precision, Accuracy, Representativeness, Comparability, and Completeness, "PARCC", that is sufficient for the needs of each project;

c) Assist in the early recognition of deficiencies which affect the quality of data;

d) Enable Alpha Analytical to identify and implement actions that are necessary to ensure the validity of laboratory data; and,

e) Require sufficient documentation to verify the quality of data submitted.

3.4 SCOPE

3.4.1 This document outlines the purpose, policies, organization, and operations of the QA Program established to support chemical analyses conducted for various programs and projects. All routine laboratory tasks have written Standard Operating Procedures (SOP's) to increase production uniformity, and are consistent with sound scientific principles. Advances in quality control procedures will be reflected in updated versions of this plan.

3.4.2 Implementation of this QA plan will help ensure the validity of data and provide a reliable foundation on which to base decisions. It is a basic policy of Alpha Analytical to provide accurate, precise, complete, and representative determinations of chemical constituents in submitted samples, and to sufficiently document the analytical QC procedures.

3.4.3 In implementing the QA Program, it is important to understand the difference between QA and QC.

QA refers to the system through which the organization provides assurance that monitoring of quality-related activities has occurred. Frequently, QA is interpreted as a record-keeping system to ensure documentation of all activities, including traceability, completeness, and security of documents.

QC refers to specific actions taken to guarantee that system performance is consistent with established limits regarding accuracy, precision, and comparability of results. QC activities are conducted within a system of QA for proof that QC exists.

3.4.4 Implementation of the QA Program is designed to assure data are collected under in-control conditions, rather than assuring documentation of poorly conducted analyses. The QA Program is intended to establish a QA system and proper QC guidelines and procedures.

3.5 APPLICATION

3.5.1 The emphasis of this QA Program is on activities which generate analytical data, and includes those aspects of field sampling that may affect the integrity of samples. Alpha is not a sampling company; and therefore, have no ultimate control over the QA/QC procedures conducted in the field. Therefore our role is one of advising field samplers as to the acceptable practices.

3.5.2 Specific requirements are provided for sampling and chemical analysis of groundwater, surface water, soil, and sediment samples. In general, principles described herein are applicable to most field/laboratory activities.

3.5.3 This program has been written and designed specifically for Alpha Analytical and represents the system used by our staff during normal operating conditions. The QA plan may be superseded or appended with different or additional QA/QC activities related to a specific project or Statement of Work (SOW).

3.5.4 If a SOW or Quality Assurance Project Plan (QAPP) is used to supplement or append this QA/QC plan, then the Data Quality Objectives (DQO's) should be reflected in that particular QA/QC data package when requested.

3.6 HIGH PROFILE POLICIES

3.6.1 Ethics and Data Integrity Policy

The QA Manual and EPA methods are written as a set of policies and procedures that define what laboratory personnel are required to do; however, our ethics policies and our Laboratory Ethics Program, Appendix G, is written to ensure that employees are educated as to what they are not allowed to do.

Our data integrity training program includes discussions regarding the critical need for honesty, full disclosure in all analytical reporting and other related data integrity issues.

3.6.1.1 It is Alpha's policy to provide ethics and data integrity training to all new employees and provide this training to current employees on an annual basis.

3.6.1.2 Alpha Analytical has a zero tolerance policy regarding unethical situations, scientific misconduct and intentional lack of compliance with required procedures.

3.6.1.3 It is Alpha's policy to encourage laboratory personnel to come forward and report inappropriate activities.

3.6.1.4 It is managements philosophy and Alpha's policy to be proactive in the training, and education in the prevention of improper, unethical or illegal actions.

3.6.1.5 It is managements philosophy and Alpha's policy to clearly document how all analytical values were obtained and to supply the data user all data necessary to re-create and/or document final data results.

3.6.2 Manual Integration Policy

Manual integration is an important subsection of data integrity, but is delineated to bring attention to and highlight the importance of this issue. Our manual integration

training program includes discussions regarding the critical need for honesty, full disclosure in all analytical reporting and other related data integrity issues.

3.6.2.1 It is Alpha's policy to produce analytical data using automated and manual integration practices, in a manner that is non-arbitrary (meaning standards, control samples, and client samples are all integrated using consistent integration parameters).

3.6.2.2 It is Alpha's policy to produce analytical data using automated and manual integration practices, in a manner that is rational and can be backed up with the reason for a particular integration practice.

3.6.2.3 It is Alpha's policy to encourage laboratory personnel to come forward and report inappropriate activities.

3.6.3 Subcontract Laboratories

3.6.3.1 It is Alpha's policy to subcontract out analytical services not performed by Alpha, to laboratories that have been certified for those methods, to the best of our ability.

3.6.3.2 It is Alpha's policy, when subcontracting work because of unforeseen reasons (e.g., workload, need for further expertise or temporary incapacity, etc.), or on a continuing basis, this work is placed with:

a) a laboratory accredited under NELAP for the tests to be performed, or

b) with a laboratory that meets applicable statutory and regulatory requirements to perform the required analytical testing.

3.6.3.3 It is Alpha's policy to first subcontract analytical services, not performed by Alpha, to those laboratories that have been requested by the client and when possible, gain the approval of the client in writing.

3.6.3.4 If for any reason the subcontract laboratory is unable to perform the duties, then Alpha will procure an alternate laboratory of our choosing.

3.6.3.5 It is Alpha's policy to maintain a register of subcontract laboratories and a record or the evidence of appropriate certification.

3.6.3.6 It is Alpha's policy, to report all data issued by the subcontract laboratory on their official letter head and not retype and or reissue hard copy data on Alpha's letter head. If this can not be accomplished, the subcontract laboratory data must be clearly labeled as to the laboratory conducting the analysis.

3.6.3.7 It is the subcontract laboratories responsibility and business liability to ensure they have and maintain the appropriate State Certifications, method and compound certifications, program certifications and any other certifications or approvals necessary to perform the related tasks. It is the responsibility of all subcontract laboratories to ensure Alpha has been notified of those samples that cannot be analyzed due to:

- Inadequate sample / extraction holding time;
- Inadequate sample volume;
- Inappropriate sampling procedures;
- Inappropriate sample containers/preservatives;
- Loss of instruments or power failure;
- Loss of certifications or approvals to perform the requested task; or,
- Any other circumstances that would prevent the appropriate or adequate analysis of those affected samples.

3.6.3.8 It is Alpha's policy not to assume any liability of any subcontract laboratory data or the preponderance of the defenseability, documentation or data quality produced by any subcontract laboratory. This is the responsibility of the subcontract laboratory and their respective certifying agents or authorities.

3.6.4 Training Policy

3.6.4.1 It is Alpha's policy to hire personnel which have appropriate education and/or On-the-Job-Training (OJT) adequate to perform their job duties.

3.6.4.2 It is Alpha's policy to conduct a training program that includes initial and continuing training of laboratory personnel.

3.6.4.3 It is Alpha's policy to ensure the competence of technical staff personnel who operate analytical equipment, evaluate results, and sign test reports.

However, it is the responsibility of the trainee to ensure they have received adequate initial and continuing training and the

documentation of that training to achieve and maintain skills commensurate with their responsibilities.

3.6.5 Policy for the Procurement of Supplies and Materials

3.6.5.1 It is Alpha's policy to evaluate and select supply vendors, chemicals, reagents and any other supplies which are critical to method performance to include additional testing to verify their quality before use.

3.6.5.2 It is Alpha's policy to purchase the item that meets or exceeds method specification, but not necessarily those brand name items specified in the method. In addition, it is Alpha's policy to determine what testing may be required to evaluate usability of supplies and materials.

3.6.5.3 It is Alpha's policy to purchase services and material supplies that affect the quality of environmental testing, at a level which will meet and/or exceed method/project criteria.

3.6.5.4 It is Alpha's policy to maintain purchasing documents for items affecting data quality.

3.6.5.5 It is Alpha's policy to maintain control over procured items such as containers, solvents, standards, etc. that have been recognized to be critical to environmental laboratories.

3.6.6 Computer Hardware/ Software Operation Policy

It is the policy of the laboratory, that the computer department has the responsibility for all software loading, upgrades, coding changes, debugging and hardware/software retirements.

It is Alpha's policy to ensure that:

a) policies and procedures are in place to protect the clients' electronic storage and transmission of results;

b) Only authorized, trained personnel are allowed to perform these functions;

c) Only authorized software is to be loaded on any company computer;

d) Only authorized, trained personnel are allowed to use company connections to the network or internet; and

e) No hardware, software, or raw data be removed from the laboratory without without written authorization.

3.6.7 Policy for Testing of Proficiency Evaluation (PE) Samples

3.6.7.1 It is Alpha's policy to ensure adequate quality control procedures are in place for monitoring the validity of environmental testing through the participation of a proficiency-testing program.

3.6.7.2 It is Alpha's policy to participate in two single-blind, single-concentrate Proficiency Testing (PT) studies, per year for each field of proficiency testing to maintain accreditation.

3.6.7.3 It is Alpha's policy to obtain PE samples from a Proficiency Testing Oversight Body (PTOB) / Proficiency Test Provider Accreditor (PTPA) approved PT provider.

3.6.7.4 It is Alpha's policy to analyze and submit PE sample results to the PT provider within their allotted time schedule as defined by the PT provider.

3.6.7.5 It is Alpha's policy to analyze and treat PE samples in a manner consistent with real environmental samples using the same staff, methods, procedure, equipment, facilities, etc. as used for routine analysis of that sample.

3.6.7.6 It is Alpha's policy that all staff members comply with the following restrictions on the transfer of PE samples and communication of PE sample results prior to the time results of the study are released:

a) No staff member shall send any PE sample to another laboratory for analysis for which accreditation is being requested;

b) No staff member shall knowingly receive any PE sample or portion of a PE sample from another laboratory for any analysis for which the sending laboratory is seeking accreditation;

c) No staff member shall communicate with any individual at another laboratory concerning the PE sample; and,

d) No staff member shall attempt to obtain assigned values of any PE sample from the PE provider.

3.6.8 Policy of Laboratory Organization and Staffing

It is Alpha's policy to have an organization that:

a) has sufficient managerial and technical personnel with the authority and resources needed to carry out their duties and to identify the occurrence of departures from the quality system or from the procedures for performing environmental tests, and to initiate actions to prevent or minimize such departures;

b) has processes to ensure that management and staff personnel are free from any undue internal and external commercial, financial and other pressures and influences that may adversely affect the quality of their work;

c) has policies and procedures to ensue the protection of client's confidential information and proprietary rights including procedures for protecting the electronic storage and transmission of results;

d) has policies and procedures to avoid involvement in any activities that would diminish confidence in its competence, impartiality, judgement or integrity;

e) defines the organization and management structure of the laboratory, and the relationship between quality management, technical operations, and support services;

f) specifies the responsibility, authority and interrelationships of personnel who manage, perform or verify work affecting quality of the environmental tests;

g) provides adequate supervision of environmental testing staff, including trainees, by persons familiar with methods and procedures, purpose of each environmental test, and with the assessment of the environmental test results;

h) in-powers the technical management with the overall responsibility for the technical operations and for providing the resources needed to ensure the required quality of laboratory operations;

i) has a member of the technical staff appointed as the quality assurance officer who, irrespective of other duties and responsibilities, has the defined responsibility and authority for ensuring that the quality system is implemented and followed at all times. In addition, it is Alpha's policy to ensure the quality assurance officer has direct access to the highest level of management at which decisions are made on laboratory policies and resources;

j) appoints deputies for key managerial personnel, including the technical director and quality assurance officer; and

k) participates in a proficiency testing program to qualify for and maintain accreditation.

3.6.9 Waste Disposal Policy

A complete description of our Hazardous Waste SOP is found in Appendix C. There are two basic types of wastes within Alpha: 1) Hazardous, and 2) Non-hazardous. The important distinction between the two is that **all** hazardous waste generated at the 255 Glendale Avenue laboratory has to stay within that facility. **NO** hazardous waste can be generated, then moved to the Freeport facility behind the laboratory.

It is Alpha's policy to have a waste disposal and pollution prevention program that:

a) has processes to ensure the safe handling and disposal of waste streams received or generated by Alpha;

b) has policies and procedures to ensue the safe protection of employees, employees health, clients, visitors and the general safe protection of our environment;

c) is throughly understood by the safety officer, waste disposal officer, employees, and anyone using, or contributing to the waste streams;

d) conducts continuous monitoring and training of employees regarding the proper and safe handling of generated wastes and their potential health concerns; and

e) has policies and procedures to ensure Alpha meets the requirements and documentation set forth by the Resource Conservation and Recovery Act (RCRA).

3.6.10 Change in Ownership / Business Termination

For a change in ownership the following policies are to be met:

3.6.10.1 Alpha agrees to be accountable for any analyses, data and reports generated up to the time of legal transfer of ownership.

3.6.10.2 The buyer must agree in writing to be accountable for any analyses, data and reports generated after the legal transfer of ownership occurs.

3.6.10.3 It is Alpha's policy to ensure that analytical records are maintained or transferred according to the clients instructions, if either a change in ownership or business termination were to occur.

3.6.11 Service to Clients

The environmental testing business is a service oriented business, requiring a large amount of interaction with our clients. It is in our best interest, to emphasis the importance of conducting client communication in an environment that is professional, informational and confidential.

3.6.11.1 It is Alpha's policy to cooperate with our clients or their representatives to clarify the client's request and to monitor the analytical performance in relation to the work performed on their project, and to provide this service in a climate that ensures confidentiality to other clients.

3.6.11.2 Service to clients is a proactive engagement with our clients which requires staff to notify clients of problem situations such as:

a) incorrect, obsolete or improper method requests;

b) the need to optimize methods to ensure data quality objectives are met for difficult matrix or poor performing analytes;

c) lack of project guidance documents, such as the QAPP, or the need for clarification of requirements in the document; and

d) problems with sampling or analysis that may impact results (e.g., improper preservation of sample).

3.6.12 Customer Complaints

3.6.12.1 It is Alpha's policy to respond to complaints and/or problems in a reasonable time frame and in a courtesy manner that is both polite and professional to the customer.

The documentation of customer complaints, the response to these complaints, and their resolution is useful information to improving the quality of our client service. This information, as part of our quality system, helps identify patterns of problems and is important in formulating a corrective response to those problems.

3.7 GENERAL POLICIES

3.7.1 Equipment Purchase Policy - see section 10.02

3.7.2 Equipment Operation Policy - see section 10.1

3.7.3 Equipment Maintenance Policy - see section 10.5.1

3.7.4 Method Validation Policy - see section 8.1.2

3.7.5 Transcription and Calculation Error Policy - see section 12.3.4

3.7.6 Calibration and Reporting Policy - see section 9.1

3.7.7 Nonconforming Environmental Work - see section 13.0.1

3.7.8 The Use of New Sample Bottle Containers - see SOP E.4

3.7.9 Accommodation of Environmental Conditions Policy - see section 10.9.

3.7.10 Housekeeping and Workspace Policy - see section 10.10.

QUALITY ASSURANCE MANUAL
VOLUME I

Section 4

Organization and Responsibility

4.0 ORGANIZATION AND RESPONSIBILITY

4.1 INTRODUCTION

4.1.1 Alpha Analytical, Inc. is a business entity (environmental laboratory) incorporated in the state of Nevada that is legally responsible for all activities performed at this laboratory.

4.1.2 The guidelines described in this manual have been developed to ensure data quality is documented, controlled and data responsibilities are delegated and executed while satisfying the needs of clients, the regulatory authorities and organizations providing recognition.

4.1.2.1 The Laboratory Director is ultimately responsible for the quality of data collected and reported in support of the various programs.

4.1.2.2 The Laboratory Manager is responsible for the implementation of the policies and procedures and for overseeing key operations within the laboratory.

4.1.2.3 The Quality Assurance Officer (QAO) is responsible for ensuring the quality system is implemented and followed at all times.

4.1.2.4 Staff members are responsible for assuming the accountability and reliability of the generated data.

4.1.3 All Alpha Analytical employees are trained and have a clear understanding of the laboratory's responsibility for producing data that are accurate, complete, documented, and meet the requirements of precision, representativeness, and comparability.

All employees have access to Alpha's Quality Assurance Manual and are trained on the specific portions that apply to their responsibilities.

All employees participate in on-going discussions of the lab's quality assurance procedures and are trained in the importance of the quality control data acquired during normal sample analysis.

4.2 RESPONSIBILITIES AND AUTHORITY

It is Alpha's policy to ensue the laboratory has sufficient managerial and technical personnel to support the analytical process and to identify the occurrence of departures from the quality system, and to initiate actions to prevent or minimize such departures. Personnel are assigned responsibilities delineating their specific jobs, i.e., clerical, analysis, and sample preparation.

The relationships between the organization and the responsibilities involved in Alpha Analytical's QA/QC are outlined below. The following descriptions assign certain tasks to various levels of responsibility. The organizational chart is show in Table 4-1. The resumes of Alpha Analytical's technical employees are included in individual employee training documents.

4.2.1 Laboratory Director

The Laboratory Director is responsible for the overall collection and analysis of data produced and reported by Alpha Analytical. The following describes some of the more important duties that are performed by the Laboratory Director. These duties include:

a) Ensures that all analytical activities are performed according to methods and protocols specified in the QA Manual;

b) Ensures that daily operations function smoothly within the operating conditions and guidelines established by Alpha Analytical;

c) Coordinates analytical work to ensure the completion of tasks are within established time frames;

d) Ensures the analytical data review process is functioning properly;

e) Oversees preventative maintenance activities;

f) Evaluates and implements changes in methods and quality control measures;

g) Identifies quality control problems and takes measures to correct or eliminate the problem source;

h) Assumes the responsibility for authorizing the resumption of work when nonconforming data has been identified.

i) Assumes the responsibility for determining the level of qualification, experience and skills necessary for staffing all positions in the laboratory to perform the technical duties with the required quality control;

j) Ensures that the training of each member of the technical staff is kept current;

k) Ensures that all technical laboratory staff members have demonstrated capability in the activities for which they are responsible, such as IDC and MDL studies;

l) Oversees personnel and evaluates their performance;

m) Ensures the laboratory is participating in a proficiency testing program and that corrective actions are implemented after testing and evaluating the effectiveness of the corrective actions; and

n) Notifies clients and discusses quality issues when data quality has impacted their sample results.

4.2.2 Laboratory Manager

The Laboratory Manager is responsible for the implementation of the policies and procedures as described by the QAM with the direction of the Laboratory Director. The Laboratory Manager is responsible for overseeing key operations within the laboratory to ensure the work flow is efficient, balanced and within the guidelines established in the QAM. The following describes some of the more important duties that are performed by the Laboratory Manager. These duties include:

a) Ensures the Sample Custody Officer(s) has the appropriate staffing, training and experience necessary to carry out the responsibility for receiving and logging in samples as they arrive at the laboratory;

b) Ensures the Document Control Officer(s) has the appropriate staffing, training and experience necessary to carry out the responsibility for implementing the Document Control Program;

c) Ensures the Director of Client Services, Technical Representatives and Project Coordinators have the appropriate staffing, training, experience and/or education necessary to carry out their responsibilities and duties;

d) Ensures the Laboratory Information Management System (LIMS) Administrator has the appropriate staffing, training and experience necessary to carry out the responsibility of implementing the Software Quality Assurance Plan (SQAP);

e) Coordinates with the Laboratory Director and the QA Officer to assure all activities, both sampling and analysis are performed according to the specific QA Project Plans (QAPP), methods and protocols specified in this QA Plan;

f) Ensures the daily operations function smoothly within the operating conditions and guidelines established by Alpha Analytical;

g) Ensures the completion of all tasks are within the established time frames;

h) Ensures the laboratory is participating in a proficiency testing program and corrective actions are implemented after testing and evaluating the effectiveness of the corrective actions; and,

i) Responsible for the assessing, selecting and use of subcontract laboratories to meet project specific criteria.

4.2.3 Quality Assurance Officer

4.2.3.1 The Quality Assurance Officer (QAO) has the responsibility and authority for ensuring the quality system is implemented and followed at all times. The QA Officer:

a) is the focal point for QA/QC and is responsible for the oversight and/or review of quality control data;

b) is independent from laboratory operations;

c) objectively evaluates laboratory data and performs assessments without outside managerial influence;

d) has documented training and experience in QA/QC procedures and is knowledgeable in the quality system as defined under NELAC;

e) has a general knowledge of the analytical test methods for which data review is performed;

f) arranges for and/or conducts internal audits annually; and

g) notifies laboratory management of deficiencies in the quality system and monitors corrective actions.

4.2.3.2 In addition, the QA Officer is responsible for reviewing and advising on all aspects of QA/QC, including the following:

a) assisting the data requester in specifying the QA/QC procedure to be used during the testing program;

b) makes recommendations to the data requester and Laboratory Director, if problems are detected, to ensure that appropriate corrective actions are taken;

c) oversees the review of quality control data to determine if test data is acceptable;

d) updates and supervises the updates of quality control markers, such as accuracy, precision, and method detection limits;

e) coordinates and oversees the preparation of quality assurance plans;

f) reviews new or proposed protocols to determine appropriate use;

g) reviews method validation data; and

h) ensures continuous improvement at the laboratory through the use of control charts and other method performance indicators.

4.2.4 Analysts

4.2.4.1 Analysts are primarily responsible for ensuring they are completely familiar with the quality systems documentation and the implementation of the policies and procedures affecting their work. The following describes some of the more important responsibilities and duties that are performed by the analysts. These responsibilities include:

a) Analysts are responsible for ensuring they perform the required analyses according to test methods specified by rule, permit, QAPPS and/or SOPs;

b) Analysts are responsible for ensuring the instrument and related equipment is working to acceptable standards; and,

c) Analysts are responsible for ensuring the required supplies are available for their particular instrument.

4.2.4.2 Some of the various duties analysts perform include the following:

a) Ensures all analytical equipment has been properly calibrated before beginning analysis;

b) Ensures all identifying information, including sample identification numbers, have been accurately transcribed into records or computer databases;

c) Ensures all calculations are correct;

d) Ensures the appropriate confirmatory tests or procedures have been completed;

e) Identifies, documents, and begins corrective actions on any quality control problem that relates to the analytical test; and,

f) Maintains equipment in working condition and documents all preventative maintenance and repairs.

4.2.5 Extraction Technicians

Extraction Technicians are responsible for a large number of duties and activities which support personnel performing sample analysis. These activities are necessary to ensure quality extracts are prepared for instrumental analysis.

Extraction Technicians are responsible for ensuring they are completely familiar with the quality systems documentation and implementation of the policies and procedures affecting their work. The following list describes some of the more important responsibilities and duties that are performed by the extraction technician. These duties and responsibilities include:

a) Performs the required extraction, clean-up procedures, and final concentration steps according to the test methods used by Alpha Analytical;

b) Ensures all extraction equipment is properly maintained before and after use;

c) Ensures all analytical equipment, such as pH meters and balances, have been properly calibrated before use;

d) Ensures all identifying information, including sample identification numbers, have been accurately transcribed into the extraction logs and other pertinent areas;

e) Documents with meticulous accuracy all procedures performed on the sample and notes any irregularities observed during the sample extraction which may affect the analysis; and,

f) Communicates to analysts and all affected personnel irregularities or observations of the sample prior to analysis; thus ensuring proper decisions are made regarding that particular sample.

4.2.6 Sample Custody Officer

The Sample Custody Officers (SCO) are responsible for implementing, updating, and maintaining Alpha Analytical's Sample Tracking Plan. The Sample Custody Officers (SCO) are primarily responsible for ensuring the proper handling and documentation of all samples are performed by the person who has legal custody of that sample during all phases of laboratory work. The SCO performs the following duties:

a) Assumes the responsibility for receiving and logging in samples as they arrive at the laboratory;

b) Obtains the documentation required to complete the chain-of-custody form for each specific sample;

c) Notes any irregularities of the sample and/or inquires of the client regarding these abnormalities;

d) Notes special project requirements with detailed information on the chain-of-custody;

e) Informs all personnel affected by special projects of the requirements and that the project is in-house; and,

f) Assumes responsibility for placing environmental samples in the proper storage area to prevent possible sample cross-contamination.

4.2.7 Document Control Officer

The Document Control Officer (DCO) is responsible for implementing, updating, and maintaining Alpha Analytical's Document Control Program. The Document Control Officer is primarily responsible for overseeing data assembly and documentation of client files. The DCO is responsible for the following areas:

a) Ensures that all documents concerning a client/sample file are accounted for when a project is completed;

b) Responsible for the organization and assembly of all documents related to a client sample file according to established SOP's;

c) Maintains control of confidential information;

d) Coordinates the Document Control Program; and,

e) Reports directly to the Laboratory Manager.

4.2.8 Laboratory Information Management System (LIMS) Administrator

The LIMS Administrator is responsible for implementing, updating and maintaining Alpha Analyticals' Software Quality Assurance Plan (SQAP). When computers are used for the capture, processing, manipulation, recording, reporting, storage and retrieval of analytical data, the LIMS Administrator ensures the following:

a) All requirements of the SQAP are being met;

b) Computer software is documented and adequate for use;

c) Ensures procedures are established and implemented for protecting the integrity of data, such as data entry or capture, data storage, data transmission and data processing;

d) Ensures computer equipment is adequately maintained to function properly; and,

e) Establishes and implements appropriate procedures for the maintenance and security of data including the prevention of unauthorized access to, and the unauthorized amendment of computer records.

4.2.9 Training Coordinator

The Training Coordinator is responsible for the oversight of the training program and the maintenance of training and qualification records. This person coordinates the training program by updating Trainers and/or the Training Committee Members of when and what type of training is needed, and the overall recommendations to the Training Program.

4.3 WORK STOPAGE

The following personnel have the authority to stop work or withhold test results in response to quality problems when nonconforming work is identified. They have the authority to approve or disapprove analytical and/or extraction batches and the authority to approve or disapprove final analyses.

1) Laboratory Director
2) Quality Assurance Officer
3) Laboratory Manager

Alpha Analytical, Inc.

Organizational Chart

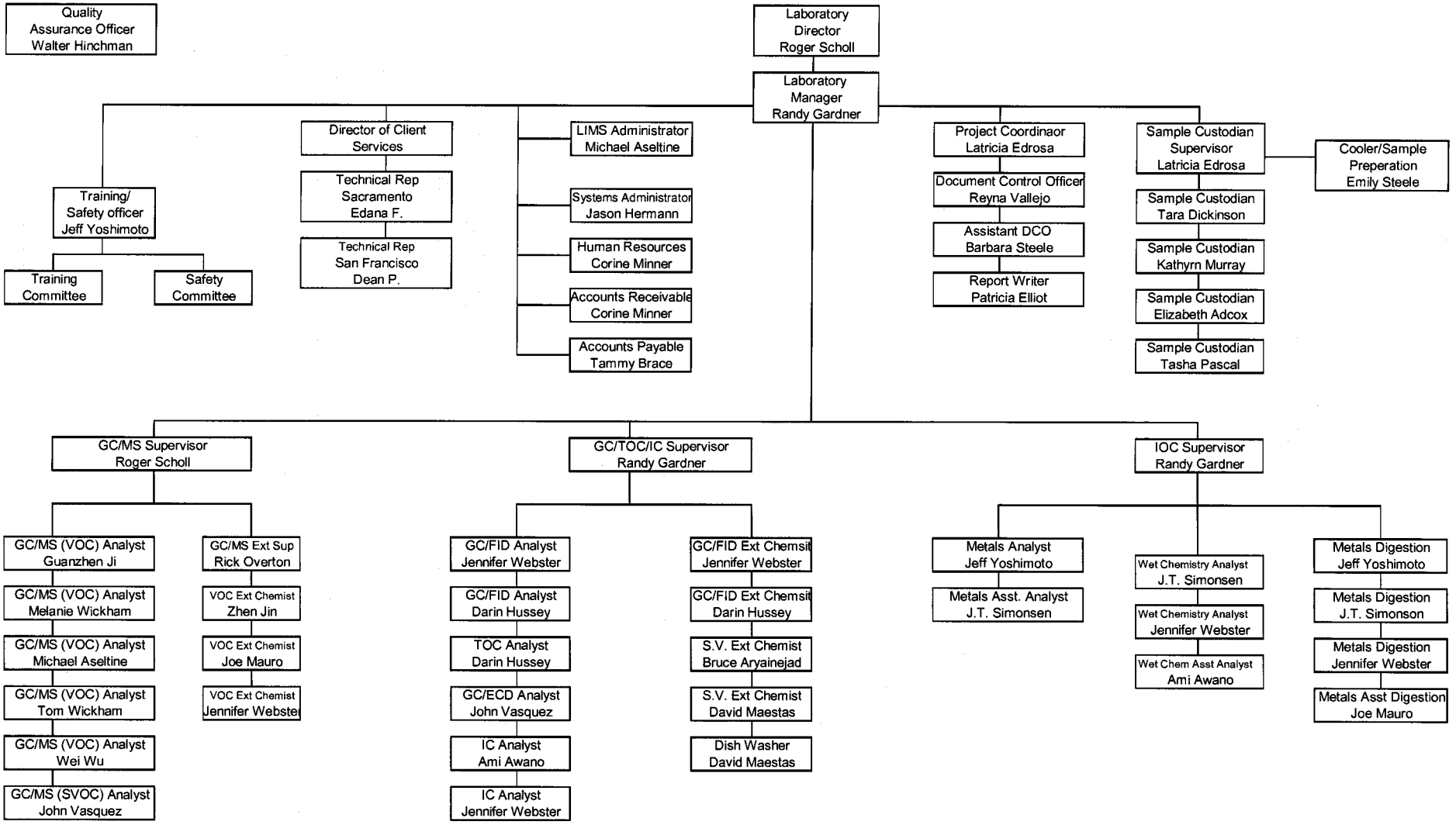


TABLE 4-1

QUALITY ASSURANCE MANUAL
VOLUME I

Section 5

Quality Assurance Routines to Assess Precision, Accuracy and the Calculation of Method Detection Limits

5.0 QUALITY ASSURANCE ROUTINES TO ASSESS PRECISION, ACCURACY AND THE CALCULATION OF METHOD DETECTION LIMITS

5.1 GENERAL DATA QUALITY OBJECTIVES

5.1.1 Data Quality Objectives (DQOs) for each method and analyte are determined to ensure analytical and method-specific goals are met. DQOs for analytical measurements are commonly interpreted as Precision, Accuracy, Representativeness, Completeness and Comparability (PARCC). Precision and accuracy are the two most common criteria used to define DQOs.

5.1.2 Accuracy and precision are generally determined for each EPA method target analyte by data presented as either single laboratory or spooled data from multiple laboratories. This type of data, represents Method Derived Data Quality Objectives. As part of our QA program, Alpha statistically determines in-house Laboratory Derived Data Quality Objectives and ensures these DQO's are comparable to method derived DQO's.

5.1.3 The last three, representativeness, completeness and comparability, are DQOs that are laboratory and project specific. Therefore, these three elements do not have method specified DQOs. The determination of method detection limits is also a useful tool to evaluate project or analytical goals.

5.2 ROUTINE METHODS USED TO ASSESS PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS AND COMPARABILITY

One of the primary objectives of this QA plan is to establish a framework that can estimate the quality of each analytical system, including Precision, Accuracy, Representativeness, Completeness, and Comparability. Specific data quality objectives for accuracy, precision, and completeness are based on prior knowledge of the measurement system employed and method validation studies using duplicates, spikes, standards, recovery studies, etc.

At the present time, the EPA has established only a couple of select PARCC guidelines that must be met by data generated in support of a few methods of analysis. However, for analysis which PARCC criteria do exist, Alpha uses those method defined QA goals.

5.2.1 Precision

Repetitive measurements of the same parameters in a sample creates a distribution curve in which the spread or dispersion about the mean can be calculated or expressed as precision. The calculations for precision where duplicate or replicate analysis have been performed are accomplished by the analysis of laboratory control samples and matrix spikes.

Field duplicate samples and matrix spike duplicates are analyzed to assess field sampling precision. Laboratory control samples and laboratory control sample

duplicates are analyzed to assess analytical precision. Precision measurements are determined using Relative Percent Difference (RPD) between the duplicate sample results and, for replicate analyses, the Relative Standard Deviation (RSD) is calculated and used to determine precision.

5.2.2 Accuracy

The accuracy of an analytical measurement is defined as the amount of agreement between an experimental measurement of the concentration of a parameter and the known true concentration of that parameter. Accuracy is commonly expressed as a percent recovery of spiked analytes. Analytical accuracy is assessed by comparing the percent recovery of analytes spiked into an LFB or LCS to a defined control limit. For organic methods of analysis, surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed.

Percent recovery, where applicable, is calculated using concentration limits, such as µg/Kg or µg/L, and converted to a percentage. Accuracy criteria is both compound and method specific.

5.2.3 Representativeness

The representativeness of samples describes the degree to which the sample represents an undisturbed matrix. Obtaining representative samples is a difficult task that requires site and project specific planing prior to any field sampling. Matrix, target analytes, methods of analyses, sampling depths, sampling equipment, time of sampling, etc. are all contributing factors in obtaining a representative sample. In order to minimize random errors introduced by non-uniform sampling procedures, the SOP's cited in the FSP are suggested procedures to be followed for sample collection. The use of standard operating procedures will help to provide uniformity for the sample collection work.

5.2.4 Completeness

Data completeness is defined as the percentage of total tests conducted that are deemed satisfactory for a specific analysis or matrix. General criteria for data completeness is determined and compared to project specific DQOs. Completeness is expressed as a percent of the overall data generated and is calculated as follows:

$C = V/T \times 100$

where,

C = Percent completeness;
V = Number of measurements judged satisfactory or validated and,
T = Total number of planned measurements.

Alpha's goal is 95% completeness for aqueous samples with a relatively clean background matrix (i.e., SDWA samples), a 90% completeness for methods which may contain a some degree of background interferences (i.e., CWA) and 85% completeness for methods which more than likely will contain significant degrees of background contamination as well as matrix bias (i.e., RCRA type samples).

5.2.5 Comparability

Comparability of data is expressed as a measure of confidence where multiple sets of data may be used to evaluate a common analyte by a standard method of analysis.

Data comparability can be scrutinized by collecting independent samples in the same manner during different sampling episodes and by processing samples using the same procedures in the laboratory. Field sampling and laboratory analytical procedures for each parameter should remain as constant as possible at all times.

Alpha uses standard EPA methods to insure inter-laboratory comparability of data. In addition, generated data is expressed in units consistent with the data generated by other laboratories reporting similar analyses to allow comparability of data between organizations. SOPs are an important element in both inter- and intra-laboratory comparison of data. These procedures allow laboratory activities to become routine and standardized, which minimizes random errors.

5.3 CONTROL CHARTS

5.3.1 Shewhart Control Chart

The Shewhart control chart is typically used to monitor variations in the accuracy of routine analysis and to detect possible trends in those variations.

This control chart is constructed from data representing the performance of a complete analytical method in order to monitor all activities associated with the analytical procedure. Although tabulations of precision and accuracy are used to evaluate if a datum point falls within the prescribed limits, trends are difficult to discern from tables.

Therefore, control charts consist of a graphical portrayal of that information. The Shewhart control chart consists of a central line or the average percentage recovery, and an upper and lower limiting line that establishes the window of acceptability.

Recovery data is used and graphed on a Shewhart control chart to monitor and establish the validity of individual sample analysis. Data are plotted chronologically, in terms of instrument analysis, to monitor instrument performance.

Several methods require laboratories to achieve a particular level of precision and accuracy, that are described and built into the methods. However, many of these methods establish precision and accuracy requirements from the results of a single

laboratory. These criteria are often times not indicative of the method or how laboratories are being evaluated on a national scale. Therefore, NELAP requires laboratories to determine and use on a regular basis, the accuracy and precision limits that reflect actual in-house control windows or criteria generated from laboratory data.

5.3.1.1 Upper and Lower Warning Limits

The calculation of limiting lines or the windows of acceptability is based on the distribution of recoveries about the mean. There are two sets of limiting lines that may be used in the construction of the Shewhart control chart. The inner window or warning limit is defined by the upper or lower warning limits (UWL) and (LWL), and is calculated as:

$$UWL = X + 2s$$
$$LWL = X - 2s,$$

where X is the mean and s is the standard deviation.

Statistically, one in twenty will fall outside the inner control lines, provided the data are statistically uniform (i.e., 95% confidence interval).

5.3.1.2 Upper and Lower Control Limits

The second window is defined by the Upper and Lower Control Limit (UCL) and (LCL) and is calculated as:

$$UCL = X + 3s$$
$$LCL = X - 3s$$

and is statistically defined at the 99% confidence level. When possible control charts are prepared for each surrogate compound using data from actual sample analysis and plotted as a percent recovery. Percent recoveries are used to allow for minor variations in standard solution concentrations.

Limits of acceptability are calculated using a minimum of thirty samples of the same sample matrix and are periodically reviewed. Only samples evaluated as in-control are used for establishing and updating control limits. Out-of-control or outlier points are plotted; however, these points are not used in control limit calculations.

5.4 METHOD EVALUATION

5.4.1 Environmental organic and inorganic analytical methods are evaluated for those parameters that adversely affect data quality. These parameters are things such as method detection limit, reporting limit, accuracy and precision.

This includes both standard and non-standard methods of analysis, test methods used outside of their published scope, and amplifications and modifications of standard methods to confirm that the method is fit for its intended use.

Method validation is as extensive as is necessary to meet the needs of the application. Method validation results and the procedure used for the validation are recorded. The following list briefly describes the minimum method parameters that are critically evaluated and documented prior to performing a new method.

5.4.1.1 Initial Demonstration of Capability (IDC) studies - an IDL study is performed prior to the analysis of samples or when a significant change in instrument, personnel, matrix or test method has taken place. Continuing Demonstrations of Capability (DOC) studies are performed annually. This data is used to initially determine method accuracy and precision.

5.4.1.2 Method Detection Limit (MDL) studies - an MDL study is conducted to determine the minimum amount of a substance that an analytical process can detect. This is also referred to as a Limit of Detection (LOD) study. Some methods state the MDLs and/or estimated MDLS that were achieved in multi-laboratory studies as a means to help the laboratory evaluate its' method data.

5.4.1.3 Limit of Quantitation (LOQ) - an LOQ is defined as the minimum level, concentration or quantity of a target analyte that can be reported with a specified degree of confidence. The LOQ was formerly known as the Practical Quantitation Limit (PQL), Minimum Reporting Limit (MRL) or simply the reporting limit.

5.4.1.4 Calibrations - Initial calibration and calibration verification protocols are typically method specific and are found in individual method SOP's.

5.4.1.5 Proficiency Evaluation (PE) samples - the results of PE sample analysis, if available, are used to evaluate our ability to produce accurate data.

TABLE 5-1
STATISTICAL CALCULATIONS

STATISTIC	SYMBOL	FORMULA	DEFINITION	USES
Mean	$\bar{x}$	$\frac{\sum_{i=1}^{n} X_i}{n}$	Measure of central tendency	Determine average value of measurements
Standard Deviation	SD	$\left(\frac{\sum (x_i - \bar{X})^2}{(n-1)}\right)^{\frac{1}{2}}$	Measure of relative scatter of the data	Calculating variation of measurements
Relative Standard Deviation	RSD	$(\frac{s}{\bar{x}})\ x\ 100$	Relative standard deviation, adjusts for magnitude of observations	Assess precision for replicate results
Percent Difference	% D	$\frac{x_1 - x_2}{x_1}\ x\ 100$	Measure of the difference of 2 observations	Assess accuracy
Relative Percent Difference	RPD	$\left(\frac{(x_1 - x_2)}{(\frac{x_1 + x_2}{2})}\right)\ x\ 100$	Measure of the variability that adjusts for the magnitude of observations	Assess total and analytical precision of duplicate measurements
Percent Recovery	% R	$\left(\frac{x_{measured}}{x_{true}}\right)\ x\ 100$	Recovery of spiked compound in pure matrix	Assess accuracy
Percent Recovery	% R	$\frac{\text{Value of Spiked Sample} - \text{Value of Unspiked Sample}}{\text{Value of Added Spike}}\ x\ 100$	Recovery of spiked compound in sample matrix	Assess matrix effects and total precision

x = Observation (concentration) n = Number of observations

QUALITY ASSURANCE MANUAL
VOLUME I

Section 6

Sampling Procedures

6.0 SAMPLING PROCEDURES

Alpha is not generally responsible for sample collection. When Alpha does collect samples for analysis, it follows the procedures outlined in this section, the Field Sampling Plan (FSP) found in appendix B or other project specific field sampling plan.

6.1 INTRODUCTION

6.1.1 The most important aspect of field sampling is to obtain samples that are proper representations of the sampled matrix. Trace levels of contaminants from sources external to the sample must be eliminated through the use of good sampling techniques.

6.1.2 Once a sample has been collected, it should be properly stored and preserved to maintain the chemical and physical properties that it possessed at the time of collection. Sample containers are packaged for shipping in insulated containers, and constructed to ensure that sample bottles will arrive intact.

6.1.3 Samples must be expeditiously sent to the laboratory and as a general rule, storage at low temperature is the best way to preserve most samples; however, the length of time a sample can be held even at low temperature varies with the analyte and matrix.

6.1.4 When samples are received, the time lapse between sampling activity and analysis should not exceed the times shown in the sample holding times tables. Sample management and stringent documentation are the key factors as outlined in the FSP.

6.2 SAMPLE HANDLING

6.2.1 Samples are collected and handled in a manner that attempts to maintain sample integrity and preserves the potential contaminants being analyzed. Samples are collected in containers specific to the matrix and requested analysis.

6.2.2 Gloves should be used during the sampling and extraction procedures for protection against possible exposure to carcinogens and to minimize accidental contamination of samples by the collector. When wearing gloves, the person must be careful not to let the gloves come into contact with the sample, the interior of the container, or allow solvents to touch both the sample and any extract.

6.3 SAMPLE SHIPMENT

6.3.1 Samples requiring refrigeration are carefully placed in coolers with ice to maintain a temperature of $< 6^{\circ}C$. Glass containers are securely packaged in ice chests using packing material, to avoid breakage in transit. Chain-of-custody forms should be completed at the sampling site and sent with the sample to maintain integrity at all times. Samples are then transported to the laboratory as soon as possible.

6.4 CONTAINERS

6.4.1 Sample containers are determined by the requested analysis. However, the following containers are generally used for environmental analysis:

- Standard 40 ml clear glass screw-cap Volatile Organic Analysis (VOA) vials with Teflon-faced silicone septum are used for volatile analysis;
- Narrow mouth, 1 L amber Boston round glass bottles with Teflon-lined lids are used for semi-volatile, analysis;
- Large mouth, 8oz, 4oz glass bottles or brass tubes are typically used for soil and sediment samples; and,
- Narrow mouth, 125, 250, 500 mL and 1-L polyethylene bottles are typically used for the analysis of metals and other general inorganic parameters.

6.4.2 All sample containers are cleaned according to EPA established protocols. Factory cleaned sample containers require no further cleaning prior to sample collection, and are the containers of choice. Sample containers are not reused. Alpha maintains a sequestered supply of sample containers to eliminate the possibility of contamination of the sample from the container. Containers are sequestered by lot to track QA/QC procedures associated with that group of sample containers.

6.5 SAMPLE PRESERVATION

6.5.1 The purpose of sample preservation is to prevent or retard chemical degradation or sample modification during transit and storage; therefore, sample preservation maintains the chemical integrity of the sample. Most solid samples require cooling as the only preservation technique. Water sample are subject to a variety of specific preservation techniques, depending on the target analytes.

6.5.2 Samples requiring chemical preservation means that the pH or removal of residual chlorine of the sample should be performed and checked in the field and verified in the laboratory during sample preparation or analysis.

6.5.3 Samples are preserved according to analytical methods and programs by which the sample will be analyzed. Chemical preservation can be generally divided into two basic categories:

a) acids and bases added to control pH and minimize microbial degradation; and

b) dechlorination reagents, such as ascrobic acid or sodium thiosulfate, added to reduce the effect of residual chlorine or other oxidizers found in some samples.

6.5.4 Efforts to preserve the integrity of the samples are initiated at the time of sampling or immediately upon sample receipt at the laboratory. Sample preservation is typically accomplished in one of two ways:

a) Send or take bottles to preserve at the sample site; or

b) Add preservatives to sample containers prior to going to the field.

6.6 SAMPLE HOLDING

6.6.1 The holding time before analysis is of critical, practical and regulatory importance. Analytes will degrade and be lost from the sample over time, even when correctly preserved and stored. All analytes have required holding times, from immediate analysis for the determination of sample pH up to 6 months for heavy metals.

6.6.1.1 Holding times were originally conceived with the idea of providing guidelines for performing analyses within a sensible time frame to minimize sample degradation. Now holding times have taken on a legal life of their own, often times with no connection to scientific reality. For instance the misconception of how a sample with a holding time of 7 days prior to extraction, is acceptable if the extraction is begun 6 days, 23 hours, 59 minutes and 59 seconds after the moment of sampling, but magically turns to garbage one second later if not in a separatory funnel!

6.6.2 The time that a preserved sample may be held between sampling and analysis is based on the specific analytical method and analytes of interest. Holding time limitations described in all standardized methods are intended to minimize chemical change in a sample before it is analyzed.

6.6.3 The holding time clock starts with the moment of sampling and ends with the beginning of the analytical procedure. In other words, holding times do not start from receipt of the sample at the laboratory.

6.6.4 Holding times, outlined in tables 6-1 through 6-8, are the maximum times allowable between sample collection, extraction and analysis. Allowable holding times apply to both solid and aqueous samples.

6.6.5 Samples analyzed after holding times have been exceeded are considered out-of-control and analytical results are unacceptable to report unless requested by the Client.

6.6.6 To expedite analysis and minimize the possibility of exceeding holding times, overnight courier service, such as Federal Express, UPS, etc., or other reliable methods of transportation are used.

6.6.7 Maintaining samples in cold storage is terminated only after all analysis has been finished and the minimum holding time requirements have been met.

6.7 FIELD SAMPLING

The sampler is ultimately responsible for collecting representative samples from the site to accurately reflect project site conditions. The client must specify the method of analysis, and the procedure to collect the sample that will represent the matrix of interest. The sampler should remove all items that are not integral components of the matrix of interest.

The client should develop a sampling plan with sample site locations, chosen to be representative of the area being investigated. These plans should be followed during the sampling excursions.

Compositing multiple samples into a single sample can be used as part of the initial sampling strategy to identify plumes of contamination and as a screening technique. Individual samples are subsequently collected and analyzed to describe the sampling points within that area of investigation.

6.7.1 Surface Water Sample Collection

Surface water samples from springs or other surface waters may be taken under many different site specific conditions. At the time of sampling, the client should designate the appropriate sampling techniques for the site-specific setting.

Before sampling, all equipment is rinsed downstream or away from the sampling point, taking care not to disturb sediments at the sampling point. After sampling each location, the equipment is rinsed with distilled water and decontaminated before further use.

All samples are placed in containers that have been pre-cleaned or have been cleaned according to established protocols. Organic samples are typically collected in glass containers with teflon-lined lids and samples for inorganic chemical analyses are typically collected in separate glass or polyethylene containers.

Sample filtration is determined by the client prior to sampling. Samples are then collected according to the QAPP or the sampling techniques described in the FSP and documented accordingly.

6.7.2 Ground Water Sample Collection

Groundwater sampling should occur only after wells have been completely developed. Well development disturbs natural groundwater systems and should remain undisturbed for several days to allow the groundwater system to return to chemical equilibrium.

All equipment used to measure and sample the groundwater system (e.g., bailer, pumps, tapes, ropes, etc.) should be cleaned before use to prevent cross-well contamination. When sediments adhere to sampling equipment, scrubbing is required in addition to the normal rinsing.

Samples are placed in containers that have been pre-cleaned or have been cleaned according to established protocols. Organic samples are typically collected in glass containers with teflon-lined lids and samples for inorganic chemical analyses are typically collected in separate glass or polyethylene containers.

6.7.3 Soil Sampling

Sampling points are typically marked with a stake and labeled with the appropriate site identification information. Prior to sampling, surface vegetation, rocks, pebbles, leaves, twigs, and other debris should be cleared from the sample point to allow for the collection of a representative soil sample.

Background samples should be taken at distances outside the investigation area, but within a location that is geologically similar to the actual sampling site. These samples give the client additional information concerning concentration levels above the background (i.e. baseline concentration). The number and location of background surface samples should be specified in the QAPP.

Soil samples should be collected in containers cleaned according to established protocols of the appropriate size. Samples are then labeled and placed in a temperature controlled ice chest immediately after sampling and delivered to the laboratory as soon as possible.

After sampling each location, all equipment should be thoroughly cleaned to prevent cross contamination of samples. Equipment should be scrubbed and rinsed with distilled water.

SDWA TABLE OF SAMPLE PRESERVATION AND HOLDING TIME REQUIREMENTS
ORGANIC ANALYSIS
Table 6-1

METHOD	PARAMETERS	PRESERVATION	CONTAINER	HOLDING TIME
*504.1	EDB/DBCP	$Na_2S_2O_3$ 3mg/40ml	40ml, G, Cool, 4 °C	Extract and analyze within 14 days
505	Organohalide Pesticides and PCB's	$Na_2S_2O_3$ 3mg/40ml	40ml, G, Cool, 4 °C	Extract within 7 days / Analyze immediately after Extraction
507	Nitrogen / Phosphorus Pesticides	$Na_2S_2O_3$ 80mg/L	1L, G, Cool, 4 °C	Extract within 14 days / Analyze within 14 days of Extraction
508	Chlorinated Pesticides	$Na_2S_2O_3$ 80mg/L	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 14 days of Extraction
515.1	Acid Herbicides	$Na_2S_2O_3$ 80mg/L	1L, G, Cool, 4 °C	Extract within 14 days / Analyze within 28 days of Extraction
531.1	Carbamates	Monochloroacetic Acid Buffer pH-3 1.2ml/40ml	40ml, G, Cool, 4 °C	Analyze within 28 days
547	Glyphosate	$Na_2S_2O_3$ 4mg/40ml	40ml, G, Cool, 4 °C	Analyze within 14 days / 18 months if frozen
548.1	Endothall	$Na_2S_2O_3$ 80mg/L	500ml, G, Cool, 4 °C	Extract within 7 days / Analyze within 14 days of Extraction
549.2	Diquat	$Na_2S_2O_3$ 50mg/0.5L	500ml, P, Amber, Cool, 4 °C	Extract within 7 days / Analyze within 21 days of Extraction
525.2	SVOCs	Na_2SO_3 50mg/1L**	1L, G, Cool, 4 °C	Extract within 14 days / Analyze within 30 days of Collection
*524.2	VOCs	pH<2, 1:1 HCl + Ascorbic Acid 25mg/40ml	40ml, G, Cool, 4 °C	Analyze within 14 days
*551.1	Disinfectant Byproducts	Na_2HPO_4 2g + KH_2PO_4 198g + NH_4Cl 1.2g Buffer Salts	40ml, G, Cool, 4 °C	Extract within 14 days / Analyze within 14 days of Extraction / Store Extracts at -10 °C
*551.1	Chloral Hydrate only	Na_2HPO_4 2g + KH_2PO_4 198g + Na_2SO_3 1.2g Buffer Salts	40ml, G, Cool, 4 °C	Extract within 14 days / Analyze within 14 days of Extraction / Store Extracts at -10 °C
552.2	Haloacetic Acids	NH_4Cl 100mg/L	40ml, G, Cool, 4 °C	Extract within 14 days / Analyze within 7 days of Extraction when stored at 4 °C / Analyze within 14 days of Extraction when stored at -10 °C

*Note-Zero head space (no air bubbles) is required for these methods.
$Na_2S_2O_3$ - Sodium Thiosulfate is used for chlorinated source water only.
Na_2SO_3 - Sodium Thiosulfite is used for chlorinated source water only.
G - Glass P - Plastic
** Sample pH is field adjusted <2 HCL if acid compounds like PCP are to be determined.

SDWA SAMPLE PRESERVATION AND HOLDING TIME TABLE
METHOD 524.2
Table 6-2

DECSRIPTION	SAMPLE VOLUME	DECHLORINATION	SAMPLE PRESERVATION	ANALYSIS HOLDING TIME
Full List Compounds	3 x 40mL	25mg ascorbic acid per 40mL sample	pH<2, 2 drops 1:1 HCL Field preserved, cool 4°C	14 days
Full List Compounds sample foams when HCL is added carbonaceous waters	3 x 40mL	25mg ascorbic acid per 40mL sample	No acid	Analyze within 24 hours
THM's only	3 x 40mL	25mg ascorbic acid per 40mL sample	pH<2, 2 drops 1:1 HCL Field preserved, cool 4°C	14 days
THM's only	3 x 40mL	3 mg sodium thiosulfate per 40 ml sample	No acid	14 days
THM's only sample foams when HCL is added carbonaceous waters	3 x 40mL	3 mg sodium thiosulfate per 40mL sample	No acid	14 days

SDWA TABLE OF SAMPLE PRESERVATION AND HOLDING TIME REQUIREMENTS
INORGANIC ANALYSIS
Table 6-3

METHOD	PARAMETER	PRESERVATION	CONTAINER	HOLDING TIME
EPA 120.1/SM2510B/9050A	Conductivity	Cool, ≤6°C	0.1 - 0.2-L, G/P	Analyze within 28 days
EPA 150.2/SM4500H/9040C	pH	Cool, ≤6 , no head-space	0.1 - 0.2-L, G/P	15 minutes, field analyze if possible
SM2540C	TDS	Cool, ≤6 °C	1-L, G/P	Analyze within 7 days
EPA 180.1/SM2130B	Turbidity	Cool, ≤6°C	0.1-L, G/P	Analyze within 48 hours
EPA 300/9056	Anions	None ,if analyzed with 48 hrs, pH <2 H2SO4	0.1-L, G/P	Analyze within 28 days if preserved, 48 hours non-preserved
SM2320B	Alkalinity	Cool, ≤6°C	0.2 - 1-L, G/P	Analyze within 14 days
EPA 314.0	Perchlorate	None	0.1-L, G/P	Analyze within 28 days
SM4500Cl G	Chlorine	Cool, ≤6 °C, no headspace, protect from light	0.1-L, Amber gls	15 minutes, field analyze if possible
SM4500 NH3 D	Ammonia	Cool, ≤6°C, pH<2 H_2SO_4,	0.1 - 1-L, G/P	Analyze within 28 days if preserved, 24 hours non-preserved
SM3500Cr D	Cr^{+6}	Cool, ≤6 °C, pH 9.2-9.7 NaOH	0.1-L, G/P	Analyze within 24 hours if preserved, 28 days non-preserved
200.8	Metals, ICP-MS	pH<2 HNO_3 Sample may be preserved in the laboratory up to 2 weeks following sample collection.	0.2-L, G/P	Analyze within 6 months
SM2340B	Hardness (Calc)	Same as for 200.8	0.2-L, G/P	Analyze within 6 months
SM3500Fe D	Ferrous Iron	Cool, ≤6°C, Field filter, then acidify pH <2 HCL,	0.1-L, G/P	72 hours to color develop and 72 hrs after color development
G-Glass, P-Plastic				

CWA TABLE OF SAMPLE PRESERVATION AND HOLDING TIME REQUIREMENTS
ORGANIC ANALYSIS
Table 6-4

METHOD	PARAMETERS	PRESERVATION	CONTAINER	HOLDING TIME
*601	Purgeable Hydrocarbons	$Na_2S_2O_3$ 10mg/40ml	40ml, G, Cool, 4 °C	Analyze within 14 days
*602	Purgeable Aromatics	pH<2, 1:1 HCl, $Na_2S_2O_3$ 10mg/40ml	40ml, G, Cool, 4 °C	Analyze within 14 days
*603	Acrolein / Acrylonitrile	$Na_2S_2O_3$ 10mg/40ml, pH 4-5 (HCL/NaOH)	40ml, G, Cool, 4 °C	Analyze within 14 days
604	Phenols	$Na_2S_2O_3$ 80mg/L	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
605	Benzidine	$Na_2S_2O_3$ 80mg/L, pH 2-7 H_2SO_4	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 7 days of Extraction
606	Phthalate Esters	No Preservation	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
607	Nitrosamines	$Na_2S_2O_3$ 80mg/L, pH 7-10 (H_2SO_4/NaOH)	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
608	Organochlorine Pesticides/PCB's	$Na_2S_2O_3$ 80mg/L, pH 5-9 (H_2SO_4/NaOH)	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
609	Isophrone	No Preservation	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
610	Polynuclear Aromatic Hydrocarbons	Na_2SO_3 80mg/1L	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
611	Haloethers	Na_2SO_3 80mg/1L	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
612	Chlorinated Hydrocarbons	No Preservatives	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
613	Dioxin	Na_2SO_3 80mg/1L	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
614	Organophosphorus Pesticides	pH 6-8 (H_2SO_4/NaOH)	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
615	Chlorinated Herbicides	No Preservatives	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
619	Triazine Pesticides	Not Specified	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
622	Nitrogen / Phosphorus Pesticides	pH 6-8 (H_2SO_4/NaOH)	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
*624	Purgeables	pH<2, 1:1 HCl, $Na_2S_2O_3$ 10mg/40ml	40ml, G, Cool, 4 °C	Analyze within 14 days
625	Base Neutral Acids	$Na_2S_2O_3$ 80mg/L	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
632	Carbamate Pesticides	$Na_2S_2O_3$ 80mg/L	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 28 days of Extraction

*Note-Zero head space (no air bubbles) is required for these methods $Na_2S_2O_3$ - Sodium Thiosulfate G - Glass P - Plastic

CWA/RCRA TABLE OF SAMPLE PRESERVATION AND HOLDING TIME REQUIREMENTS
INORGANIC ANALYSIS
Table 6-5

METHOD	PARAMETER	PRESERVATION	CONTAINER	HOLDING TIME
EPA 120.1/SM2510B/9050A	Conductivity	Cool, ≤6°C	0.1 - 0.2-L, G/P	Analyze within 28 days
EPA 150.2/SM4500H/9040C	pH	Cool, ≤6 , no head-space	0.1 - 0.2-L, G/P	15 minutes, field analyze if possible
SM2540B	TS	Cool, ≤6°C	1-L, G/P	Analyze within 7 days
SM2540C	TDS	Cool, ≤6 °C	1-L, G/P	Analyze within 7 days
SM2540D	TSS	Cool, ≤6 °C	1-L, G/P	Analyze within 7 days
EPA 180.1/SM2130B	Turbidity	Cool, ≤6°C	0.1-L, G/P	Analyze within 48 hours
EPA 300/9056	Anions	None ,if analyzed with 48 hrs, pH <2 H2SO4	0.1-L, G/P	Analyze within 28 days if preserved, 48 hours non-preserved
SM2310B	Acidity	Cool, ≤6 °C	0.2 - 1-L, G/P	Analyze within 14 days
SM2320B	Alkalinity	Cool, ≤6°C	0.2 - 1-L, G/P	Analyze within 14 days
EPA 314.0	Perchlorate	None	0.1-L, G/P	Analyze within 28 days
SM4500Cl G	Chlorine	Cool, ≤6 °C, no headspace, protect from light	0.1-L, Amber gls	15 minutes, field analyze if possible
SM4500 NH3 D	Ammonia	Cool, ≤6°C, pH<2 H_2SO_4,	0.1 - 1-L, G/P	Analyze within 28 days if preserved, 24 hours non-preserved
SM4500N C	Total Kjeldahl -N	Cool, ≤6 °C, pH<2 H_2SO_4,	0.1 - 1-L, G/P	Analyze within 28 days if preserved, 24 hours non-preserved
EPA 365.3/SM4500P E	Total Phosphorus	Cool, ≤6 °C, pH<2 H_2SO_4,	0.2-L, G/P	Analyze within 28 days
SM4500S D	Sulfide	Cool, ≤6 °C, 0.2 mL 2N zinc acetate, 0.2 ml 6 N NaoH, pH >9 per 0.1-L	0.2-L, Clear glass	Analyze within 7 days
SM4500S D	Sulfide, dissolved	Cool, ≤6 °C, 0.2 ml 6 N NaoH, pH >9 per 0.1-L, no head-space	0.2-L, Clear glass	Analyze within 7 days
SM4500SO3 B	Sulfite	None	0.5-L, G/P	15 minutes, field analyze if possible
EPA 410.4/SM5520D	COD	Cool, ≤6 °C, pH<2 H_2SO_4,	0.1-L, G/P	Analyze within 28 days
SM 5210B	BOD	Cool, ≤6 °C	2-L, Plastic	Analyze within 48 hours
SM5540C	MBAS/Surfactants	Cool, ≤6 °C	2-L, Clear Glass	Analyze within 48 hours
SM5310C	TOC	Cool, ≤6°C, pH<2 H_2SO_4, protect from sunlight	0.1-L, G/P	Analyze within 28 days
EPA 245.1/7470	Mercury	Cool, ≤6 °C, pH<2 HNO_3	0.2-L, G/P	Analyze within 28 days
200.8/6020	Metals, ICP-MS	pH<2 HNO_3 (Field filter prior to pH adjustment for dissolved metals)	0.2-L, G/P	Analyze within 6 months
SM3500Cr D/7196A	Cr^{+6}	Cool, ≤6 °C, pH 9.2-9.7 NaOH	0.1-L, G/P	Analyze within 24 hours if preserved, 28 days non-preserved
SM3500Fe D	Ferrous Iron	Cool, ≤6°C, Field filter, then acidify pH <2 HCL,	0.1-L, G/P	72 hours to color develop and 72 hrs after color development
1664A	Oil and Grease	Cool, ≤6°C, pH<2 HCL or H2SO4,	1-L Glass only	Analyze within 28 days

RCRA TABLE OF WATER / AQUEOUS SAMPLE PRESERVATION AND HOLDING TIME REQUIREMENTS
ORGANIC ANALYSIS
Table 6-6

METHOD	PARAMETERS	PRESERVATION	CONTAINER	HOLDING TIME
*8010	Halogenated Volatiles	$Na_2S_2O_3$ .008%	40ml, G, Cool, 4 °C	Analyze within 14 days
*8011	EDB/DBCP	$Na_2S_2O_3$ 3mg/40ml	40ml, G, Cool, 4 °C	Analyze within 14 days
*8021B	Aromatic Volatiles	pH<2, 1:1 HCL, $Na_2S_2O_3$ .008%	40ml, G, Cool, 4 °C	Analyze within 14 days
8041	Phenols	$Na_2S_2O_3$ .008%	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
8081A	Organochlorine Pesticides	pH 5-9 (H_2SO_4/NaOH) $Na_2S_2O_3$ .008%	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
8082	Polychlorinated Biphenyls (PCBs)	pH 5-9 (H_2SO_4/NaOH) $Na_2S_2O_3$ .008%	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
8141A	Organophosphorus Pesticides	pH 5-9 (H_2SO_4/NaOH)	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
8151A	Chlorinated Herbicides	$Na_2S_2O_3$ .008%	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
*8260	Volatile Organics	pH<2, 1:1 HCl, $Na_2S_2O_3$ .008%	40ml, G, Cool, 4 °C	Analyze within 14 days
8270	BNAs	$Na_2S_2O_3$ .008%	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
8310	Polynumclear Aromatics	$Na_2S_2O_3$ .008%	1L, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
8318	N-methyl carbamates	Monochloroacetic Acid Buffer pH 4-5; 1.2mL per 40mL	40ml, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
8015B/Purgeable*	TPH/GRO	pH<2, 1:1 HCl	40ml, G, Cool, 4 °C	Analyze within 14 days
8015B/Extractable	TPH/DRO	pH<2, 1:1 HCl	40ml, G, Cool, 4 °C	Extract within 7 days / Analyze within 40 days of Extraction
8015B	Nonhalogenated VOC's	pH<2, 1:1 HCl, $Na_2S_2O_3$ .008%	40mL, G, Cool, 4 °C	Analyze within 14 days

*Note-Zero head space (no air bubbles) is required for these methods
$Na_2S_2O_3$ - Sodium Thiosulfate
G - Glass P - Plastic

RCRA TABLE OF SOIL / WASTE SAMPLE PRESERVATION AND HOLDING TIME REQUIREMENTS
ORGANIC ANALYSIS
TABLE 6-7

METHOD	PARAMETERS	PRESERVATION	CONTAINER	HOLDING TIME
8081A	Organochlorine Pesticides and PCBs	Soil - Cool to 4 °C Waste - None	4 to 8 oz., G, Cool, 4 °C	Extract within 14 days / Analyze within 40 days of Extraction
8082	PCB's (Aroclor)	Soil - Cool to 4 °C Waste - None	4 to 8 oz., G, Cool, 4 °C	Extract within 14 days / Analyze within 40 days of Extraction
8141A	Organophosphorus Pesticides	Soil - Cool to 4 °C Waste - None	4 to 8 oz., G, Cool, 4 °C	Extract within 14 days / Analyze within 40 days of Extraction
8151A	Chlorinated Herbicides	Soil - Cool to 4 °C Waste - None	4 to 8 oz., G, Cool, 4 °C	Extract within 14 days / Analyze within 40 days of Extraction
*8260	Volatile Organics	Soil - Cool to 4 °C Waste - None	4 to 8 oz., G, Cool, 4 °C	Analyze within 14 days
8270	BNAs	Soil - Cool to 4 °C Waste - None	4 to 8 oz., G, Cool, 4 °C	Extract within 14 days / Analyze within 40 days of Extraction
6020	Metals	Soil - Cool to 4 °C Waste - None	4 to 8 oz., G, Cool, 4 °C	Digest and analyze within 6 months.

*Note - Zero Headspace is required for these methods
G - Glass P - Plastic

TABLE OF TCLP/SPLP PRESERVATION AND HOLDING TIME REQUIREMENTS
ORGANIC AND INORGANIC ANALYSIS
Table 6-8

Method	Parameters	Preservation	Container	Holding Time
1311/1312	VOCs	No Preservation	2L/300g, G, Cool, 4° C	See Table Below
1311/1312	SVOCs	No Preservation	2L/300g, G, Cool, 4° C	See Table Below
1311/1312	Metals	No Preservation	2L/300g, G/P, Cool, 4° C	See Table Below
G - glass P - Plastic				

Method	Parameters	From Field Collection to TCLP/SPLP Extraction	From TCLP/SPLP Extraction to Preparative Extraction	From Preparative Extraction to Determinative Analysis	Total Elapsed Time
1311/1312	VOCs	14 days	NA	14 days	28 days
1311/1312	SVOCs	14 days	7 days	40 days	61 days
1311/1312	Metals (except Hg)	180 days	NA	180 days	360 days
1311/1312	Mercury	28 days	NA	28 days	56 days

QUALITY ASSURANCE MANUAL
VOLUME I

Section 7

Sample Custody

7.0 SAMPLE CUSTODY

7.1 SAMPLE CUSTODY PROCEDURES

7.1.1 Traditionally, record keeping is the primary emphasis of a QA program and this is the case in sample custody. Without a rigid and formal record keeping system, the QC procedures would not be documented appropriately.

7.1.2 All samples, from receipt through analysis, are handled under our Sample Tracking Plan. This portion of the QA program helps ensure the maintenance of sample integrity. It also helps to ensure all test procedures are performed in a timely and efficient manner.

7.1.3 The Sample Tracking Plan (STP, Appendix C) is a set of SOPs written with the maintenance of custody as a primary objective interwoven through all of the SOPs. Alpha is responsible for sample tracking and the maintenance of custody once it arrives and continues through sample analysis.

7.1.4 The Sample Custody Officer (SCO) is responsible for sample custody and for the overall implementation of the STP. This responsibility includes assuring proper handling and that the documentation of all samples are performed according to the described SOPs.

7.2 SAMPLE DOCUMENTATION PROCEDURES

7.2.1 Sample documentation, identification and chain-of-custody procedures are designed to assure accountability and control of all samples. Analytical records are kept and maintained in sufficient detail to track and recreate all analytical activities to ensure sample integrity. Project and client communication is also an extremely important aspect of the sample documentation procedures. SOP topics associated with the sample custody and documentation procedures are as follows:

- Sample Receiving and Project Communication,
- Manual Chain-of-Custody Procedure,
- LIMS Generated Chain-of-Custody Procedure,
- Sample Identification Procedure,
- Labeling Field Samples,
- Internal Chain-of-Custody Procedure,
- Sample Log-In Ledger,
- Sample Storage Procedure,
- Maintenance of Custody,
- Sample Tracking Procedure,
- Client Communication, and
- Sample Scheduling Procedure.

7.2.2 Chain-of-Custody (COC)

Samples are documented on a chain-of-custody form and signed by both the client and laboratory. This document formalizes the sample transaction and is critical to the maintenance of sample custody. The chain-of-custody is generally regarded as a legal document and should be completely filled out as legibly and as error free as possible. Information required on this document is described in the following SOPs found in Appendix C:

- Manual Chain-of-Custody Procedures,
- LIMS Generated Chain-of-Custody Procedures, and
- Internal Chain-of-Custody Procedure.

7.2.3 Sample Log-in Ledger

Upon arrival at the laboratory, samples are logged into the LIM system with the pertinent information by the Sample Custodian. A long term ledger is maintained as a permanent record of samples logged into our LIM system. Approximately every 2 weeks the LIM system is queried to print all samples logged-in during that period. A computer program or macro is activated to parse-out the relevant information from each chain-of-custody produced by the laboratory. This information is printed and stored in a 3-ring binder labeled "Log-In". Sample information contained in the "Log-In" book includes:

- Initials,
- Date of sample receipt,
- Laboratory's sample identification,
- Client's sample identification,
- Matrix type,
- Analysis requested,
- Turn-around-time (TAT),
- Date sampled, and
- Work order comments.

This document is used primarily by the sample custodian as a quick source to check historical information on the chain-of-custody records.

7.2.4 Sample Scheduling

The Laboratory Supervisors coordinate sample scheduling to maintain an even production flow while ensuring samples are extracted and analyzed within their prescribed holding times.

Scheduling is coordinated with the appropriate personnel to maximize production according to the numbers and types of analyses to be performed during the analytical

or extraction batch. Scheduling requires a working knowledge of instruments, personnel and lab activities. This balance is often shifted by the presence of "rush" analysis. A rush analysis takes precedence in the scheduling of samples. All other normal analyses are pushed back by these requests, and are scheduled according to their sampling date.

Large sample projects are coordinated with the Laboratory Manager or Laboratory Director before samples arrival. This preplanning eases potential workload difficulties while ensuring the appropriate level of QA/QC is maintained. All discrepancy reporting is handled by the Laboratory Director to ensure the problem is expressed to the client and is properly documented.

7.3 LABORATORY LOGBOOK POLICY

Bound logbooks are the preferred method of record keeping. However, certain laboratory functions are formalized enough to use standard forms (e.g., sample preparation log). These activities are documented and recorded using spiral bound or loose leaf three-ring binders. In this case, pages are dated in chronological order which helps reference data.

Each analyst, instrument or specific laboratory function has its own logbook to track and document lab activities, dates and times more effectively. When more than one analyst shares a common logbook, they delineate their data insertions by initialing and dating data entries.

All logbook entries are made in ink. Corrections are made by drawing one line through the incorrect entry, and then entering the correct information, initialing and dating this change. Complete information is entered so that during an examination it can be decided what was done, by whom, when and what the results were. All logbook entries are signed by the analyst or technician recording those entries.

7.3.1 Instrument Sequence Logbook

Associated with each instrument is a sequence logbook in which all tuning, calibration and analytical activities conducted on that instrument are recorded. Analytical schedules are the preferred method of tracking analytical instrument activities. This logbook is instrument-specific, not person-specific.

At the end of each day or upon completion of an analytical batch, each analyst must sign and date the first page that contain data entries for that day.

Appropriate information contained in the standard preparation logbook may be annotated in the instrument logbook. This has the advantage of correlating standards, QC checks, lot numbers, etcetera, to the appropriate analytical batch without additional searching of records.

7.3.2 Analytical Data Record Keeping System

The need for a single, yet efficient, procedure for analytical data record keeping is paramount in reconstructing historical analytical records. Therefore, the analytical data record keeping system is designed for this procedure.

For each analytical instrument there is an associated record keeping system. Every analytical run made by an instrument is partially or completely documented by this system.

7.4 PHYSICAL SECURITY AND DOCUMENT CONFIDENTIALITY

Data may be compromised in many ways other than QA/QC measures normally associated with the validation of generated data. An important aspect of data integrity is answering the question and eliminating the possibility that data may have or could have been compromised by the lack of or inappropriate security measures. Physical security, security measures, document confidentiality and employee policies regarding ethics, waste, fraud and abuse are addressed and continuously monitored in order to generate data of the highest quality that will stand a legal challenge. Physical security, security measures and document confidentiality are generally of the following type:

- Building security,
- Perimeter - door security,
- Visitor security,
- Document confidentiality, and,
- Sample security.

7.4.1 Building Security

Alpha Analytical, Inc. has installed a Z1100 security system through ADT Security Systems. The Z1100 is a digital communicator system monitored 24 hours a day by a central station. When the monitoring station receives an alarm from Alpha, it immediately contacts the correct response agency (ambulance, police or fire).

The Z1100 is an arming system programmed with a pre-alarm and automatic bell cutoff. Alpha has door contacts at all entrances. Passive and infrared motion detectors are strategically located throughout the laboratory to detect intruders in sensitive areas. Alpha has smoke and heat detectors in all areas where flammable chemicals or heat-generating equipment is located. Alpha also has glass breakage detectors on all high travel perimeter glass windows, where intruder entrance through a window could take place.

Alpha continuously updates the security codes to prevent unwanted entry by former employees or others who may have had access to security codes.

7.4.2 Perimeter Door Security

The normal layout of Alpha's laboratory includes a series of perimeter access doors which would not intentionally be designed in the physical plant of a laboratory such as ours. However, since our laboratory is situated in an office building complex, there are a large number of perimeter access doors which necessitates additional perimeter security. The types of perimeter access doors have been identified and are as follows:

- Perimeter doors which will remain open at all times during our normal laboratory hours (e.g., the two main entrance doors);
- Perimeter doors not in direct line with any associated travel patterns of our employees, and which otherwise have no need to be opened for normal business practice; and,
- Perimeter doors in direct line with the travel path of most employees, and need to be secured in a way which allows unfettered access to employees while also being a deterrent to outside intrusions.

The majority of perimeter doors are one-way locking doors such that an employee may exit a perimeter door without a key. However, to gain access to the building would require an access code.

7.4.3 Visitor Security

Unwanted physical intrusions may occur at any time unless a number of security measures are implemented. Once the premise has been secured, attention is now addressed to the non-employees whom may obtain access to our facility.

7.4.3.1 Visitors (e.g. non-employees) are given a visitor badge upon entrance to our facility.

Note: Clients logging in samples or visitors constrained to the main reception area are not required to sign the visitor logbook.

7.4.3.2 Visitors are required to sign-in upon arrival at the front desk, and answer the following questions:

- Date/Time of arrival,
- Company or institute they represent,
- Personal signature,
- Badge or ID number,
- Person whom they are visiting, and
- Date/Time of departure.

7.4.3.3 Visitors are required to place this badge on their garment in such a way to be highly visible at all times.

7.4.3.4 Visitors are required to be escorted to their area of interest and accompanied while on premises.

7.4.3.5 Visitors without a badge will be escorted immediately to the front area and asked to remain there until their party arrives.

7.4.3.6 Visitors without badges also will be questioned to obtain the seriousness and extent of this breach of security and the possibility of data invalidation.

7.4.3.7 Visitors are required to return the badge and sign out at the front desk upon leaving our facility.

Visitor Log-In

Page:_____

Badge ID	Printed Name	Signed Name	Company you represent	Person Visiting	Date/Time Arrival	Date/Time Departure

7.4.4 Sample Security

7.4.4.1 Sample security is the responsibility of the person who has custody of the sample at any particular time. The overall responsibility resides with the SCO to ensure sample custody practices and procedures are being followed.

7.4.4.2 Sample storage refrigerators are not locked for most routine samples; however, occasionally a higher level of sample security and custody is required by a sensitive project. Alpha Analytical is prepared and can use locked and secured storage facilities for this purpose.

7.4.4.3 Samples that require separately locked storage facilities will be the responsibility of the SCO. Staff members associated with that particular project will be assigned access and sample custody will remain with the designated project-specific personnel during laboratory activities.

7.4.5 Document Confidentiality

7.4.5.1 All samples and project documents are considered to be confidential. Standard Business Records Confidentiality practices apply to all documents, materials and relevant information.

7.4.5.2 Specific procedures that are followed to maintain legal confidentiality include the following:

7.4.5.2.1 All documents and files are secured in locked file cabinets or equally secured areas, i.e., secured building, during other than normal working hours, unless the files are personally attended by someone authorized to have access to such files;

7.4.5.2.2 Employees other than management, DCO or SCO are not allowed immediate or direct access to confidential files or documents without approval of the Laboratory Director; and,

7.4.5.2.3 All sample documents and any verbal information will only be released to the client who requested sample analysis.

Note: Persons or organizations, other than the client, requesting such information may only receive the information upon approval to release the data.

If there are any doubts concerning the identity of the organization or authority, then they must show proof of identification before Alpha will release information.

QUALITY ASSURANCE MANUAL
VOLUME I

Section 8

Analytical Procedures

8.0 ANALYTICAL PROCEDURES

8.1 INTRODUCTION

8.1.1 Standardized analytical methods used by Alpha are generally published methods from recognized federal agencies (i.e., SW-846, Standard Methods, EPA's Methods for the Determination of Organic Compounds in Drinking Water etc.).

8.1.2 Most standardized methods require an initial demonstration of capability study which generates precision and accuracy data establishing a baseline typical of routine analysis. The initial demonstration of capability studies are used primarily to preclude a laboratory from analyzing unknown samples via a new, unfamiliar method prior to obtaining some experience with it.

It is Alpha's policy to demonstrates the ability to perform that method of analysis with the prescribed degree of precision and accuracy before using an analytical method to analyze environmental samples.

8.2 ANALYTICAL METHODS

Standardized analytical methods are described by a set of written procedures completely defining the techniques used to process a sample and obtain analytical results. Descriptions of analytes, sample matrix, sample preparation, types and quantities of reagents, instrumental calibration and measurement parameters, and computations are all integral parts of a complete method.

8.2.1 Selection of Methods

Analytical methods are selected for environmental testing, including methods for sampling, to meet the needs of our clients and which are cited in regulation as the appropriate methods for the specific regulatory programs.

8.2.2 Sources of Standardized Methods

8.2.2.1 Alpha uses standardized methods for commonly encountered analytes in order to provide a common point of reference, and to establish standard practices that allow inter-laboratory comparison of data. Alpha uses methods that are program specific and are typically referenced in the regulatory literature.

8.2.2.2 In addition to specifying sample preparation and analytical procedures, each method also typically specifies calibration procedures, calibration acceptance criteria, methods of preparing standard solutions, and preparation of QC samples.

8.2.2.3 The latest valid edition of these referenced methods are used unless it is not appropriate or impossible to do.

8.2.2.4 Requested methods of analysis are used unless it is not appropriate, or if we are not certified for the requested method and an equivalent certified method exists, then that method will be used.

8.2.2.5 When the client does not specify a method of analysis, Alpha only uses methods that have been fully documented and validated and the client informed of the chosen method.

8.2.2.6 When a client proposes a method that is considered to be inappropriate or out of date, the client is informed as to the problem and instructed as to the most appropriate method.

8.2.3 Procedure Manual

Analytical method used in our facility has an associated in-house analytical SOP and in total comprise our Procedure Manual. These SOPs are written, reviewed, approved, and distributed according to the procedures outlined in Appendix D. When the referenced method is ambiguous or does not provide sufficient information, our in-house analytical SOP clarifies those issues detailed in Clarification Boxes.

8.2.4 Laboratory Developed Methods

If an analytical test method is developed by Alpha, it will be planned and executed in a well organized, scientifically supported manner. As method development proceeds, the modifications, changes, experiments, etc. are communicated to all involved personnel, in order to keep them abreast of those changes.

8.2.5 Non-Standard Methods

In the event that analyses must be conducted for compounds for which no reliable method exists, development of a method will be conducted under the supervision of the Technical Director. As part of the method development, and to ensure continuous quality of data, QC criteria is initially proposed and established that is consistent with similar methods or technology. At a minimum the following QC requirements are addressed:

- Calibration,
- Contamination,
- Precision and accuracy,
- Interference, and
- Analyte identification.

When testing of the analytical procedure has been successfully completed, the method is evaluated for scientific and technical soundness and is documented in the standardized format.

8.3 SUMMARY OF ANALYTICAL PROCEDURES

The analytical and extraction procedures presented in the following sections are methods currently used at Alpha Analytical in support of the various environmental regulatory programs. A brief description of the methods are in the subsections following the tables.

8.4 ANALYTICAL METHODS IN SUPPORT OF THE SAFE DRINKING WATER ACT (SDWA)

A series of inorganic methods of analysis are found in Methods for Chemical Analysis of Water and Wastes. These are a series of wet chemistry and various metals methods used in support of the Safe Drinking Water Act (SDWA). Standard Methods for the Examination of Water and Wastewater is also used in support of the SDWA; however, this reference contains inorganic wet chemistry, metals and organic methods of analysis. An additional series of methods written by the EPA covering all methods required under the SDWA is found in Methods for the Determination of Organic and Inorganic Compounds in Drinking Water and associated supplements. Methods of analysis Alpha Analytical uses in support of the SDWA is as follows:

SDWA Methods of Analysis
Table 8-1

EPA METHODS	STANDARD METHODS	PARAMETERS
Inorganic		
120.1	SM2510B	Conductivity
150.2	SM4500H B	pH
	SM2540C	TDS
180.1	SM2130B	Turbidity
200.8		Metals
300.0		Anions
	SM2320B	Alkalinity
314.0		Perchlorate
	SM4500Cl G	Free Residual Chlorine
	SM3500Cr D	Chromium VI
	SM2340B	Hardness (calculated)
Organic		
524.2		Volatile Organics

8.4.1 Conductivity - EPA Method 120.1/Standard Method 2510B

Conductivity is the ability of a solution to pass a current. The amount of current a solution may conduct is proportional to the number of ions present in the sample. Therefore, conductivity is a measure of the total ionic concentration in a sample. Specific conductance of a sample is determined by the use of a self-contained conductivity meter at 25°C, thus standardizing the measurement by compensating for cell geometry and temperature.

8.4.2 pH - EPA Method 150.2/Standard Method 4500H B

The pH of a sample is determined electrometrically using a combination electrode. The pH meter is calibrated using a series of standard pH buffers at a known pH.

8.4.3 Total Dissolved Solids (TDS) - Standard Method 2540C

A sample is filtered through a standard glass-fiber filter, and the filtrate is evaporated to dryness in a pre-weighed crucible and dried to a constant weight in an oven at a final fixed temperature of 180°C. The increase in weight over that of the empty crucible represents the total dissolved solids.

8.4.4 Turbidity - EPA Method 180.1/Standard Method 2130B

Turbidity measurement is based upon a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension.

8.4.5 Metals - EPA Method 200.8

This procedure is a multi-elemental procedure for the determination of analytes by ICP-MS in environmental samples. Elements in solution are introduced by pneumatic nebulization and the resulting aerosol is transported by argon gas into a radio frequency plasma where the energy transfer process causes desolvation of the elements followed by atomization and ionization. The ions produced by high temperatures are entrained in the plasma gas and introduced, by means of a vacuum interface, into a mass spectrometer. The ions produced are sorted according to their mass-to-charge ratios by a quadrapole mass spectrometer and detected with the assistance of a electron multiplier. Isobaric elemental interferences and interferences from polyatomic ions derived from the plasma gas, reagents and sample matrix are corrected by the data acquisition software.

8.4.5.1 For the determination of total recoverable metals, analytes are solubilized by gentle refluxing with nitric and hydrochloric acids i.e., block digestion. After cooling, the sample is brought back to its

original volume, mixed and centrifuged or allowed to settle overnight prior to filtration and sample analysis.

8.4.5.2 For the determination of dissolved metals in a filtered sample, or the direct analysis of analytes in drinking water samples where the sample turbidity is <1 NTU, the sample is made ready for analysis by the addition of nitric acid prior to sample analysis.

8.4.6 Anions - EPA Method 300.0

A small volume of sample is introduced into an ion chromatograph to flush and fill a fixed volume sample loop. The sample is then injected into a mobile phase eluent of carbonate-bicarbonate. The anions are separated and measured using an Ion Chromatograph (IC) comprised of a guard column, an analytical column, a suppressor device and the conductivity detector. The suppressor device reduces the amount of background conductivity of the carbonate-bicarbonate eluent to a negligible level. Anions are identified based on their retention times compared to known standards.

8.4.7 Alkalinity - Standard Method 2320B

An unaltered sample is titrated to an electrometrically determined end point of pH 4.5 for total alkalinity and to a second endpoint of 8.3 if the speciation of alkalinity is required. The sample is not filtered, diluted, concentrated, or altered in any way.

For samples of low alkalinity (less than 20 mg $CaCO_3$/L) an extrapolation technique is used to determine the equivalence point. The amount of standard acid required to reduce the pH exactly 0.30 pH units beyond the normal end point of 4.5 corresponds to an exact doubling of the hydrogen ion concentration.

8.4.7.1 Chemical Reactions

Sulfuric acid (hydrochloric acid may also be used) reacts with three forms of alkalinity converting them to water or carbonic acid. If hydroxide is present, it reacts to form water:

$$2OH^- + H_2SO_4 \rightleftarrows 2H_2O + SO_4^{2-}$$

This conversion usually is complete at a pH of approximately 10. Phenolphthalein alkalinity is determined by titration to an end point of pH 8.3, which corresponds to the conversion of carbonate to bicarbonate.

$$2CO_3^{2-} + H_2SO_4 \rightleftarrows 2HCO_3^- + SO_4^{2-}$$

If hydroxide is present, titration to pH 8.3 will indicate the alkalinity due to all of the hydroxide plus one-half of the carbonate. Continued titration to pH 4.5 completes the conversion of carbonate plus any bicarbonate present to carbonic acid. This value is termed total alkalinity.

$$2HCO_3^- + H_2SO_4 \rightleftarrows 2H_2CO_3 + SO_4^{2-}$$

8.4.8 Perchlorate - EPA Method 314.0

A volume of sample is introduced into an ion chromatograph to flush and fill a fixed volume sample loop. The sample is then injected into a mobile phase eluent of 70 mM KOH. The perchlorate anion is separated and measured using an IC comprised of a guard column, an analytical column, a suppresser device and the conductivity detector. The suppressor device reduces the amount of background conductivity of the KOH eluent to yield a baseline with no more than 4-5 nanosiemen (nS) noise/drift per minute. Perchlorate is identified based on its retention time compared to known standards. Quantitation is accomplished by measuring peak area and comparing it to a calibration curve generated from known standards.

8.4.9 Free Residual Chlorine - Standard Method 4500Cl G

Free residual chlorine also known as free available chlorine exists in most waters as hypochlorous acid (HOCl) or hypochlorite ion (OCl^-). These analytes react immediately with DPD (N,N-diethyl-p-phenylenediamine) indicator to form a pink color. The intensity of the pink color is proportional to the chlorine concentration. Chlorine is measured at a wavelength of 530nm.

8.4.10 Chromium VI - Standard Method 3500Cr D

Hexavalent chromium is determined colorimetrically by a reaction with diphenylcarbazide in an acid solution. A purple color will appear if hexavalent chromium is present in the absence of interfering analytes. The concentration of hexavalent chromium is determined by its absorbance measured photometrically at a wavelength of 540 nm.

8.4.11 Hardness (Calculated) - Standard Method 2340B

Total hardness is defined as the sum of calcium and magnesium concentrations, both expressed as calcium carbonate, in milligrams per liter. Although hardness can be determined in a number of ways, the preferred procedure is to compute hardness from the results of separate determinations of calcium and magnesium as a ratio to calcium carbonate. Therefore, the calculation of "Hardness (calc), mg equivalent $CaCO_3$ = 2.497 [Ca, mg/L] + 4.118 [Mg, mg/L].

8.4.12 Volatile Organics - EPA Method 524.2

Helium is sparged through a 25ml water sample contained in a purge-and-trap chamber at ambient temperature. The purgeable organics are transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent trap where the purgeables are absorbed. After purging is completed, the trap is heated to thermally desorb the purgeables onto a gas chromatographic column. The GC is temperature programmed to separate the purgeables which are then detected with a mass spectrometer. Analytes are quantitated using an internal standard procedural calibration process.

8.5 ANALYTICAL PROCEDURES IN SUPPORT OF THE CLEAN WATER ACT (CWA)

The Clean Water Act includes a promulgated series of methods enacted to satisfy the analytical requirements of a facility holding an NPDES discharge permit. The 600 series organic methods of analysis are found in 40 CFR, Appendix A, Part 136, and Methods for Organic Analysis of Municipal and Industrial Waste Water. These are a series of GC, GC/MS and HPLC methods for the determination of compounds that may be found in municipal and industrial discharges.

The inorganic methods of analysis are found in Methods for Chemical Analysis of Water and Wastes. These are a series of wet chemistry and various metals methods used in support of the CWA. These are the same procedures as used in support of the SDWA. Standard Methods for the Examination of Water and Wastewater is also used in support of the CWA. Methods of analysis Alpha Analytical uses in support of the CWA is as follows:

CWA Methods of Analysis
Table 8-2

EPA METHODS	STANDARD METHODS	PARAMETERS
Inorganic		
120.1	SM2510B	Conductivity
150.2	SM4500H B	pH
	SM2540C	TDS
	SM2540D	TSS
	SM2540B	TS
180.1	SM2130B	Turbidity
200.8		Metals
300.0		Anions

	SM2310B	Acidity
	SM2320B	Alkalinity
314.0		Perchlorate
	SM4500Cl G	Total and Free Residual Chlorine
	SM4500NH3 D (NH3 B-distillation)	Ammonia
	SM4500NH3 D (Norg C-digestion)	Total Kjeldahl-N
365.3	SM4500P E (B5 - digestion)	Total Phosphorus
	SM4500S D	Sulfide
410.4	SM5220 D	COD
	SM5310C	TOC
	SM2340B	Hardness (calculated)
	SM3500Cr D	Chromium VI
	SM3500Fe D	Ferrous Iron
1664A		n-Hexane Extractable Material (Oil and Grease)
Organic		
608	SM6630C	Organochlorine Pesticides and PCBs
624		Purgeables
625		Semivolatile Base/Neutal and Acids

8.5.1 Total Suspended Solids (TSS) - Standard Method 2540D

A well-mixed sample is filtered through a pre-weighed glass-fiber filter and the residue retained on the filter is dried to a constant weight at a final fixed temperature of 103-105°C. The increase in weight of the filter represents the total suspended solids.

8.5.2 Total Solids (TS) - Standard Method 2540B

A well-mixed sample is evaporated in a pre-weighed crucible and dried to a constant weight in an oven at a final fixed temperature of 103 to 105°C. The increase in weight over that of the empty crucible represents the total solids.

8.5.3 Acidity - Standard Method 2310B

The sample pH is determined and a measured amount of standard acid is added to lower the pH to 4 or less. If the initial sample pH is less than 4.0, the addition of acid is not required. This is an arbitrary inflection point, because accurate identification of inflection points may be difficult or impossible in buffered or complex mixtures.

The sample is oxidized with hydrogen peroxide because samples of industrial wastes, acid mine drainage, or other solutions that contain appreciable amounts of hydrolyzable metal ions such as iron, aluminum or manganese may exist in other reduced forms of the polyvalent cations. The sample is subsequently boiled to hasten hydrolysis.

The sample is cooled and titrated electrometrically with standard alkali to a pH of 8.3. The titration to an end point of 8.3 corresponds to the stoichiometric neutralization of carbonic acid to bicarbonate and is reported as total acidity (pH 8.3). This end point is generally accepted as the standard of total acidity, including CO_2 and most weak acids. However, for more complex mixtures or buffered solutions such as waste waters or grossly polluted waters, use two end points, 3.7 and 8.3 for standard acidity determinations where simple carbonate equilibria cannot be assumed. In this case acidity is reported as "methyl orange acidity" (pH 3.7) and total acidity (pH 8.3).

8.5.4 Total Residual Chlorine - Standard Method SM4500-Cl G

8.5.4.1 Free Residual Chlorine (A fraction)

Free residual chlorine also known as free available chlorine exists in most waters as hypochlorous acid (HOCl) or hypochlorite ion (OCl^-). These analytes react immediately with DPD (N,N-diethyl-p-phenylenediamine) indicator to form a pink color. The intensity of the pink color is proportional to the chlorine concentration. Chlorine is measured at a wavelength of 530nm (A reading).

8.5.4.2 Combined Chlorine (B-A fraction) + (C-A fraction)

Chloroanimes analyzed and reported as combined chlorine may be estimated with an additional sample preparation procedure.

Monochloramine (B-A fraction)

The monochloramine (ClH_2N) fraction (B-A) is estimated by the addition of 0.1mg of KI per 10 mL sample volume using the same sample as used in the free residual analysis followed by immediate sample analysis (B reading).

Dichloramine (C-A fraction)

The dichloramine (Cl_2HN) fraction may further be estimated by the addition of 0.2g KI per 10 mL sample volume using this same sample followed by immediate analysis.

A simplified approach for determining monochloramine and dichloramine together as combined chlorine would be to add 0.2g KI per 10 mL sample

volume and not fractionate the combined chlorine subfractions (total residual chlorine). To determine the concentration of the combined chlorine, run a free residual chlorine test. Subtract the results of the free chlorine test from the total chlorine test to obtain the combined chlorine concentration.

8.5.4.3 Total Chlorine (A fraction) + (B-A fraction) + (C-A fraction)

Total chlorine may be determined as the addition of free residual and combined chlorine. This is accomplished in a single spectophotometric reading by adding the full amount of KI, 0.2g per 10 mL sample volume, at the start of the analysis along with the DPD indicator.

Total chlorine analysis is actually a determination of the iodine present in a sample. Iodine is produced in a stoichiometric relationship with combined chlorine from the addition of KI. The combined chlorine oxidizes iodide in the reagent to iodine. The iodine and free chlorine react with DPD to form a pink color which is proportional to the total chlorine concentration.

8.5.5 Ammonia - Standard Method SM4500NH_3 D

8.5.5.1 Distillation - Standard Method SM4500NH_3 B

Samples are buffered to a pH of 9.5 with a borate buffer solution to decrease hydrolysis of cyanates and organic nitrogen compounds. Samples are then distilled into a weak sulfuric acid solution to trap the ammonia and analyzed by an ammonia-selective electrode.

8.5.5.2 Analysis

The ammonia concentration of a sample is determined potentiometrically using an ion selective gas-sensing combination ammonia electrode. Dissolved ammonia ($NH_{3(aq)}$ and NH_{4+}) are converted to $NH_{3(aq)}$ by raising the pH to above 11 with a strong base. The gas sensing electrode responds to dissolved ammonia gas in solution. The dissolved ammonia gas diffuses across a hydrophobic gas-permeable membrane into a small volume of (ammonium chloride) buffer solution, specific to the ammonia electrode. Reaction of the gas with the buffer causes a pH change sensed by an internal pH electrode. The fixed level of chloride in the internal fill solution is sensed by a chloride ion-selective electrode that serves as the reference electrode. Because the reference electrode is built-in, a separate reference electrode is not necessary.

This same procedure using a gas-sensing electrode can also be used to measure ammonium ions after conversion to ammonia, or organic nitrogen after Kjeldahl digestion of the sample.

8.5.6 Total Kjeldahl Nitrogen (TKN)- Standard Method SM4500NH3 D

8.5.6.1 Digestion - Standard Method $SM4500NH3_{org}$ C

Prior to the distillation or analysis of ammonia as described below, the sample is heated in the presence of concentrated sulfuric acid, potassium sulfate and copper sulfate until the solution becomes colorless or pale blue-green. The ammonia is subsequently distilled from the sample and determined potentiometrically.

8.5.6.2 Analysis

See ammonia analysis above.

8.5.7 Total Phosphorus - EPA Method 365.3/Standard Method SM4500P E

The determination of phosphorus can generally be summed up into two procedural steps: a) conversion of the various forms of phosphorous to ortho-phosphate and b) colorimetric determination of ortho-phosphate.

8.5.7.1 Digestion - Standard Method SM4500B5

Total phosphorus procedure converts organic and inorganic phosphorous to the ortho-phosphate form by a persulfate digestion.

Acid-hydrolyzable phosphorous or polyphosphates forms of phosphorus are converted to the orthophosphate form by sulfuric acid hydrolysis. This form of phosphorus will contain free orthophosphate plus a small amount of organically bound phosphorous. Therefore acid-hydrolyzable phosphorous is reported as the difference between the results obtained using the hydrolysis procedure and the results of ortho-phosphate analyzed directly without acid hydrolysis.

8.5.7.2 Analysis

These preparatory procedures are then followed by the analysis of orthophosphate. Orthophosphate reacts with molybdate in an acid medium to produce a phosphomolybdate complex. This complex is reduced to an intensely blue-colored complex by ascorbic acid. This colorimetric procedure is based on reactions that are specific for the orthophosphate ion. The color is proportional to the phosphorus concentration.

8.5.8 Sulfide - Standard Method SM4500S D

The methylene blue method is based on the reaction of sulfide, ferric chloride, and

N,N-dimethyl-p-phenylenediamine in an acidic solution to form the dye methylene blue. The excess color due to ferric chloride is removed by the addition of diammonium hydrogen phosphate.

8.5.8.1 Total Sulfide

Hydrogen sulfide and acid-soluble metal sulfides are collected and preserved with zinc acetate which forms the insoluble ZnS, and further basified with sodium hydroxide. This preservation and extraction treatment limits the loss (volatilization) of potential sulfide prior to sample analysis. Interferences are removed from the sample (and the sample concentrated) by carefully withdrawing the supernatant liquid from the ZnS precipitate, and either replacing the removed water with deionized water or leaving at the lesser volume for sample concentration. Sulfide is then color developed by the reaction with N,N-dimethyl-p-phenylenediamine sulfate to form methylene blue. The intensity of the blue color is proportional to the sulfide concentration. Sulfide is measured at a wavelength of 665 nm.

8.5.8.2 Dissolved Sulfide

Dissolved sulfide may be determined after the suspended solids have been removed by flocculation and settling prior to color development and sample analysis.

8.5.9 Chemical Oxygen Demand (COD) - EPA Method 410.4/Standard Method SM5520D

The mg/L COD results are defined as the mg of O_2 consumed per liter of sample under conditions outlined in this procedure. Samples are prepared by a closed-reflux digestion procedure with sulfuric acid along with an excess of potassium dichromate ($K_2Cr_2O_7$) followed by sample analysis. The COD reagents also contain silver and mercury ions. Silver sulfate ($AgSO_4$) serves as a catalyst to assist oxidation of straight-chain hydrocarbons such as diesel fuel and motor oil and mercury is used to control the chloride interferences. The sample is digested at a temperature of 150°C for two hours to drive the reaction to completion. During digestion the samples' carbon bearing compounds are oxidized by the acid and potassium dichromate, reducing the dichromate ion (Cr_2O_7) to green chromic ion (Cr_3+) while the organic matter and inorganic carbon compounds are oxidized to CO_2 and H_2O. Colorimetric analysis is suitable for COD because the two chromium ions absorb at different wavelengths in the visible range Cr_3+ at 600nm and Cr_6+ at 420 nm.

8.5.10 Total Organic Carbon (TOC) - Standard Method 5310C

Inorganic carbon in most water samples is the main fraction of carbon and is generally many times greater than the TOC fraction. TOC is the main focus of this procedure, therefore, the IC fraction is first eliminated by acidification of the sample to convert

the inorganic carbon to CO_2. Subsequent purging of the sample strips the sample of CO_2; however, sample purging also removes POC so that the organic carbon measurement made after eliminating the IC fraction is actually a NPOC determination.

Note: In most surface and ground waters the POC fraction is negligible. Therefore, in practice, the NPOC determination is substituted for TOC.

Organic carbon in the sample is then converted to carbon dioxide (CO_2) by persulfate oxidation and UV irradiation. The CO_2 formed is stripped from the sample with a stream of gas and measured directly by a non-dispersive infrared (NDIR) detector. The amount of CO_2 is directly proportional to the concentration of organic carbon material in the sample.

8.5.11 Ferrous and Ferric Iron - Standard Method SM3500Fe D

8.5.11.1 Ferrous Iron (Fe^{2+})

The 1,10-phenanthroline indicator in the Ferrous Iron Reagent pillow reacts with ferrous iron in the sample to form an orange color in proportion to the iron concentration. Ferric iron does not react.

8.5.11.2 Ferric Iron (Fe^{3+})

The ferric iron concentration can be determined by subtracting the ferrous iron concentration from the results of a total iron test.

8.5.12 Hexane Extractable Material (HEM) - EPA Method 1664A

This method is a performance based procedure applicable to aqueous matrices that requires the use of n-hexane as the extraction solvent and gravimetry as the determinative technique.

8.5.12.1 A 1-L sample is acidified to a pH <2 and extacted with n-hexane. The n–hexane is reduced to dryness, desiccated and weighed. The residual weight gain is calculated and reported as HEM.

8.5.12.2 The HEM may be further speciated into Silica Gel Treated (SGT-HEM) by re-dissolving the dried extract with n–hexane and silica gel. The silica gel adsorbs the polar fraction leaving the non-polar fraction. This fraction is reduced to dryness, desiccated and weighed. The residual weight gain is calculated and reported as SGT-HEM.

8.5.13 Pesticides and PCBs - EPA Method 608/Standard Method 6630C

This procedure is a GC method used to determine organochlorine pesticides and

PCBs. A measured volume of water sample is extracted with solvent. The extract is separated by a GC equipped with an Electron Capture Detector for the identification of the target compounds.

8.5.14 Purgeables - EPA Method 624

Method 624 is a GC/MS method used in the determination of a number of volatile organics in industrial and municipal wastewater. Helium is bubbled through a 25 ml water sample contained in a specially designed purging chamber at ambient temperature. The purgeables are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent trap where the purgeables are trapped. After purging is completed, the trap is heated and back-flushed to desorb the purgeables onto the GC. The gas chromatograph is temperature programmed to separate the purgeables which are then detected with a mass spectrometer.

8.5.15 Base/Neutrals and Acids - EPA Method 625

Method 625 is a GC/MS procedure used in the determination of a number of organic compounds that are partitioned into an organic solvent and are amenable to gas chromatography. A measured sample volume is extracted with methylene chloride at a pH greater than eleven and again at a pH less than two using a separatory funnel or by mechanical tumbling or shaking. The methylene chloride extract is dried, concentrated and analyzed by GC/MS.

8.6 ANALYTICAL PROCEDURES IN SUPPORT OF THE RESOURCE CONSERVATION AND RECLAMATION ACT (RCRA)

Several of the hazardous waste regulations under Subtitle C of RCRA require that specific test methods described in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Final Update III (SW-846) be employed for certain applications. Specific requirements are found in 40 CFR, part 140 through 290.

SW-846 provides the test procedures and guidelines for field and laboratory quality control, sampling, determining hazardous constituents in waste, determining the hazardous characteristics of waste (toxicity, ignitability, reactivity, and corrosivity) and for determining the physical properties of waste. Methods of analysis Alpha Analytical uses in support of RCRA is as follows:

RCRA Methods of Analysis
Table 8-3

EPA METHODS	OTHER METHODS	PARAMETERS
Inorganic		
SW6020/6020A		Metals
SW7196A		Chromium (VI)
SW9040C/9045D		Corrosivity
SW9050A		Conductivity
SW9056		Anions
SW9060A		TOC
Organic		
SW8015B/D-DRO	NWTPH-dx	Total Petroleum Hydrocarbons (Diesel Range)
SW8015B/D-GRO	NWTPH-gx	Total Petroleum Hydrocarbons (Gasoline Range)
SW8081A		Organochlorine Pesticides
SW8082		Polychlorinated Biphenyls (PCBs)
SW8260B		Volatile Organics
SW8270C		Semi-volatile Organics

8.6.1 Metals - EPA Method SW6020/6020A

An aliquot of a well mixed, aqueous or solid sample is weighed or measured for sample processing. For total metals analysis, analytes are solubilized by acid digestion. After cooling, the sample is made up to volume prior to analysis.

This procedure is a multi-elemental procedure for the determination of analytes by ICP-MS in environmental samples. This method measures ions produced by a radio frequency inductively coupled plasma. Analyte species originating in a liquid are nebulized and the resulting aerosol is transported by argon gas into the plasma torch. The ions produced by high temperatures are entrained in the plasma gas and introduced, by means of an interface, into a mass spectrometer. The ions produced in the plasma are sorted according to their mass-to-charge ratios and quantified.

8.6.2 Hexavalent Chrome - EPA Method 7196A

Hexavalent chromium is determined colorimetrically by a reaction with diphenylcarbazide in an acid solution. A purple color will appear if hexavalent chromium is present in the absence of interfering analytes. The concentration of hexavalent chromium is determined by its absorbance measured photometrically at a wavelength of 540 nm.

An alkaline digestion procedure using a 0.28M Na_2CO_3/0.5M NaOH solution and heating the digestate to 90-95°C for 60 minutes is required to extract hexavalent chromium in soils prior to color development and spectrophotometric analysis. The pH of the sample digest must be carefully adjusted during the digestion procedure and temperature monitored to ensure the complete dissolution of Cr(VI) and stabilize it against reduction to Cr(III).

8.6.3 Conductivity - EPA Method 9050A

Conductivity is the ability of a solution to pass a current. The amount of current a solution may conduct is proportional to the number of ions present in the sample. Therefore, conductivity is a measure of the total ionic concentration in a sample. Specific conductance of a sample is determined by the use of a self-contained conductivity meter at 25°C, thus standardizing the measurement by compensating for cell geometry and temperature.

8.6.4 Anions - EPA Method SW9056

A small volume of sample is introduced into an ion chromatograph to flush and fill a fixed volume sample loop. The sample is then injected into a mobile phase eluent of carbonate-bicarbonate. The anions are separated and measured using an Ion Chromatograph (IC) comprised of a guard column, an analytical column, a suppressor device and the conductivity detector. The suppressor device reduces the amount of background conductivity of the carbonate-bicarbonate eluent to a negligible level. Anions are identified based on their retention times compared to known standards. An extraction procedure is performed on soil and/or solid samples prior to sample analysis.

8.6.5 Total Organic Carbon (TOC) - EPA Method SW9060A

Inorganic Carbon (IC), carbonate and bicarbonate is removed by acidification and purging. Sample purging also removes Purgeable Organic Carbon (POC) so that the organic carbon measurement made after eliminating IC interferences is actually a Non Purgeable Organic Carbon (NPOC) determination. Therefore, in practice, the NPOC determination is substituted for TOC. Organic carbon in the sample is then converted to carbon dioxide (CO_2) by persulfate oxidation. The CO_2 formed is measured directly by a non-dispersive infrared detector. The amount of CO_2 is directly proportional to the concentration of carbonaceous material in the sample.

8.6.6 Total Petroleum Hydrocarbons (TPH) - EPA Method 8015B/D-DRO

This method is applicable to the analysis of semi-volatile petroleum hydrocarbons, commonly referred to as Diesel Range Organics (DRO). DROs typically correspond to the range of petroleum compounds from C_{13} to C_{22}; however, this range may be changed as required. Diesel fuel is used as the default standard for quantitation of

petroleum hydrocarbons identified in this C range. Samples are solvent extracted and analyzed by GC/FID.

8.6.7 Total Petroleum Hydrocarbons (TPH) - EPA Method 8015B/D-GRO

This method is applicable to the analysis of volatile petroleum hydrocarbons, commonly referred to as Gasoline Range Organics (GRO). The SW846 Method 8015B/D-GRO specifies a C range of C_6 to C_{10} using 2-methylpentane and 1,2,4-trimethylbenzene as the C range markers. Our policy is to define GROs as those hydrocarbons which correspond to the range of alkanes from C_4 to C_{13}; however, this may be changed as required. Gasoline is used as the default standard for quantitation and includes compounds from C_4 to C_{13}. Samples are analyzed by the GC/MS purge-and-trap procedure.

8.6.8 Organochlorine Pesticides - EPA Method SW8081A

Method 8081A is used to determine the concentration of various organochlorine pesticides in extracts from solid and liquid matrices. A measured volume or weight of sample is extracted using the appropriate sample extraction technique. After the sample has been extracted and dried it is exchanged into hexane for final concentration. The extract is injected into a GC equipped with an Electron Capture Detector for separation and quantitation. All compounds identified tentatively in the primary analysis are confirmed on a dissimilar GC column.

8.6.9 Polychlorinated Biphenyls (PCBs) - EPA Method SW8082

Method 8082 is used to determine the concentration of the several common PCBs as Aroclors or as individual PCB congeners in extracts for solid and liquid matrices. A measured volume or weight of sample is extracted using the appropriate sample extraction technique. After the sample has been extracted and dried, it is exchanged into hexane for final concentration. The extract is injected into a GC equipped with an Electron Capture Detector for separation and quantitation. All compounds identified tentatively in the primary analysis are confirmed on a dissimilar GC column.

8.6.10 Volatile Organics - EPA Method SW8260B

Volatile (or purgeable) organics in water and soil samples are analyzed using method SW8260B. This method uses a gas chromatography mass spectrometry technique. Volatile compounds are introduced into the GC by purge and trap (SW5030C). Helium gas is bubbled through the sample to transfer the purgeable organic compounds from the liquid to vapor phase. Soil samples are extracted with methanol before purging or are directly sparged with a special purge and trap device. The vapor is then swept through a sorbent trap where the purgeable organics are trapped. The trap is back- flushed and heated to desorb the purgeable organics onto a capillary GC column where they are separated and then detected with a mass spectrometer. The

Internal Standard (IS) procedure is used for the quantitation of analytes of interest. For quantitation, RFs are calculated from the base ion peak of a specific IS that is added to each calibration standard, blank, QC sample, and sample.

8.6.11 Semi-volatiles - EPA Method SW8270C

Semi-volatile organics (also known as base/neutral and acid extractables) in water and soil samples are analyzed using method SW8270C. This technique quantitatively determines the concentration of a number of SVOCs. Samples are extracted and both base/neutral and acid extracts are then combined. Compounds of interest are separated and quantified using a capillary column GC/MS. The IS procedure is used for quantitation of target analytes. For quantitation, RFs are calculated from the base ion peak of a specific IS that is added to each calibration standard, blank, QC sample, and sample.

8.7 SAMPLE EXTRACTION

8.7.1 Water Sample Preparation

The need to filter water samples depends on whether total or dissolved contaminants are of interest. The client will determine this prior to sample collection for each specific site/project.

Samples which are analyzed only for dissolved analytes such as metals must be filtered prior to chemical preservation. Analysis for volatile organic compounds and oil/grease are the only two universal exceptions to this guideline; they are never filtered. Samples may be filtered in the laboratory prior to extraction if requested by the client. The filter material used by Alpha is chosen on the basis of compatibility factors between the filter paper and the analytes of interest. Compatibility is defined in the following way:

- The sample being filtered is not changed by the filter material; and,
- The filter paper does not absorb or leach out the chemical analytes of interest.

Generally, particulate matter is not considered to be a natural component of groundwater, and normally will be filtered through a 0.45 micron filter prior to analysis, especially if the particulate matter is suspected of interfering with sample workup except for VOCs and Oil and Grease analyses. Filtration of drinking water or tap water will occur if specified by the method of analysis (e.g. all HPLC methods require filtration prior to analysis).

Organic samples for RCRA analysis are prepared using the EPA 3500 series methods when appropriate. In particular, water samples are prepared according to Method 3510C, separatory funnel, Method 3511, micro-extraction, Method 3520C continuous

liquid-liquid extractions, or Method SW3535 Solid Phase Extraction (SPE). These preparation methods are used specifically with the 8000 series methods of analysis.

Inorganic RCRA samples are generally prepared by one of two procedures, EPA method 3010, block digestion or method 3015, microwave digestion. These two acid digestion procedures are used with analytical method 6020 as well as various other analytical metals procedures.

Methods of analysis in support of the SDWA and CWA have their extraction or digestion procedures written into the analytical procedure. Even though they do not have an extraction method assigned to them; they are essentially the same procedures as outlined in the equivalent RCRA procedures. Method specific extraction procedures can be found in the various analytical SOPs.

8.7.2 Soil/Sediment Sample Preparation

Soil and sediment samples are complex mixtures, even within a single sample site. Therefore, surrogate and analyte recovery depends on many factors, including organic content, mineral content, particle size and moisture content of the soil. Soil and sediment samples are analyzed in the condition they are received. Soil samples are generally prepared for extraction or digestion as follows:

The sample is mixed as thoroughly as possible in the original wide-mouth glass bottle by shaking or stirring. Glass rods are used for stirring. If samples have analyses for both volatile organic compounds and other analyses, the VOC sample preparation activity takes precedence before any other sample work-up and subsequent sample homogenization.

Generally, samples are quantitated on a "wet-weight" basis. When necessary, samples are quantitated on a "dry-weight" basis and the percent dry weight content of the sample is determined.

For each soil sample, an aliquot of the sample is dried according to the procedure established in Standard Operating Procedure for Percent Dry Weight and Percent Moisture. Soils are weighed and dried at 105°C for no less than four hours. The calculated % dry weight for each sample is determined and used in final analytical determinations.

The determination of % dry weight is calculated as follows:

$$\% \text{ dry weight} = \frac{\text{Sample Weight (Dry)}}{\text{Sample Weight (Wet)}} \times 100$$

Composite samples are proportioned according to the number of samples and % dry weight content is determined.

Organic sample extractions for soil are prepared according to EPA Methods 3540C, soxhlet extraction; Method 3545, Pressurized Fluid Extraction (PFE), Method 3550A, sonication or Method 3570, micro-extraction. Exceptions to these techniques are method specific as outlined in the SOPs found in Appendix E.

Inorganic soil sample digestion procedures for the analysis of metals are generally prepared according to EPA method 3051, micro-wave digestion.

8.7.3 Sample Batch

Samples are routinely analyzed by a batch system. Alpha uses two types of batch systems: 1) an extraction batch; and 2) an analytical batch. An extraction batch consists of a maximum of 20 samples, that can be extracted together. An analytical batch is any number of samples that can be analyzed during an 8 or 12 hr GC/MS period which is associated with a MS tune.

GC methods usually require calibration verification standards analyzed at a specific sample frequency; however, this does not preclude the analyses of additional standards interspersed with samples. The rate of sample collection or shipment does not determine maximum batch size, although it may limit the number of samples available for analysis at a given time. A batch may consist of samples from more than one client. However, all samples in one batch must be completely processed through any given step in the same time period.

8.8 Extraction Test Procedures for Hazardous Waste

There are two primary extraction tests using buffered reagents to simulate particular environmental conditions in order to determine if a solid waste exhibits the characteristic of toxicity. These procedures are referred to as: 1) Toxicity Characteristic Leaching Procedure (TCLP); or 2) Synthetic Precipitation Leaching Procedure (SPLP). These procedures are used if the total concentration in the waste equals or exceeds the Maximum Concentration of Contaminants for the Toxicity Characteristic (TC) Limits.

8.8.1 Toxicity Characteristic Leaching Procedure (TCLP) - EPA Method SW1311

Method SW1311 is an extraction procedure, using a buffer system similar to acid rain used for the determination of the concentration of organic (volatile and semi-volatile) and inorganic analytes that are leachable from waste or other materials.

8.8.2 Synthetic Precipitation Leaching Procedure (SPLP) - EPA Method SW1312

Method SW1312 is designed to determine the mobility of both organic and inorganic analytes present in liquids, solids, and wastes. This procedure is exactly like the TCLP procedure with the exception of a different buffering medium.

8.9 GENERAL LABORATORY OPERATIONS

There are numerous activities required by our laboratory to be executed with minimal mistakes on a routine basis. Many of these activities are critical in the overall production of analytical methods and in some way influence the QA and QC of the laboratory. Many of these procedures have SOPs not only because they are routine activities, but also because they are regulated by law or by a regulatory agency. Activities other than analytical methods and extraction procedures which have written SOPs are as follows:

- Dish Washing and Steam Scrubber Operations, Appendix E,
- Manual Glassware Cleaning, Appendix E,
- Sample Container Cleaning Procedure, Appendix E,
- Prevention of Sample Contamination, Appendix E,
- Standards Preparation, Appendix E,
- Storage Blank Procedures, Appendix E,
- A Practical Application Guide for Performing a Demonstration of Capabilities (DOC) and Method Detection Limit (MDL) Study, Appendix E,
- Manual and Automated Integration Procedures, Appendix E,
- Waste Disposal, Appendix C,
- Preparation of Reagent Grade Water, Appendix E,
- Sample Compositing and Sub-sampling Procedure, Appendix E, and
- A Practical Application Guide to Performing Initial Calibration, Calibration Model Determination and Calibration Verification, Appendix E,

QUALITY ASSURANCE MANUAL
VOLUME I

Section 9

Calibration Procedures, Reference Standards, Reagents and the Procurement of Supplies and Materials

9.0 CALIBRATION PROCEDURES, REFERENCE STANDARDS, REAGENTS AND THE PROCUREMENT OF SUPPLIES AND MATERIALS

9.1 Instrument Calibration

The following section specifies the essential elements that define the procedures and documentation for initial calibration and continuing instrument calibration verification to ensure that the data is of a known quality and is appropriate for a given regulation or decision.

This section does not specify the detailed procedural steps ("how to") for calibration, but establishes the essential elements for selection of the appropriate technique(s). This approach allows flexibility and permits the employment of a wide variety of analytical method prescribed procedures and statistical approaches currently applicable for calibration.

9.1.1 Initial Instrument Calibration

The following items are defined as essential elements of initial instrument calibration:

a) The details of the initial instrument calibration procedures including calculations, integrations, acceptance criteria and associated statistics is included and/or referenced in the test method SOPs (Procedural Manual).

b) Raw data records are retained to permit the reconstruction of the initial calibration. Raw data records include such things as: calibration date, test method, instrument, analysis date, each analyte name, analyst's initials or signature, concentration and response, calibration curve or response factor, or the unique equation or coefficient used to reduce the instrument response to concentration.

c) Sample results are quantitated from the initial instrument calibration and may not be quanitated from any continuing instrument calibration verification, unless otherwise required by regulation, method or program.

d) Second Source Standard (Initial Calibration Verification Standards)

All initial instrument calibrations are verified with a standard obtained from a second manufacturer or lot if the lot can be demonstrated form the manufacturer as prepared independently from other lots. If available, commercially purchased standards are traceable to a national standard and documented with the Certificate of Analysis (C of A).

The following guidelines are used when method guidance does not exist.

Note 1: The use of standards from a second lot is acceptable when only one manufacturer of the calibration exists.

Note 2: The requirement for a second source standard for the initial calibration is waived if a second source standard is used for the calibration verification.

Note 3: The date of preparation of each second source standard is considered when evaluating its suitability for use. This consideration includes an assessment of the stability of the standard solution, as well as its natural degradation rate.

Note 4: The second source standard is prepared at a concentration at or near the middle of the calibration range. Since most methods do not require the analysis of this standard and no method criteria exists, the criteria of acceptance is generally established using the calibration verification criteria.

e) The initial calibration criteria established and documented in the method SOPs are derived directly from the referenced method, if available. If the referenced method does not provide calibration criteria, then the in-house criteria detailed in the method SOP is established to be appropriate to the calibration technique employed.

f) The limit of quantitation, reporting limit, can not be established lower then the lowest initial calibration standard.

Note 1: Data reported below the limit of quantitation, or the lowest initial calibration point is considered to have an increased uncertainty and is only reported using data flags or footnotes.

Note 2: It is Alpha's policy to not report data below our lowest established calibration point and to only report data below the established limit of quantitation, if required by the client as an estimated value.

g) The highest calibration standard is the highest concentration for which quantitative data is reported.

Note 1: Data reported above the highest calibration point is considered to have an increased quantitative uncertainty and is only reported using data flags or footnotes.

Note 2: It is Alpha's policy to not report data above our highest calibration point and to use dilutions as necessary to report all data below the highest concentration point established in the calibration curve.

h) Analyte concentrations reported outside the established working calibration range, are reported as having less certainty and are reported using data flags or footnotes. The lowest calibration standard is above the established limit of detection.

Noted NELAP Exceptions:

If a method or instrument technology (such as ICP/MS) employs a single point calibration strategy, then the following are required:

1) Prior to the analysis of samples a zero point (i.e., calibration blank) and a single point calibration must be analyzed and the linear calibration range of the instrument must be established by analyzing a series of standards, one which is at the lowest quantitation limit. Sample results reported within the established linear calibration range do not require data flags.

2) Zero points, (calibration blanks) and single point calibration standards must be analyzed with each analytical batch.

3) A standard corresponding to the limit of quantitation must be analyzed with each analytical batch and must meet established acceptance criteria.

4) The linearity is verified at a frequency established by the method and/or the manufacturer.

Note: See the ICP/MS method SOP for details.

i) If the initial instrument calibration results are outside of the established acceptance criteria, corrective actions are performed and all associated samples reanalyzed. If reanalysis of the samples is not possible, data associated with an unacceptable initial calibration is reported with the appropriate data flags or footnotes.

j) If the referenced analytical method does not specify the number of initial calibration points, then the minimum number is two (one of which must be at the limit of quantitation), not including blanks, or zero standards, with the exception of methods which only require a single point calibration. The minimum number of calibration points are established and referenced in each of the analytical SOPs.

Note: It is Alpha's policy to establish the minimum number of contiguous calibration points as 3 for inorganic analysis and 5 for organic analysis. All reported single response target analytes are included in the initial calibration with the noted exceptions for some mulit-component analytes, such as PCBs, toxaphene and technical chlordane which may require a separate initial calibration.

9.1.2 Initial Calibration Verification

See section 9.1.1 d above for details

9.1.3 Calibration Verification

When an initial instrument calibration is not performed on the day of analysis, the validity of the initial calibration is verified prior to sample analyses by analyzing an acceptable continuing calibration verification standard at the method specified frequency. As long as the continuing calibration verification is acceptable, a new initial instrument calibration is not necessary.

Note: This is applicable only when method-specific guidance does not exist.

The following items are essential elements of continuing instrument calibration verification:

a) The details of the continuing instrument calibration procedure, calculations and associated statistics are included or referenced in the analytical method SOP.

b) Calibration is verified for each discrete (single response) analyte or element except for mult-component analytes such as PCBs, toxaphe, technical chlordane or total petroleum hydrocarbons where a single response standard mix is used.

c) Instrument calibration verification is performed as follows:

c1) Frequency

1) at the beginning and end of each analytical batch (except, if an internal standard is used, only one verification standards needs to performed at the beginning of the analytical batch);

2) whenever it is expected that the analytical system may be out of calibration or might not meet the verification acceptance criteria;

3) if the time period for calibration or the most previous calibration verification has expired; or

4) if the method specifies a calibration verification requirement.

Note 1: When the method specifies that the CVs be analyzed at a specific sample interval (for example, every 10 or 20 samples), the count of these samples generally includes field samples only.

Note 2: QC samples must be analyzed with their associated batches. The grouping of QC samples from a variety of batches is unacceptable.

Note 3: If the method does not specify an interval for periodic calibration verification standards, then every analytical batch, using an external calibration procedure, should bracket at least every 20 field samples.

c2) Concentration

1) Methods which employ an internal standard calibration procedure should analyze CVs at or just below the middle of the calibration range.

2) Method which employ an external standard calibration procedure, should alternate the concentration of CVs to cover both the low and high end of the initial calibration range.

c3) Standard Source

1) The source of the CV standard can be the same standards used for the initial calibration. As noted above, the requirement for a second source standard for the initial calibration verification is waived if a second source standard is used for the calibration verification.

d) Raw data records are retained to permit the reconstruction of the continuing instrument calibration, e.g., analyst's name, test method, instrument, analysis date, each analyte name, concentration and response, calibration curve or response factor to convert instrument response into concentrations. Continuing calibration records and data are maintained in a manner to explicitly connect the continuing calibration to the initial instrument calibration.

e) The criteria for the acceptance of a continuing instrument calibration verification is established and detailed in the individual method SOPs.

Acceptance Criteria

e1) Corrective Action

1) If the continuing calibration verification results obtained are outside of the established acceptance criteria, corrective action is generally required.

2) If routine corrective action procedures fail to produce a second consecutive (immediate) calibration verification within acceptance criteria, then either, after corrective action, the next two consecutive calibrations verification standards has to be acceptable or a new initial instrument calibration should be performed.

e2) Reporting non-perfect CV Data

If the calibration has not been verified, sample analyses can not occur until the analytical system is calibrated or the calibration is verified. However, if samples are analyzed on an instrument that has failed the continuing instrument calibration, then the results are flagged for the failing analytes. Data associated with an unacceptable calibration verification may be fully useable under the following special conditions:

1) when the acceptance criteria for the continuing instrument calibration verification is exceeded high, (i.e., high bias), and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise the samples affected by the unacceptable calibration verification should be reanalyzed after corrective action and an acceptable calibration verification or a new calibration curve has been established, evaluated and accepted.

2) when the acceptance criteria for the continuing instrument calibration verification is exceeded low, (i.e. low bias), those samples may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable calibration verification should be reanalyzed after corrective action and an acceptable calibration verification or a new calibration curve has been established, evaluated and accepted.

9.2 Standards, Reagents and Reference Materials

9.2.1 Policy

9.2.1.1 It is Alpha's policy to purchase calibration and/or verification and validation standards, to include S class weights, and thermometers, that are traceable to national standards and measurements when possible. These are typically documented with a Certificate of Analysis.

9.2.1.2 It is Alpha's policy to participate in a inter-laboratory comparison program such as a proficiency testing program in an effort to provide additional evidence of correlation of sample results.

9.2.1.3 It is Alpha's policy to properly label and store all bottles, flasks, beakers or vials that contain samples, sample extracts or standard solutions.

9.2.2 Standards and Reference Material

During standard calibration and sample analysis, solutions containing known target compounds at known concentrations are prepared. These standards are used to calibrate instruments and quantitate analytical data.

Alpha Analytical uses the following types of reference material:

- commercial standards;
- commercially prepared custom standards; and
- custom-made standards prepared from reagent grade or neat chemical.

9.2.2.1 Commercial Standards

Commercial standards are the primary source of reference material used in the determination of analytical data. Commercial standards are compared with a secondary source (e.g., ICV standards) of commercial standards to verify standard concentrations and analyte purity. Individual and standard mix solutions procured from commercial vendors are purchased for specific methods of analysis and are factory prepared for ease of secondary dilutions.

9.2.2.2 Custom Standards

Commercial vendors are used to prepare custom standards, that are not easily produced and or prepared with specific analytes and concentrations that are different than their catalogue products.

9.2.2.3 Neat Standards

Neat standards are purchased to prepare in-house custom-made standards. This type of standard is an additional source of reference standard material used in the determination of analytical data. Chemicals used in the preparation of custom made standards are typically ACS reagent grade of >98 % purity.

9.2.3 Reference Material

See section 9.3 below for details.

9.2.4 Transport and Storage

9.2.4.1 Standards and Reference Material

The Standard Preparation SOP, found in Appendix E, describes in detail our procedure for safe handling, transportation, storage and use of reference material (i.e., instrument calibration standards) in order to prevent contamination or deterioration and in order to maintain and protect its integrity.

Semi-volatile reference materials are generally stored in a refrigerator at <6°C and volatile reference materials are generally stored in a freezer at <0°C. Most inorganic reference material is either stored at <6°C or at room temperature.

9.2.4.2 Reagents

Laboratory reagents and chemicals must be stored according to method guidelines and the manufacturer's instructions. All solvents used for VOC analyses (i.e. methanol) must be isolated and stored separately from solvents which may be target analytes.

Reagents are stored and segregated according to compatibility groups (e.g. flammable solvents and non flammable solvents). Storage of all chemicals and solvents follow all OSHA requirements.

9.2.5 Documentation and Labeling of Standards, Reagents and Reference Material

a) Reference Material

A record of all standards, reagents and chemicals are maintained in the Standards Preparation Logbook.

To insure the proper quantification of sample analytes, all standards are the finest quality available.

To insure the integrity of sample quantitation, records are retained for all standards, reagents, and reference material and documented as follows:

- the manufacturer/vendor;
- the manufacturer's Certificate of Analysis or purity;
- lot number;
- the date of receipt;
- recommended storage conditions; and
- expiration date;

Note: standards may not be used past their expiration date unless its reliability is verified.

If standards are prepared, the following additional information is required:

- preparation date,
- amounts and concentration of all source reagents and compounds used; and
- signature and initials of preparer.

Upon receipt of the standards or reagents, the technician or chemist responsible for the preparation and traceability of that standard, dates and initials all certificates. The certificates are then placed in a 3-ring binder for historical reference.

b) Original containers (such as those provided by the manufacturer or vendor) are labeled with an expiration date.

c) Standard Preparation Logbook

The standard preparation logbook is designed to maintain records on standards, reagents and reference material preparation. These records document the traceability of purchased stock and neat standards to the method of preparation, lot number, expiration date and the preparer's initials.

d) All containers of prepared standards and reference material are labeled with a unique identification and expiration date that unequivocally links that container with its associated standard and reference material documentation.

e) The standards preparation logbook contains method requirements to ensure the standards meet the test method criteria. Method specified reagent preparation criteria is specified in the individual analytical SOPs.

f) Containers holding standards and reagents prepared in house are labeled with the following minimum information: standard and/or reagent identification, preparation data and expiration date.

Note: The standard or reagent preparation date is included in its identification and there is no need to duplicate this information.

Note If reference material are to be diluted, or prepared in any way, then they are labeled and documented as detailed above and in the Standard Preparation Logbook.

9.3 Procurement of Supplies and Materials

9.3.1 Vendor Evaluation and Supply Policy

9.3.1.1 It is Alpha's policy to evaluate and select supply vendors, chemicals, reagents and any other supplies which are critical to method performance to include additional testing to verify their quality before use.

9.3.1.2 Supply vendors are typically required to provide information to substantiate their ability to provide suitable quality e.g., Certificates of Analysis (C of A), and their mechanism to assure consistent delivery.

9.3.2 Service and Supplies Purchasing Policy

9.3.2.1 If a method specifies a particular brand name, it is Alpha's policy to purchase the item that meets or exceeds method specification, but not necessarily those brand name items specified in the method.

9.3.2.2 If no industry standard is available which specifies the appropriate quality grade, then it is Alpha's policy to determine what testing may be required to evaluate usability of supplies and materials.

9.32.3 It is Alpha's policy to purchase services and material supplies that affect the quality of environmental testing, at a level which will meet and/or exceed method/project criteria. These services and supplies are typically thought of as:

- Instruments,
- Solvents,
- Reagents,
- Gasses,
- Reference material,
- Sample containers, and
- Other laboratory supplies.

9.3.3 Sample Containers

9.3.3.1 All sample containers used by Alpha are pre-cleaned according to EPA established protocols and require no further cleaning prior to sample collection.

9.3.3.2 Alpha does not clean or reuse sample containers.

9.3.3.3 Alpha maintains a sequestered supply of sample containers to eliminate the possibility of contamination of the sample from the container and to track sample containers by lot numbers.

9.3.3.4 Containers are purchased and sequestered by lot in order to minimize the tracking associated with a group of sample containers.

9.3.3.5 VOC containers are checked by Alpha to insure that the container is not contaminated and is not adding low level analytes to the sample.

1) Clarification: DoD requires sample containers used for the collection of DoD samples to be checked for contamination. Sample containers are analyzed on a lot-by-lot basis for the method and target analytes used for their particular samples to one-half of the project specified reporting limit. This also includes other supplies and materials used for DoD samples.

9.3.4 Once chemical purity, grade or quality has been established, it is Alpha's policy to repurchase these same items and document their continuing quality with the associated certificate of analysis for historical records.

9.3.5 Materials and supplies which have associated certificate of analysis will be inspected upon receipt. If the quality of supplies or materials are suspect, certain actions will be required on the part of the analyst or extraction chemist.

i. The analyst/extraction chemist will first verify the lot number and C of A of the material in question and assure that it has met vendor/supplier specification.

ii. Secondly, the analyst/extraction chemist will document the quality issue and inform the Laboratory Director, QA Officer and Purchasing Agent of the problem and any additional correction taken on his/her part.

iii. Thirdly, the Laboratory Director or QA Officer, will take the necessary actions to rectify and document the problem and the solution to the problem.

9.3.6 Service and Supply Documentation Policy

9.3.6.1 It is Alpha's policy to maintain purchasing documents for items affecting data quality. These items are reviewed and approved for technical content by the purchasing agent prior to release. Such items are as follows:

a) Materials such as standards, reagents, solvents, chemicals, etc. are documented with:

i. date of receipt,
ii. expiration date (if applicable),
iii. identification of vendor or manufacturer,
iv. lot number, and
V. certificate of analysis (if applicable.)

See the Preparation of Standards SOP for additional details.

b) Services such as balance calibration are documented by the vendors certificates as described in the Analytical Balance Logbook SOP.

c) The documentation of accuracy and precision for S class weights is described in the Analytical Balance Log Book SOP.

d) The documentation of accuracy and precision for Class A glassware and manual volumetric dispensing devices is described in the Manual Volumetric Dispensing Device SOP.

e) The documentation of accuracy and precision for thermometers is described in the Annual Thermometer Calibration SOP.

9.3.7 Policy for the Control of Procured Items

Alpha Analytical has contracted with major environmental suppliers for the procurement of critical and non-critical items.

9.3.7.1 Items purchased on a regular basis that have an impact on the final data results are sequestered by lot to maintain quality uniformity and controlled conformity. Items such as containers, solvents, standards, etc. have been recognized by the industry to be critical to environmental laboratories; therefore, suppliers have specialized in producing these items to meet and exceed method specification.

9.3.7.2 These items are controlled by our procurement process by repeatedly buying the same product. If an item does not meet the required

specification, our procurement process will have the documentation to pull these items from our laboratory and return them to the supplier.

9.3.7.3 All critical items are constantly checked by their daily use, i.e., methanol is checked by analyzing daily method blank and standards are checked against the response factors of independent standards. These activities occur daily and are documented in various areas of the laboratory such as the analysts' logbooks and the instrument document control books.

QUALITY ASSURANCE MANUAL
VOLUME I

Section 10

Equipment and Instrument Maintenance

10.0 EQUIPMENT AND INSTRUMENT MAINTENANCE

10.0.1 Alpha Analytical, Inc. provides a full range of environmental analyses for contaminants in soil, water, industrial waste and other matrices. Alpha has analytical capabilities including sophisticated instrumentation for the detection of metals, inorganic analytes, industrial solvents, and other analytes encompassing the range of Hazardous Substances, Priority Pollutants, and the identification of thousands of organic compounds by Gas Chromatography/Mass Spectrometry (GC/MS).

10.0.2 It is Alpha's policy to purchase equipment capable of achieving the accuracy, precision, sensitivity, and selectivity required for the intended use of the analytical test methods.

10.1 EQUIPMENT OPERATION POLICY

10.1.1 Analytical test instruments are only operated by authorized personnel. Instrument manuals on the use and maintenance of this equipment is available for use by the analysts.

10.2 EQUIPMENT IDENTIFICATION

10.2.1 Analytical test instruments and their associated software are uniquely identified. This identification is used on all documents to reference that particular instrument.

10.2.2 Instrument identification documents are maintained to record the following information:

a) the identity of the item of equipment and its software;
b) the manufacturer's name, type of equipment, and serial an/or model number;
c) date received and date placed in service (if available);
d) equipment location; and
e) if available, condition when received (e.g., new, used, reconditioned).

10.3 MAJOR EQUIPMENT

Alpha Analytical is equipped with modern instrumentation to provide the quality of data required by the regulatory agencies and to provide redundancy for all major systems.

10.3.1 Gas Chromatograph/Mass Spectrometers for Volatile Organic Analysis

Alpha is equipped with Hewlett-Packard (HP) 5890 and 5890 series II GCs attached to HP 5970 and 5972 MSDs and Agilent Technolgies (AT)6890 GC's attached to AT 5973 MSD's. The MSDs are quadruple mass analyzers and are equipped with turbo molecular pumps. Mass spectral data is acquired using windows based PCs and the HP/AT ChemStation and Enviroquant software.

Water samples are introduced into the GC's using Tekmar and OI Liquid Sample Concentrators (LSC) and Automatic Liquid Samplers (ALS). These(GC/MS) systems are dedicated to the analysis of Volatile Organic Compounds (VOCs) by methods 624, 8260B, 524.2 and total petroleum hydrocarbons..

10.3.2 Gas Chromatograph/Mass Spectrometer for Semi-volatile Analysis

Alpha's semi-volatile instrument uses the same hardware as described for the volatiles GC/MS systems excluding the purging devices. The instrument is configured for automatic sample injection using the AT 7683 auto-tower. Data acquisition and reduction is acquired through the use of a windows based PC, AT ChemStation and Enviroquant Software. This instrument is dedicated to the analyses of semi-volatile organic compounds by methods 625 and 8270C.

10.3.3 Gas Chromatographs with Flame Ionization Detectors

Alpha is equipped with HP 5890 GC's and AT 6890 each with Flame Ionization Detectors (FID). Several of these systems are configured with the ProSep® large volume injection inlets and capillary columns for Method 8015B, DRO Total Petroleum Hydrocarbon (TPH) analysis. One system is configured with a headspace analyzer for the analysis of dissolved gases, and the other for sreening SVOCs.

10.3.4 Gas Chromatograph with Electron Capture Detectors

Alpha is equipped with a AT 7890 GC configured with a low thermal mass MACH system to enhance the thermal cycle frequency. This system employs Gerstel large volume injectors and is configured with dual micro electron capture detectors. This instrument is dedicated to the analyses of pesticides and PCBs.

10.3.5 High Pressure Liquid Chromatograph (HPLC) with UV and Fluorescence Detectors

Alpha has a HP1050 (TI) HPLC quaternary pump suitable for both gradient and isocratic instrument conditions. This system is configured with either/or Ultra Violent (UV) and fluorescence detectors. Data is acquired on a PC through an A/D converter box using AI-450 software.

10.3.6 Ion Chromatograph (IC) with Conductivity Detector

Ions are determined by the use of a Dionex DX 500 and DX 600 Ion Chromatography system. The DX500 is a modular system consisting of the GP40 pump, CD-20 conductivity detector, LSC 25 column heater department and AS40 auto-sampler.

The DX600, IC is configured essentially the same as above; however this instrument has a GP 50, a CD25 detector. Both systems use the Chromeleon software for data acquisition.

Perchlorates are determined by the use of a Dionex ICS2000 Ion Chromatography system. This is a non-modular system where the pump, detector and column heater are built into a single instrument. The AS-40 auto-sampler is modular and is the same auto-sampler as used for the other two systems. This instrument also uses the Chromellian software for data acquisition.

10.3.7 Inductively Coupled Plasma / Mass Spectrometer (ICP-MS)

Most metals analysis is performed on an AT7500i ICP-MS. This system is configured with the Cetax ASX510AS autosampler and a Neslab NSLCF-100 chiller. Data acquisition is accomplished with the Agilent ChemStation software. This instrument is dedicated to metals analysis by methods 200.8 and 6020.

10.3.8 Accelerated Solvent Extractor (ASE 200)

The ASE 200 is used by method SW3545 for accelerated solvent extraction of base/neutral and acids (BNAs). The ASE 200 accelerates the extraction of solid matrices by using solvents at elevated temperature and pressure. Increased temperature accelerates the extraction kinetics, while elevated pressure keeps the solvent below the boiling point, thus enabling safe and rapid extraction.

10.3.9 Microwave for the Digestion of Metals

The digestion of RCRA samples for metals analysis is performed using a Milestone Ethos Plus microwave digestion instrument. This microwave digestion instrument is designed with a complete temperature and pressure control system, thus preventing over-pressurization. The instrument is controlled with a PC using the EasyWAVE software for automatic parameter control.

ANALYTICAL INSTRUMENT LIST
TABLE 10-1

INSTRUMENT ID	MODEL	DETECTOR	AUTO-SAMPLER	DATA ACQUISITION SYSTEM	METHODS OF ANALYSIS
GC/MSD # 1	HP5890	HP5970B	LSC-3000 Aqua Tek-70	HP ChemStation	VOC Screens
GC/MSD # 2	HP5890	HP5970B	HP7673A ProSep 800 plus	HP ChemStation	MeOH, EtOH
GC/MSD # 3	HP5890 (Series II)	HP5970	LSC-2000 ALS-2050	HP ChemStation	524.2
GC/MSD # 4	HP5890 (Series II)	HP5972A	LSC-2000 ALS-2050	HP ChemStation	VOC Screens
GC/MSD # 6	HP5890 (Series II)	HP5972	Velocity XPT Aqua Tek-70	HP ChemStation	VOC Screens
GC/MSD # 7	AT6890	AT5973	LSC 3000 Aqua Tek-70	AT Chem Station	624, 8260, TPH-G
GC/MSD # 8	AT6890	AT5973	OI Eclipse OI 4554-A	AT ChemStation	624, 8260, TPH-G
GC/MSD # 9	AT6890N	AT5973N	LSC-3000 Aqua Tek-70	AT ChemStation	624, 8260, TPH-G
GC/MSD # 10	AT6890	AT5973	LSC-3000 Aqua Tek-70	AT ChemStation	624, 8260, TPH-G
GC/MSD # 11	HP5890	HP5970	HP7673A ProSep 800 plus	HP ChemStation	MeOH, EtOH
GC/MSD # 12	AT6890N	AT5973N	LSC-3100 Aqua Tek-70	AT ChemStation	624, 8260, TPH-G
GC/MSD # 14	AT6890N	AT5973Inert	AT7683	AT ChemStation	625, 8270C, PNA SIMs
GC/MSD # 15	AT6890N	AT5973Inert	Velocity XPT Aqua Tek-70	AT Chem Station	624, 8260, TPH-G

ANALYTICAL INSTRUMENT LIST
Continued
TABLE 10-1

INSTRUMENT ID	MODEL	DETECTOR	AUTO-SAMPLER	DATA ACQUISITION SYSTEM	METHODS OF ANALYSIS
GC/FID #1	AT 6890	FID	AT 7683B ProSep 800 Plus	AT ChemStation	TPH-D
GC/FID #2	AT 6890	FID	AT 7683B ProSep 800 Plus	AT ChemStation	TPH-D
GC/FID #5	HP 5890 Series II	FID	HP 7673A	HP Chem Station	SV Screen
GC/FID #6	AT 6890N	FID	AT G1888 Headspace Sampler	AT Chem Station	Dissolved Gases
GC/FID #7	AT 6890	FID	AT 7683B ProSep 800 Plus	AT ChemStation	TPH-D
GC/ECD #1	AT 7890A	ECD	AT 7683B	AT ChemStation	Pesticides/PCBs
HPLC # 1	HP1050 (TI)	HP1046A HP 1050UV	HP7673/1050	DIONEX AI-450	Organic Acids Neutraceuticals
HPLC # 3	HP1050 (TI)	HP1046A HP1050UV	HP7673/1050	DIONEX AI-450	Organic acids Neutraceuticals
IC #1	DX500	CD-20	AS-40	Chromeleon	300.0
IC #2	DX600	CD-25	AS-40	Chromeleon	300.0
IC #3	ICS2000	D-56	AS-40	Chromeleon	314.0
TOC	Dohrmann Phoenix 8000	UV	Dohrman STS 8000	TOC Talk	SM5310C / 9060
ICP-MS	Agilent 7500i	MS	Cetax ASX510AS	ChemStation	200.8, 6020/6020A

EQUIPMENT IDENTIFICATION FORM
TABLE 10-2

Equipment Identification Form			
Instrument ID:			
1) Date Reviewed:			Location:
3)	GC	Equipment Manufacturer	
		Model Number	
		Serial Number	
		Purchase Date	
		Date Placed in Service	
4)	Detector	Equipment Manufacturer	
		Model Number	
		Serial Number	
		Purchase Date	
		Date Placed in Service	
5)	Liquid Sample Concentrator	Equipment Manufacturer	
		Model Number	
		Serial Number	
		Purchase Date	
		Date Placed in Service	
6)	Auto sampler	Equipment Manufacturer	
		Model Number	
		Serial Number	
		Purchase Date	
		Date Placed in Service	
7)	Computer	Equipment Manufacturer	
		Model Number	
		Serial Number	
		Purchase Date	
		Date Placed in Service	
8)	Software	Software Name	
		Software Revision	

10.4 SUPPORT EQUIPMENT

Support equipment is defined as those devices that may not be the actual test instrument, but are necessary to support general laboratory operations. This equipment includes such things as: balances, ovens, refrigerators, freezers, water baths, temperature measuring devices, and volumetric dispensing devices (such as Eppendorf pippetors and automatic dispensing devices). Procedures for individual instruments are described in detail in Appendix D. In general the following are included in those SOPs:

10.4.1 All support equipment is maintained in proper working order and a record of all repair and maintenance activities including service calls are maintained in their respective maintenance logbooks.

10.4.2 All support equipment is calibrated or verified at least annually using NIST traceable references when available, over the entire range of use. The results of these calibrations or verifications are maintained to ensure the equipment is within the specification required of the application for which the equipment is used. If the equipment does not meet these specifications then:

a) the equipment is removed from service until repaired; or

b) records are maintained to establish correction factors to correct all measurements.

10.4.3 Raw data records are maintained to document equipment performance.

10.4.4 Prior to use on each working day, balances, ovens, refrigerators, freezers, and water baths are checked in the expected range with NIST traceable references where commercially available. The acceptability of use or continued use is established according to the needs of the analysis or application for which the equipment is being used.

10.4.5 Mechanical volumetric dispensing devices (MVDD) (excluding Class A glassware) is checked for accuracy on at least a quarterly basis.

Note: Glass microliter syringes are considered the same as Class A glassware, but a certificate attesting to accuracy is documented and maintained.

10.5 INSTRUMENT MAINTENANCE

10.5.1 Policy

It is Alpha's policy to maintain, inspect and clean all equipment, and to document maintenance procedures in the maintenance log book.

10.5.2 Purpose

Alpha's Preventative Maintenance Program (PMP) establishes the basic procedures for maintaining test and measurement equipment used to conduct sample analyses. These procedures are established to ensure laboratory equipment perform their intended functions in a timely and effective manner.

10.5.3 Responsibility

Preventative maintenance is a critical element of the quality assurance program at Alpha Analytical. Responsibility for preventative maintenance lies with the analyst and their direct supervisor in charge of monitoring equipment. Our analytical staff is dedicated to the implementation of the preventative maintenance program and are always watchful for signs that there is a need for maintenance activities.

10.5.3.1 In-house Maintenance

Analysts perform routine preventive maintenance such as the replacement of parts, cleaning of components, and changing of pump oil. Analytical instruments such as GCs, GC-MS and ICP-MS systems are serviced and maintained by in-house personnel.

10.5.3.2 Outsourced Maintenance

Occasionally there are instances when service personnel are contracted to replace or service instruments that cannot be serviced by our personnel. Other instruments such as analytical balances are serviced on a routine basis by a contracted company. All instrument maintenance is recorded in an instrument maintenance logbook specifically associated with that particular instrument.

10.5.4 Monitoring

10.5.4.1 Instruments are constantly monitored by the use of daily standards, sensitivity, and response checks to determine if maintenance is required. In the event that an instrument does fail, every effort is made to meet obligations to the client's holding times and due dates.

10.5.4.2 Instruments that have been subjected to overloading or mishandling, gives suspect results, or has been shown to be defective or outside specified limits are taken out of service.

Note: NELAC suggests the instrument to be isolated to prevent its use or to clearly label or mark the instrument as being out of service, until it has been repaired and shown by calibration or

test to perform correctly. Since instruments are assigned to specific analysts, the probability of this happening is essentially non-existent.

10.5.4.3 If a piece of equipment or an instrument is sent in for bench repair, the instrument is re-calibrated and/or checked to ensure the instrument is functioning satisfactorily before it is returned to analytical service.

10.5.4.4 Laboratory support equipment such as refrigerators and ovens are also monitored and serviced regularly. The laboratory quality assurance program is designed to reduce data loss by monitoring and recording the functioning of these systems, allowing rapid correction of any malfunction before data loss can occur.

10.5.4.5 Alpha Analytical's Preventative Maintenance Program concentrates on four primary areas of concern and they are as follows:

1) A suggested PM schedule. See Table 10-3;

2) Documentation of all maintenance and repairs;

3) Vendor/manufacturing operation and maintenance manuals available for all instruments; and,

4) Alpha Analytical's Analytical Contingency Plan.

10.5.5 Maintenance Schedule

10.5.5.1 Equipment Purchase

When Alpha Analytical was established in 1987, one of the primary goals in the start-up operation was to buy the finest equipment available to reduce and minimize down time.

10.5.5.2 Suggested Maintenance Schedules

Maintenance that is performed on a regular schedule consists of changing pump oil, changing septum and injection inserts, cleaning syringe barrels on automatic sample injectors, etc. Most other types of maintenance are those that cannot be prevented by regular servicing, such as electronic board failure, filament burnout, detection degradation, etc.

Table 10-3 identifies suggested preventative maintenance activities by instrument type and recommended frequencies. It should be noted

that it may be necessary to perform activities more or less frequently depending on workload, sample types analyzed, and/or instrument performance. Frequency of instrument maintenance activities incorporates both laboratory experience and instrument manufacturer's recommended PM frequency.

Note: The suggested maintenance schedule is only suggested and does not require the frequency and/or suggested activity need take place. For instance: the GC instrument maintenance suggests to change septa, check cylinder gas pressure and moisture and oxygen traps on a daily basis. This does not mean that a check list and/or annotation in the maintenance log that these were checked on a daily basis needs to be documented. In fact, many days the instrument may have not even been run. These are suggested activities and frequencies, and should only be documented when they have occurred.

10.6 MAINTENANCE LOGBOOK

10.6.1 An individual instrument maintenance logbook is assigned to each instrument. This logbook is used to record preventive maintenance checks and services in addition to emergency maintenance procedures. The maintenance logbook contains descriptions of instrument problems, solutions, replacement parts, and maintenance personnel.

Each maintenance period or problem is signed and dated to record the maintenance history of each piece of equipment.

10.7 MAINTENANCE MANUALS

10.7.1 As stated earlier in this section, Alpha Analytical's instrumentation consists primarily of Hewlett-Packard/Agilent Technologies GCs, GC-MSs, ICP-MSs and HPLCs. Agilent generally publishes three to four separate service books associated with each analytical instrument and they are as follows:

1) Operators Handbook - A description of the use and operation of a particular instrument;

2) Installation and Maintenance Guide - A handbook that describes how to install, troubleshoot, and maintain each instrument;

3) Getting It All Together - A handbook which describes how to connect different modules to make a complete system; and,

4) Parts Manual - This handbook displays blow-ups of various sub-components of a system while giving part numbers and electronic schematics.

Alpha Analytical maintains a library of maintenance manuals for all Hewlett-Packard and Agilent equipment and PM manuals for all other equipment Alpha Analytical uses on a regular basis.

10.8 CONTINGENCY PLANS

10.8.1 Instrument Capacity/Back up Instruments

For most methods, we have the instrument capacity to perform analysis on multiple instruments. This capability changes over time based on sample work load and the availability of it's backup.

10.8.2 Spare Parts Inventory

In the event of complete instrument failure, a number of decisions need to be made quickly in order to prevent invalidating the current sample work load. All priorities and effort will be addressed to resolve the instrument problem. Alpha Analytical maintains a sizeable inventory of spare parts for this scenario. However, it is impractical and impossible to predict and maintain an inventory of all possible spare parts. Parts can be delivered overnight for repair the next day.

10.8.3 Service Calls

The second decision which is made at the onset of instrument failure is if our in-house personnel are able to repair the problem at hand. If not, then a service call is made to determine the logistical requirements of getting a service person to the laboratory at the earliest possible date. Service calls also are useful in talking or resolving an instrument problem over the phone. The conversation usually entails a series of diagnostic activities, which will guide the analyst or person in charge of that instrument to a reason for the instrument failure. This activity is the first plan of attack when an instrument fails for non-obvious reasons. If the problem can still not be resolved, then the service call goes one step further and a repair person is dispatched to the laboratory.

Alpha Analytical's service priorities are as follows:

1) Service our clients by performing the work within their contract or specified turn-around time;

2) Perform this work under the guidance of a certification program; and,

3) Provide quality analytical data.

10.8.4 Sub-contracting Laboratories

In the event of instrument failure, it is Alpha's goal to accomplish and perform all testing and analysis in-house. When it becomes apparent that our laboratory cannot meet these obligations, Alpha Analytical will then sub-contract this work to one of several laboratories that are available.

10.9 ACCOMMODATION AND ENVIRONMENTAL CONDITIONS

10.9.1 It is Alpha's policy to ensure that the environmental conditions do not invalidate the test results or adversely affect the required quality of any measurement. These types of environmental conditions include but are not limited to energy sources, lighting, heating, cooling humidity and ventilation.

10.9.2 When required by a method or procedure or where they may influence the quality of the test results, it is Alpha's policy to monitor, control and record the environmental conditions.

10.9.3 As a precaution to prevent cross-contamination, neighboring areas in which there are incompatible activities are separated and are a key component to producing accurate data results.

10.10 HOUSEKEEPING AND WORKSPACE

10.10.1 It is Alpha's policy to ensure good housekeeping in the laboratory and to make accommodations for special procedures when necessary.

10.10.2 In is Alpha's policy to ensure workspaces are unencumbered to include:

a) access and entryways to the laboratory;

b) sample receipt areas;

c) sample storage areas;

d) chemical and waste storage areas; and

e) data handling and storage areas.

TABLE 10-3
SUGGESTED PREVENTATIVE MAINTENANCE ACTIVITIES

Note: The suggested maintenance schedule is only suggested and does not require the frequency and/or suggested activity need take place. For instance: the GC instrument maintenance suggests to check the septa, cylinder gas pressure and moisture and oxygen traps on a daily basis. This does not mean that a check list and/or annotation in the maintenance log that these were checked on a daily basis needs to be documented. In fact, many days the instrument may have not even been run. Common sense needs to be applied; therefore, maintenance which affects data quality should only be documented.

INSTRUMENT	ACTIVITY		FREQUENCY
Gas Chromatographs	General	Check septa, cylinder gas pressure, and oxygen, moisture traps	D
		Bake out injection body	2
		Check electronics (voltages, waveforms, etc.)	3, 4
	Columns	Change glass inserts, shorten ends of columns, change glass wool plugs, replace ferrules, and check for leaks	3, 5
	Electron Capture Detector	Wipe tests	A
		Return detector to factory for cleaning and refoiling	2,3, 4
	Flame Ionization Detector	Clean	Q
		Replace flare tip	A
		Replace flare ignition	1
	Nitrogen Phosphorous Detector	Clean	Q
		Replace bead	1, 3, 4
Mass Spectrometers	General	Replace vacuum pump oil	A (1)
		Check ion source and analyzer (dismantle and clean, replace parts as needed)	A (1, 2, 3, 4, and 5)
		Check mechanical (vacuum pump, gas pressures, and flows)	Q
	Purge and Trap	Bake vessels	2
		Change trap	A
		Bake trap	2
		Check purge flow	M
		Check for leaks	M

Key to Frequencies: (1) Replace as necessary; (2) High background; (3) Loss of sensitivity or failing resolution; (4) Erratic response; (5) QC failure; (A) Annually; (D) Daily; (M) Monthly; (Q) Quarterly; (BA) Bi-annually; (SA) Semi-annually; and (W) Weekly.

TABLE 10-4
SUGGESTED PREVENTATIVE MAINTENANCE ACTIVITIES

Note: The suggested maintenance schedule is only suggested and does not require the frequency and/or suggested activity need take place. For instance: the HPLC instrument maintenance suggests checking the gas lines for leaks on a daily basis. This does not mean that a check list and/or annotation in the maintenance log that these were checked on a daily basis needs to be documented. In fact, many days the instrument may have not even been run. Common sense needs to be applied; therefore, maintenance which affects data quality should only be documented.

INSTRUMENT	ACTIVITY		FREQUENCY
High Pressure Liquid Chromatographs	General	Gas Lines Checked for leaks	D
		Clean mobile phase flow system with 10% nitric acid	BA (3,4)
		Clean detector flow cells	BA(3,4)
		Clean injection valve (replace rotors and seals)	A(1)
		Check solvent filters	W
		Check pump seals and check valve assemblies (clean and replace as pressures and flows of mobile phase indicate)	D(1)
		Lubricate post column reagent pumps	M
		Check valves and replace post column restrictors and frits or clean restrictors with 10% nitric acid	M(1,3,4)
Ion Chromatographs	General	Replace or quick start suppressor	1,2,3,4,5
		Clean detector flow cell	2,3,4
		Clean injection valve (replace rotors and seals)	A(1)
		Check pump seals (clean and replace as pressures and flows of mobile phase indicate)	D(1)
ICP-MS	General	Check cylinder gas pressure	D(1)
	ICP	Clean sample and skimmer cones	2,3,4,5
		Clean torch and spray chamber assemblies	2,3,4,5
		Replace liquid sample lines	M(2,4,5)
	MS	Check turbo pump	Q
		Replace vacuum pump oil	A(1)
		Check ion source and analyzer	A(1,2,3,4,5)
Auto Samplers	General	Check needles/syringes	D(1)
		Replace motors, belts, carriage assemblies, and sensors	1,4
		Clean	Q
Data Systems	General	Clean computers, check battery backup, and check ventilation fans	A

Key to Frequencies: (1) Replace as necessary; (2) High background; (3) Loss of sensitivity or failing resolution; (4) Erratic response; (5) QC failure; (A) Annually; (D) Daily; (M) Monthly; (Q) Quarterly; (BA) Bi-annually; (SA) Semi-annually; and (W) Weekly.

TABLE 10-5
SUGGESTED PREVENTATIVE MAINTENANCE ACTIVITIES

Note: The suggested maintenance schedule is only suggested and does not require the frequency and/or suggested activity need take place. Therefore this does not mean that a check list and/or annotation in the maintenance log that these were checked on the suggested frequency be documented. In fact, many days the instrument may have not even been run. Common sense needs to be applied; therefore, maintenance which affects data quality should only be documented.

INSTRUMENT	ACTIVITY		FREQUENCY
Refrigerators/Ovens	General	Clean interiors	SA
		Check thermometer temperatures against NBS certified thermometer	A
Analytical Balances	General	Clean pan and compartment	D
		Check with S class weights	D
pH and Ion Selective Electrodes	Probes	Check probe for cracks and proper levels of filling solution; check reference junction; clean electrode	D(1)
	Meter	Check electronics or batteries for loose connections and cracked leads	D(1)
Spectrophotometers	General	Clean sample compartment interior	SA
		Check wave-length calibration with holmium-oxide filter	A
TOC Instrument	General	Check carrier gas, and reagents	D
		Clean UV reactor and IC sparger	W(2,3,4)
		Inspect chorine scrubber	M(1,2,3,4,5)
		Inspect permangenate dryer	M(1,2,3,4,5)
Thermometers	General	Check for cracks in the glass and gaps in the fluid	D(1)

Key to Frequencies: (1) Replace as necessary; (2) High background; (3) Loss of sensitivity or failing resolution; (4) Erratic response; (5) QC failure; (A) Annually; (D) Daily; (M) Monthly; (Q) Quarterly; (BA) Bi-annually; (SA) Semi-annually; and (W) Weekly.

QUALITY ASSURANCE MANUAL
VOLUME I

Section 11

Quality Control Procedures to Assess Laboratory Data

11.0 QUALITY CONTROL PROCEDURES TO ASSESS LABORATORY DATA

11.1 ELEMENTS OF QUALITY CONTROL CHECKS

This section presents QC requirements relevant to analysis of environmental samples that are followed during all analytical activities. The purpose of this QC program is to provide quantitative evidence that the entire analytical method is performed within the specified criteria. Data generated from control samples are used to monitor day-to-day variations in routine analysis, which provides a mechanism for ongoing control and evaluation of data quality measurements through the use of QC material.

11.2 INTRA LABORATORY QUALITY CONTROL

Intra laboratory quality control is performed as described in the Standard Methods for the Examination of Water and Wastewater, 1996, 20th Edition, Environmental Protection Agency Methods for Organics in Finished Drinking Water, and Test Methods for Evaluating Solid Waste, 3rd Edition. Quality Control data is used to review and determine method precision and accuracy.

11.3 FIELD QC SAMPLES

The following QC check samples are the basic requirements needed to ensure the reliability and integrity of field data. For details, see the Quality Control Field Samples SOP located in Appendix B.

11.3.1 Equipment/Rinsate Blanks

These are field QC check samples used to ensure non-dedicated sampling devices (bailers, filtering equipment, pumps, etc.) have been effectively decontaminated. After field washing and decontamination, sampling equipment should be rinsed with reagent free water. This rinse water is then transferred to a sample bottle, and returned to the laboratory for analysis. A representative number of the equipment / rinsate blanks should be analyzed, depending on the SOW.

11.3.2 Field Reagent Blanks (FRB)/ Field Transfer Blanks (FTB)

These types of QC samples are reagent grade water placed in a sample container at the laboratory and treated exactly as a sample in all respects, including exposure to sampling site conditions, storage, preservation and all analytical procedures. The purpose of the FRB/FTB is to determine if the method analytes or other interferences are present as air-borne constituents in the field environment. These types of QC samples are analyzed for project specific compounds.

11.3.3 Trip Blanks (TB)

Trip Blanks (TB) are analogous to FRBs in all respects except they are not opened or exposed to the field environment at any time. The purpose of the TB is to determine if method analytes or other air-borne interferences are present in the environment to which actual samples were exposed, and perhaps contaminated or cross-contaminated samples by air-borne infusion through the sample septum. TBs are most typically sent in coolers with samples requesting VOC analysis.

11.3.4 Field Duplicates

Field duplicates are two separate samples collected at the same time, under identical circumstances, and treated exactly the same throughout the field and laboratory procedures. Analysis of field duplicates give a measure of the precision associated with sample collection, preservation and storage, as well as with laboratory procedures. Field duplicates are typically collected for an analysis at a frequency of 10% of the total samples taken for each parameter group.

11.4 LABORATORY QUALITY CONTROL SAMPLES

Laboratory control samples are those samples introduced into the train of environmental samples to function as monitors on the performance of the analytical method. All QC samples are prepared and processed through the complete analytical method. Stock solutions used to spike QC samples are prepared independently of stock standards used for calibration standards.

Method Blanks (negative controls) and laboratory control samples(positive controls) are used to monitor day-to-day performance of routine analytical methods. Internal standards are used to monitor the performance of the instrument. Surrogates, matrix spikes and sample duplicates are used to assess the effects of extraction efficiency, sample matrix and sampling, respectively, on the analytical data. The following descriptions indicate the types of QC samples that are included in an analytical or an extraction batch.

11.4.1 Method Blank (MB)

11.4.1.1 Matrix Composition and MB Definition

Method blanks are prepared from a matrix similar to the batch of associated samples (e.g., reagent grade water for water matrices, or ottowa sand, sodium sulfate or teflon chips for soil matrices) that is free from the analtyes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

11.4.1.2 Purpose

The method blank is used to assess the preparation batch for possible contamination during the preparation and processing steps. The method blank is processed along with and under the same conditions as the associated samples to include all steps of the analytical procedure.

11.4.1.3 Frequency

The method blank is prepared and analyzed at a minimum of 1 per preparation batch not to exceed 20 samples. In those instances for which no separate preparation method is used (example: volatiles in water) the batch is defined as the group of environmental samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

11.4.1.4 Evaluation Criteria

The goal for the method blank is to have no detectable contamination, however each method blank is critically evaluated as to the nature of interferences and the effect on the analysis of each sample within the batch. The source of contamination is investigated and measures are taken to minimize or eliminate the problem.

11.4.1.5 Corrective Actions

If a blank exceeds the detectable limit for reporting of target analytes, then the analytical and extraction systems are evaluated and the appropriate corrective actions are taken. These may include such things as: cessation of further sample analysis to determine the source of contamination; reanalyses of all samples processed with that blank, or reporting the results with the appropriate footnotes.

11.4.2 Laboratory Control Sample (LCS)

11.4.2.1 Matrix Composition and LCS Definition

Laboratory control samples are prepared from a sample matrix, similar to the batch of associated samples (e.g., reagent grade water for water matrices, or ottowa sand, sodium sulfate, or teflon chips for soil matrices), free from the analytes of interest and spiked with verified known amounts of analytes or material containing known or verified amounts of analytes.

Note: The matrix spike may be used in place of the LCS as long as the acceptance criteria are as stringent as for the LCS. Alternatively the LCS may be prepared from a matrix which contains known and verified concentrations of analytes or as a Certified Reference Material (CRM). All analyte concentrations must be within the calibration range of the method.

11.4.2.2 Spike Composition

The components spiked into the LCS are those specified by the mandated test method or other regulatory requirement or as requested by the client. In the absence of specified spiking components LCS samples are spiked as follows:

a) For those components that interfere with an accurate assessment (i.e., spiking multi-component analytes together such as spiking simultaneously with technical chlordane, toxaphene and PCBs) the spike is chosen that represents the chemistries and elution patterns of the components to be reported.

b) For those test methods that have extremely long lists of analytes, a representative number may be chosen. The selected analytes are chosen in a manner representing all reported analytes. The following criteria is used for determining the minimum number of analytes to be spiked. However, all target analytes are spiked and evaluated over a 2 year period.

1) For methods that include 1-10 targets, all compounds are spiked and evaluated;

2) For methods that included 11-20 targets, at least 10 or 80% of those compounds whichever is greater are spiked and evaluated;

3) For methods that include more than 20 targets, a minimum of 16 compounds are spiked and evaluated.

11.4.2.3 Purpose

The LCS is used to evaluate the performance of the total analytical system, including all preparation and analysis steps.

11.4.2.4 Frequency

An LCS is analyzed at a minimum of 1 per preparation batch. Exceptions for this frequency are for those methods/analytes for which no spiking solutions are available such as pH. In those instances for which no separate preparation method is used (Example: volatiles in water) the batch is defined as the group of environmental samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

11.4.2.5 Evaluation Criteria

The results of the individual batch LCS analytes are calculated in percent recovery and compared to established acceptance criteria. These calculations are documented on method worksheets and/or on LIMS generated summary LCS reports. LCS results are compared to acceptance criteria as follows:

a) If LCS criteria is method specified, than the LCS is compared to the criteria as published in the mandated test method.

b) If LCS criteria is not method specified, than the LCS is compared to laboratory derived criteria, and the method used to establish the limits are documented.

c) Client specified criteria.

A LCS that is determined to be within the criteria effectively establishes that the analytical system is in control and validates system performance for the samples in the associated batch. Samples analyzed along with a LCS determined to be "out-of-control" are considered suspect and the samples are reprocessed and re-analyzed or the data reported with the appropriate footnote.

Marginal Exceedance Limits (Optional, if used with in-house limits)

If a large number of analytes are in the LCS, it becomes statistically likely that a few will be outside control limits. This many not indicate that the system is out of control, therefore, corrective action may not be necessary. Upper and lower marginal exceedance (ME) limits may be established to determine when corrective action is necessary. A ME is defined as being beyond the LCS control limit (3 standard deviations), but within the ME limits. ME limits are between 3 and 4 standard deviations around the mean.

The number of allowable marginal exceedances is based on the number of target analytes evaluated in the LCS. If more analytes exceed the LCS control limits than are allowed, or if any one analyte exceeds the ME limits, the LCS fails and corrective action is necessary. This marginal exceedance approach is relevant for methods with long lists of analytes such as Methods 8260B and 8270C. This evaluation does not apply to target analyte lists with fewer than 11 analytes.

The number of allowable marginal exceedances is as follows:

1) >90 analytes in LCS, 5 analytes allowed in ME;
2) 71-90 analytes in LCS, 4 analytes allowed in ME;
3) 51-70 analytes in LCS, 3 analytes allowed in ME;
4) 31-50 analytes in LCS, 2 analytes allowed in ME;
5) 11-30 analytes in LCS, 1 analytes allowed in ME;
6) <11 analytes in LCS, no analytes allowed in ME.

Marginal exceedances must be random. Analytes which repeatedly exceed the ME are not random and is an indication of a systemic problem. If this occurs, the source of the problem is located and corrective action is taken.

11.4.2.6 Corrective Actions

Any affected samples associated with an out-of-control LCS is reprocessed for re-analysis or the results are reported with the appropriate footnotes.

11.4.3 Matrix Spike (MS)

11.4.3.1 Matrix Composition and MS/MSD Definition

Matrix spike samples are prepared by adding a known mass of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used to determine the effect of the matrix on a methods' recovery efficiency.

Matrix spike duplicate (MSD) is a replicate aliquot of the same sample taken through the entire analytical procedure. The results form this analysis indicates the precision of the results for the specific sample using the selected method.

Client samples used as the batch MS/MSD are randomly picked to ensure spiked samples are rotated through the client sample stream.

11.4.3.2 Spike Composition

The components spiked into the MS are those specified by the mandated test method or other regulatory requirement or as requested by the client. In the absence of specified spiking components MS samples are spiked as follows:

a) For those components that interfere with an accurate assessment (i.e., spiking multi-component analytes together such as spiking simultaneously with technical chlordane, toxaphene and PCBs) the spike is chosen that represents the chemistries and elution patterns of the components to be reported.

b) For those test methods that have extremely long lists of analytes, a representative number may be chosen. The selected analytes are chosen in a manner representing all reported analytes. The following criteria is used for determining the minimum number of analytes to be spiked. However, all target analytes are spiked and evaluated over a 2 year period.

   1) For methods that include 1-10 targets, all compounds are spiked and evaluated;

   2) For methods that included 11-20 targets, at least 10 or 80% of those compounds whichever is greater are spiked and evaluated;

   3) For methods that include more than 20 targets, a minimum of 16 compounds are spiked and evaluated.

11.4.3.3 Purpose

Matrix specific samples indicate the effect of the sample matrix on the precision and accuracy of the results generated using the selected method. The information from these controls is sample and matrix specific and is not normally used to determine the validity of the entire batch. The MS is extracted and analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results.

11.4.3.4 Frequency

Each preparatory batch, not to exceed 20 samples, must contain an associated MS and MSD using the collected project samples. If adequate sample material is not available, then the lack of MS/MSDs are noted. Additionally, MS/MSD frequency may be project specified or test method specified.

11.4.3.5 Evaluation Criteria

The results from matrix spike/matrix spike duplicate are primarily designed to assess the precision and accuracy of analytical results in a given matrix and are expressed as percent recovery (%R), relative percent difference (RPD), or other appropriate statistical technique that allows comparison to establish acceptance criteria. These calculations are documented on method worksheets and/or on LIMS generated summary MS reports. MS/MSD results are compared to acceptance criteria as follows:

a) If MS criteria is method specified, than the MS is compared to the criteria as published in the mandated test method.

b) If MS criteria is not method specified, than the MS is compared to laboratory derived criteria, and the method used to establish the limits are documented.

c) Client specified criteria.

The background concentration of the analytes in the sample matrix are first determined in a separate non-spiked aliquot, and the measured values in the spiked MS/MSDs are corrected for background concentrations.

11.4.3.6 Corrective Actions

If matrix spike, spike duplicate results are outside the established criteria, for either accuracy or precision, corrective action is documented or the results are reported with the appropriate footnotes.

Often-times, MS recoveries exhibit matrix interference and are outside the range of acceptability. In these cases the LCS is used to qualify analytical data; therefore, the recovery problem encountered with the spiked sample is judged to be matrix related, not system related, provided both LCS and MS were extracted in the same extraction batch.

11.4.4 Matrix Duplicate (Sample Duplicate)

11.4.4.1 Matrix Composition and Duplicate Definition

Laboratory duplicates are two sample aliquots taken from the same sample and analyzed separately with identical procedures. The composition is usually not known. Client samples used as sample duplicates are randomly picked to ensure they are rotated through the client stream.

11.4.4.2 Purpose

Sample duplicate is a replicate aliquot of the same sample taken through the entire analytical procedure. The results form this analysis indicates the precision of the results for the specific sample using the selected method. The sample duplicate provides a usable measure of precision only when target analytes are found in the sample chosen for duplication.

11.4.4.3 Frequency

If target analytes are known in a sample duplicate then it may be analyzed in place of an MSD. Duplicate analysis whether MSD or sample duplicates must be performed at a minimum frequency of once per preparatory batch not to exceed 20 samples.

Note: Since it not typically known if a sample contains target analytes, preparing and analyzing a sample duplicate in place of a MSD is impractical and is discouraged. However, if a client or a project requires a sample duplicate, then both a sample duplicate and a MSD or prepared and analyzed.

11.4.4.4 Evaluation Criteria

The results from a sample duplicate containing target analytes is primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). These calculations are documented on method worksheets and/or on LIMS generated summary sample duplicate reports. Duplicate results are compared to acceptance criteria as follows:

a) If sample duplicate criteria is method specified, than the duplicate data is compared to the criteria as published in the mandated test method.

b) If sample duplicate criteria is not method specified, than the duplicate data is compared to laboratory derived criteria, and the method used to establish the limits are documented.

c) Client specified criteria.

11.4.4.5 Corrective Actions

If sample duplicate data results are outside of the established criteria, corrective actions are documented or the data is reported with the appropriate footnotes.

11.4.5 Surrogate Spikes

11.4.5.1 Definition

A substance with properties that mimic the analytes of interest which is unlikely to be found in environmental samples and is added to samples for quality control purposes.

11.4.5.2 Purpose

Surrogates are used most often in organic chromatography test methods and are chosen to reflect the chemistries of the targeted components of the method. Surrogates are added prior to sample preparation/extraction and provide a measure of recovery for every sample matrix.

11.4.5.3 Frequency

Surrogates are added to all samples, standards, and blanks for all appropriate test methods, except where the matrix precludes its use.

11.4.5.4 Spike Composition

Surrogate compounds are chosen to represent the various chemistries of the target analytes in the method. They are most often specified by the mandated method and are deliberately chosen for their being unlikely to occur as an environmental contaminant. Often this is accomplished by using deuterated analogs of selected compounds.

11.4.5.5 Evaluation Criteria

The results from surrogate spikes are used to monitor the effect of the matrix on the accuracy of the analysis. Surrogates are also used to

assess the recovery of the method and to detect any systematic extraction problems. Results are reported in terms of percent recovery. These calculations are documented on method worksheets and/or on LIMS generated summary reports. Surrogate results are compared to acceptance criteria as follows:

a) If surrogate criteria is method specified, than the surrogate recovery data is compared to the criteria as published in the mandated test method.

b) If surrogate criteria is not method specified, than the surrogate recovery data is compared to laboratory derived criteria, and the method used to establish the limits are documented.

c) Client specified criteria.

11.4.5.6 Corrective Action

Surrogates outside the acceptance criteria are evaluated to determine if the aberration is indicating an effect on the individual sample results. The appropriate corrective action are generally guided by the data quality objectives or other site specific requirements. Results reported from analyses with surrogate recoveries outside the acceptance criteria are reported appropriately.

11.4.6 System Monitoring Compounds

System Monitoring Compounds are added to every blank, sample, matrix spike, matrix spike duplicate and standard for volatile organic analysis, and are used to evaluate the performance of the entire analytical system. These compounds serve essentially the same purpose as the surrogates used in extractable analysis.

11.4.7 Internal Standards

11.4.7.1 Definition

A known amount of standard is added to a known volume of sample to be analyzed as a reference for evaluating and controlling the precision and bias of the applied analytical method.

11.4.7.2 Purpose

Internal standards are used in internal standard calibration methods to correct sample results affected by changing instrument sensitivity, injection and purging losses, by measuring and comparing the relative

responses of method analytes that are components of the same solutions.

11.4.7.3 Frequency

Internal standards are added to all samples, standards, and blanks for all appropriate test methods, except where the matrix precludes its use.

11.4.7.4 Spike Composition

Internal standards are chosen to represent the various chemistries of the target analytes in the method. They are most often specified by the mandated method and are deliberately chosen for their being unlikely to occur as an environmental contaminant. Often this is accomplished by using deuterated analogs of selected compounds.

11.4.7.5 Evaluation Criteria

The results from internal standards are used to monitor the effect of the matrix on the accuracy of the analysis. Internal standard results are compared to acceptance criteria as published in the mandated test method.

11.4.7.6 Corrective Action

Internal standard results outside the acceptance criteria are evaluated to determine if the aberration is an effect of the individual sample matrix or an instrument problem. Typically samples which have exceeded the method criteria are re-analyzed. If the re-analyses indicates a matrix effect, then results reported from analyses with internal standard recoveries outside the acceptance criteria are footnoted appropriately.

QUALITY ASSURANCE MANUAL
VOLUME I

Section 12

Data Reduction, Review and Storage

12.0 DATA REDUCTION, REVIEW AND STORAGE

12.1 CONTROL OF DATA

The data reduction, review, reporting, and verification procedures described in this section are established to help ensure data are correctly reported. The primary focus of this multi-tiered peer review is as follows:

- Reported data is free from transcription and calculation errors;
- Quality control measures are reviewed, and evaluated before data is reported;
- Calibrations, manual calculations and manual integrations are correct; and
- Complete documentation is maintained.

Laboratory data reduction and review procedures are required to ensure that the overall objectives of analysis and reporting meet method or project specifications.

All laboratory activities and procedures are documented where possible to ensure maximum sample integrity. Data reduction, review, and reporting activities are included in all client data files and/or the Analytical Data Record Keeping System.

The overall Data Quality Objectives (DQOs) for the analytical activities can only be met if the data generated can be proven to be valid.

12.2 DATA REDUCTION

Alpha Analytical maintains written Standard Operating Procedures (SOPs) governing all aspects of the data acquisition and reporting process. This record keeping procedure makes it possible to reanalyze data at a future date and is used in support of the experimental conclusions.

Data reduction is the process of converting measurements collected by analytical data systems into an expression of parameters and information from which conclusions about the sample or site can be made. This process must be performed with acceptable precision and accuracy. All calculations and data entries are reviewed to maintain the accuracy of this process.

Laboratory QC samples (such as matrix spikes, matrix spike duplicates, method blanks, surrogate spikes, and laboratory control samples) are analyzed and data generated to evaluate and assess the accuracy and precision of the data. Accuracy and precision data are used to determine if errors are produced through the analytical procedure.

In addition, the QC field samples (such as trip, equipment/rinse blanks, and field duplicate samples) are analyzed to determine any systematic or random errors introduced by field procedures.

12.2.1 Compound Identification

When appropriate, identification and quantitation is based on internal standards, such as those specified in EPA Methods 524.2, 624, 625 and 200.8. When internal standards methods are not satisfactory, external standard methods are used to quantitate analytical data.

Chromatographic compound identification is routinely accomplished by comparison of its retention time to the retention times of standard reference chromatograms. If the retention time of an unknown compound in a sample corresponds, within the retention time (RT) limits which are established by standard calibrations, then identification is considered positive for the analytical column only.

12.2.2 Analytical Column

For GC analysis of single response analytes, which use RT as the only source of compound identification, an alternative technique is employed to confirm peak identification. When possible, sample confirmation is determined by GC/MS. This may be limited by trying to confirm compounds at very low levels of detection where other GC detectors are more sensitive.

12.2.3 Confirmation Column

The second technique that Alpha uses for positive peak identification is through the use of a confirmation column. Each confirmation column is selected with a different polarity than the analytical column; therefore, the retention time and the retention time order are different for each column. If the unknown compound is within the prescribed retention time windows on the confirmation column and compound quantitation is similar to the analytical column, then compound identification is considered positive.

Multi-response analytes (i.e., TPH and PCBs) do not require additional confirmation because they each have a unique chromatographic signature that positively identifies each of these types of compounds.

12.2.4 Retention Time Windows

Retention time windows are calculated and used in chromatographic methods of analysis for qualitative identification of analytes. They are generally calculated from the analyses of standards over the course of an analytical sequence. The standard deviation of the retention time of multiple injections for each single component or

analyte in question is calculated. Typically plus or minus three times the standard deviation from the mean of the retention time of each standard is generally used to define the retention time window.

In those cases where the standard deviation is zero, the standard deviation of a similar close eluting compound is used to develop a valid retention time window. The procedure and calculation methods are given in SW 846, Method 8000. This is not a hard and fast criteria, and often times compound and instrument behavior is more heavily used in the interpretation of chromatography and the establishment of retention time windows.

12.2.5 Compound Quantitation

Analyte concentrations in the sample are calculated from the response of those analytes used in the calibration procedures.

If an internal standard calibration procedure is used, the concentration (C) in the sample is calculated using the Response Factor (RF) ratio to the appropriate internal standard. RF is calculated for each analyte and surrogate using the following equations:

$$RF = \frac{(A_s)(C_{is})}{(A_{is})(C_s)},$$

where: A_s = Response of the analyte;
A_{is} = Response of the internal standard;
C_{is} = Concentration of the internal standard; and,
C_s = Concentration of the analyte to be measured.

and:

$$C = \frac{(A_s)(I_s)}{(A_{is})(RF)(V_o)},$$

where: I_s = Amount of internal standard added to each extract; and,
V_o = Volume or weight extracted or purged.

If the external standard calibration procedure is used, calculate the peak area response by using the calibration curve or calibration factor determined from the initial calibration. The concentration (C) in the sample can then be calculated from the following equations:

$$C = \frac{(A)\,(V_t)}{(V_i)\,(V_s)},$$

where : A = Calculated peak area response;
V_i = Volume of extract injected;
V_t = Volume of total extract; and,
V_s = volume or weight of sample extracted.

12.3 DATA VERIFICATION (Review)

Data validations are not performed by the laboratory. However, Alpha does provide data review to assure the analytical documentation is provided and the analysis is carried out in accordance with the data user's project specifications so that future third-party data validations can be performed. Alpha maintains records sufficient to recreate each extraction and analytical event during a sample's progress throughout the laboratory. Records are assembled and kept in the client file or by the QA officer.

12.3.1 Data Integrity

The following is a list of the important records that are checked and maintained by Alpha:

- Chain-of-custody forms,
- Extraction and analytical logbooks,
- Instrument and Document Control Logbooks,
- Initial and continuing calibration records,
- Standard preparations logbooks,
- Internal standard results,
- Surrogate recovery charts,
- Method blank analyses,
- Spike and spike duplicate records and results,
- Initial method demonstrations, and
- Raw data including instrument printouts, chromatogram and quant reports.

Alpha maintains and uses written procedures for analytical QA/QC functions when appropriate.

12.3.2 Data Review

Before releasing any analytical data, it is our policy to review and verify that the data has met all of the method criteria and is scientifically correct. Data reviews include the evaluation of information, as presented by the analyst or staff member, for accurate representation of the samples submitted. Analytical data are generally subjected to a four-person tiered review before it is released with each successive check performed by a different person.

12.3.2.1 Analyst Review (Tier-1)

First the analyst will run, quantitate, and review analytes found in a particular sample or sample set. This includes reviewing and performing the following activities:

- Calibrations, tunes, blanks, and any other instrument quality control criteria were met and in-control during the analysis reported;
- Calculations of individual analytes and detection limits were met;
- Verify holding times or extraction times were met; and,
- Make notes or footnotes on the quantitation report if abnormalities occurred during the analysis or any other QA/QC problems associated with the sample.

12.3.2.2 QC/Peer Review (Tier-2)

Samples pass through a two way QC review prior to final sample signature. The first half of this review includes a QC review of the calibration data and the other half of the review is a general QC review of all other QC batch data. Often times this review occurs simultaneously.

Calibration Review

Initial calibrations, initial calibration verifications, and daily calibration verifications are reviewed for correctness against the method criteria or other in-house established criteria prior to releasing the analytical data associated with that particular calibration.

Batch QC Review

Once the data has been worked-up by the analyst and the data has passed the first phase of the calibration review the data proceeds to the QC review department. The QC review person, then verifies that all dates, sample identification, reporting limits, reported analyte values, concentration units, header information, and footnotes or comments were transcribed accurately. All information on the final report that can be verified against the chain-of-custody is checked for errors and completeness.

12.3.2.3 General Data Review (Tier-3)

When this step is completed, the client file, which includes chain-of-custody, chromatograms, quantitation reports, draft reports, and final reports, are reviewed by a third person. This person is typically another analyst, QC reviewier (QC upload person), or an assistant to the person signing the final report.

This person may review such things as:

- Chain-of-Custody records were analytically followed;
- Calculations and quantitation were performed correctly;
- Analytical holding times were met;
- Correct methods were used;
- Quality control criteria were met;
- Reporting limits were calculated properly;
- Correct concentration units were reported; and,
- Follow up and verify that any abnormalities which may have occurred during the analysis did not affect the final report. If abnormalities did occur, this person verifies the QA documentation and footnotes to determine if they are appropriate.

12.3.2.4 Final Review/Data Signature (Tier-4)

The Laboratory Director, Laboratory Manager, or QA Officer will, at any time a problem is encountered, question the appropriate staff members and make determinations concerning the quality of the data.

Finally, the client file is checked and verified by the Laboratory Director or other designee who is signing final reports. This person spot checks activities associated with the log-in, tracking, extraction, sample analysis, and final reporting for technical and scientific soundness.

Many of the same activities reviewed by the Laboratory Director are also spot checked by the QA Officer, or designee as part of the internal quality assurance program. The QAO or the appointed designee reviews approximately 10% of all data for technical completeness and accuracy. Once this has been accomplished, the final reports or summary reports are signed indicating they have been approved for release to the client.

12.3.3 Quality Control Data Reporting

The results for each analyte in the spiked QC samples are determined using the same calibration curve used for environmental samples in that batch. Values less than the reporting limit are reported as "Not Detected" (ND).

QC data is typically reported in terms of accuracy and precision, which translates into percent recovery of spiked compounds and relative percent difference of spiked analytes between duplicate analyses. This is the most commonly accepted practice for all analytical data. Alpha reports QC data in several different formats depending on the type of analysis that the client or regulatory agency requests. We frequently modify or change QC summary reports to satisfy the requirements of a particular SOW.

12.3.4 Transcription and Calculation Errors

It is a general policy of Alpha Analytical to minimize any errors associated with data reduction, validation and the reporting procedures including transcription errors.

If transcription errors are discovered during any part of the data review process, those errors challenged by the reviewer are taken to the person where the error was first propagated and discussed. During this discussion, the alleged transcription error will either proven to be a transcription error or not.

If the alleged transcription error is found to be a true error than the following are required:

12.3.4.1 LIMS Transcription Errors

- LIMS generated COC are amended with the correct information. The mistake is annotated in the comments section, with the name of the person making the correction, and a new blue colored COC is issued to all affected personnel.

- LIMS generated extraction batch reports are amended with the correct information. The mistake is annotated and a mistake free batch report is generated. The new batch report is attached to the old batch report as a way to track the initial error.

- LIMS generated final reports are reissued with the correct information. The mistake is annotated as a footnote which clearly indicates the mistake, i.e., "This report replaces the report issued 1/10/07 due to a change of client ID"

12.3.4.2 Non-LIMS Transcription Errors

- Instrument quantitation reports and any other non-LIMS generated data are amended (hand written) with the correct information, dated and initialed by the analyst.

12.4 DATA STORAGE

12.4.1 Client File Data Assembly

Following final data review, client files are organized in a manner to enhance future referencing of the data. Data files are organized by the DCO to facilitate easy data review and reconstruction of laboratory activities. Data files are generally organized in the following order:

- Computer generated chain of custody,
- Client chain of custody,
- Sub-contract lab chain of custody (if present),
- Work order information (if present),
- Sample receipt checklist,
- Sample receipt checklist fax confirmation,
- Final Alpha analytical reports,
- Alpha QA/QC data reports (if present),
- Final sub-contract lab reports (if present),
- Sub-contract lab QA/QC data reports (if present),
- Alpha invoice-always make sure than an invoice is present,
- Sub-contract lab invoices (if present),
- Raw data:
- Final report raw data. The initials of the analyst indicating final data should be indicated somewhere on all of the sheets and should be paper clipped together; and,
- Screen reports, re-runs, etc. this is indicated on the top sheet and should be clipped together,
- Air bill,

- Correspondence; and,
- Report fax or e-mailed confirmation.

If there were amendments made to the work order, put the amended COC on top of the previous COCs. Put amended final reports on top of other lab reports.

12.4.2 Archival Storage

12.4.2.1 Analytical Data

All analytical instrument data is permanently archived on the LIMS Server Disk as well as on Compact Disks (CD's) as a backup to hard copy data. The archival storage of data allows samples to be reevaluated at any time, providing proof of previous identifications, and the ability to search for other non-target compounds if GC-MS or ICP-MS data is being reevaluated.

12.4.2.2 Client File Data

All client data, which includes final reports, calculation sheets, chains-of-custody, records, chromatograms, quantitation reports, correspondence, and other associated data, are maintained by Alpha Analytical, Inc. for no less than five years. This hard-copy data is stored on location at the laboratory for approximately one year. After this period of time, the data is scanned and stored electronically as a PDF file at an off-site location.

12.5 COLLECTIONS AND VALIDATIONS OF COMPUTERIZED DATA

12.5.1 In a computerized environment there are unique problems which must be considered in order to assure data integrity. Particularly unique data attributes such as: data acquisition, processing, recording, storage, retrieval, archival, data security and soft-ware program integrity.

12.5.2 The computerized data collection and handling systems used by Alpha are designed such that data entries and data files are uniquely identified so that data can be reliably stored and retrieved without loss. Additionally each datum is supported by at least one hard copy output or laboratory notebook entry.

12.5.3 It is the responsibility of the LIMS Administrator to ensure the computerized data handling systems is used by trained personnel such that data corruption is prevented. Additionally, the LIMS Administrator is responsible for ensuring the integrity and accuracy of data handling and reduction programs are maintained to include the following:

a) computer software developed by Alpha is documented in sufficient detail and is suitably validated as being adequate for use;

b) established procedures are implemented for protecting the data to include: the integrity and confidentiality of data entry and collection, data storage, data transmission and data processing;

c) computers are maintained to ensue proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of the test data; and

d) to establish and implement appropriate procedures for the maintenance of data security, including the prevention of unauthorized access to, and the unauthorized amendment of computer records.

Note: Commercial off-the-shelf software (e.g., word processing, database and statistical programs) used within their designated application range are considered sufficiently validated. However, analytical data acquisition software only needs to be validated initially, and again if modifications have been made to the software.

12.5.4 A complete description of Alpha's Software Quality Assurance Plan (SQAP) is found in Appendix F of the QAM. Specific items found in the SQAP are as follows:

- Computer Software/Hardware Operations,
- Data Collections and Storage,
- Data File Uploading,
- Electronic Diskette Deliverables (EDD's),
- MSAccess 97 DataBases,
- Data Archiving,
- PC Server Integrity and Software Validation,
- Sample Log-In, and
- Sample Prep Omega SOP.

QUALITY ASSURANCE MANUAL
VOLUME I

Section 13

Corrective Actions and Control of Nonconforming Environmental Test Work

13.0 CORRECTIVE ACTIONS AND CONTROL OF NONCONFORMING ENVIRONMENTAL TEST WORK

13.0.1 Policy

13.0.1.1 It is Alpha's policy to designate the responsibilities and authorities for the management of nonconforming work and to define the necessary actions when nonconforming work is identified.

13.0.1.2 It is Alpha's policy to make an evaluation of the significance of the nonconforming work.

13.0.1.3 It is Alpha's policy to take immediate corrective actions, and make appropriate decisions regarding the acceptability of the nonconforming work.

13.0.1.4 It is Alpha's policy to notify the client when data quality has been impacted by nonconforming work and affected their data results.

13.0.1.5 It is Alpha's policy to define the responsibility for authorizing the resumption of work.

13.0.2 Summary

Analytical methods require strict adherence to initial calibration, calibration verification, defined accuracy and precision limits, as well as a host of other critical QC elements with prescribed criteria. These QC elements are continuously monitored by the analyst, supervisors and QA Officer to ensure they are conforming to the prescribed method criteria.

In an imperfect world, occasionally, one or more of these QC elements do not comply with the method and/or project defined criteria and are identified as a nonconforming sample.

There are four primary areas where a sample may be noncompliant or nonconforming. They are generally described as:

i. the sample is nonconforming due to a sampling or sample receiving issue;
ii. the sample is nonconforming due to a sample matrix effect issue;
iii. the sample is nonconforming due to a sample preparation issue; or
iv. the sample is nonconforming due to a instrument issue.

In addition, samples may be nonconforming due to a combination of the potential issues or causes as described above.

13.0.3 Types of Corrective Actions

The Laboratory Director, Laboratory Manager, analyst, and QA Officer may all be involved in corrective actions. Corrective actions are of two kinds:

1. Immediate, to correct or repair non-conforming equipment and systems. The need for this type of action is most frequently identified by the analyst as a result of calibration checks and QC sample analyses.

2. Long-term, to eliminate causes of non conformance. The need for such actions is normally identified by audits. Examples of this type of action include:

   a) staff training in technical skills or in implementing the QA Program;

   b) rescheduling of laboratory operations to ensure analysis within allowed holding time;

   c) identifying vendors who supply reagents of sufficient purity; and

   d) revision of the QA Program or replacement of personnel.

13.0.4 Procedural Outline

The following procedure is implemented when samples are determined to be noncompliant either by method, laboratory defined criteria, or by client requirements. The following outline describes this procedure:

1) the responsibilities and authorities for the management of nonconforming work is designated and actions (including halting of work and withholding test reports, as necessary) are defined and taken when nonconforming work is identified;

2) an evaluation of the significance of the nonconforming work is determined;

3) correction are taken, together with any decision about the acceptability of the nonconforming work;

4) where the data quality is impacted, the client is notified; and

5) the responsibility for authorizing the resumption of work is defined.

13.0.5 Conclusion

A comprehensive discussion which would include a compendium of situations, various

scenarios to resolve these issues, ways to improve or minimize these issues, the corrective actions associated with these issues, and their respective follow up is beyond the scope of this discussion.

However, the following discussion, identifies the key elements of our policy and defines the procedures to implement these findings in a manner to correct and minimize nonconforming samples.

The following discussion is an extremely important aspect of environmental testing and is critical to improving our quality systems.

If the evaluation of nonconforming work indicates the issue could reoccur or a systemic problem is discovered, the corrective actions procedures described below is promptly followed.

13.1 CORRECTIVE ACTIONS

When, as a result of audits or QC sample analysis, analytical systems are shown to be unsatisfactory, a corrective action is implemented. Generally, quality control information is reviewed by several individuals. The responsibility for the initial assessment of a quality control measure lies with the analyst who identifies a problem with the sample or procedure and has access to the test results.

13.1.1 Initial QC Assessment and Assignment of Responsibility and Authority

The individual responsible for operating the analytical instrument is responsible for performing the first initial data review (Tier-1 review).

Table 13-1 identifies typical quality control checks that may be required by the various test methods. The typical acceptance range or the source of the acceptance range is also identified in this table. This table does not include sample receiving criteria but focuses on sample matrix, sample preparation and instrument criteria.

If one or more of these key QC elements fail, than the sample is noncompliant. The root cause of the failure is investigated, and corrective actions are taken to resolve these issues.

The following QC samples are typically reviewed by the analyst:

- Calibrations, which may include initial calibration, initial calibration verification, continuing calibration verification and tuning standards when specified;

- Blank, which may include, method or reagent blanks, equipment and trip blanks;

- Spikes, which may include matrix spikes, control spikes, duplicate spikes; and
- Surrogate and internal standards when required.

13.1.2 Secondary QC Assessment and Assignment of Responsibility and Authority

In addition to the analyst, the following controls are also reviewed by a second person (Tier-2 review) such as a QC assistant. This generally includes the following:

- standards,
- blanks,
- spiked samples (matrix and blank), and
- duplicates.

13.1.3 Corrective actions are ultimately the responsibility of the individual in oversight authority (i.e., supervisor, Laboratory Director, Laboratory Manager, or QA Officer).

GENERAL ACCEPTANCE CRITERIA FOR QUALITY CONTROL CHECKS TABLE 13-1

QC CHECKS	ACCEPTANCE CRITERIA
Calibrations	
Initial Calibration	Method Acceptance Criteria
Initial Calibration Verification	
Continuing Calibration Verification	
Tuning	
Blanks	
Method Blanks	< Reporting Limit or Client Defined
Reagent Blanks	
Equipment Blanks	
Trip Blanks	
Spikes	
Matrix Spikes	Method/Laboratory/Client Specified Accuracy Limits
Laboratory Control Samples	
Duplicates	

Laboratory Duplicates	Method/Laboratory/Client Specified Precision Limits
Matrix Spike Duplicates	
Field Duplicates	
Others	
Surrogates	Method /Laboratory/Client Specified Accuracy Limits
Internal Standards	Method Acceptance Criteria
Split Samples	Meets Precision Criteria

13.1.4 Cause Analysis

Finding the source of a QC problem involves identifying probable sources of error and checking each source to determine if the protocols were properly followed. Common sources of error and expected follow-up protocols are outlined in Tables 13-2, 13-3, 13-4, and 13-5.

13.1.5 Selection and Implementation of Corrective Actions

When the source of a QC error has been identified, a corrective action is selected and implemented. The selection of a particular corrective action and its implementation is premised on the action(s) most likely to eliminate the problem and to prevent future recurrence.

Corrective actions are selected and implemented to match the degree that is appropriate to the magnitude and the risk of the problem.

13.1.6 Documentation of Corrective Actions

13.1.6.1 If a quality control measure fails to meet acceptance criteria (i.e., immediate or short-term corrective actions), the QC measure and the procedures used to correct the problem is typically documented using analytical corrective action worksheets.

If system changes are required resulting from corrective action investigations (i.e., long-term corrective actions), these changes and the implementation of these changes are also documented.

13.1.6.2 The selection and implementation of corrective actions are documented by the appropriate individuals and procedures. For example, documentation does not imply a formal memo but may be documented in the following fashion:

a) Corrective actions that are initiated during an on-going analytical run typically documented on the chromatogram as well as in the instrument analytical log book; and

b) Corrective actions that require input or intervention of more than one individual is typically documented in the related log books and records.

Both of these types of immediate or short-term corrective actions are documented using the instrument corrective action worksheets.

13.1.6.3 If an identified quality control problem affects more than one set of data or multiple projects, then the documentation associated with identifying and resolving the problem is cross-referenced to all associated projects.

13.1.7 Monitoring of Corrective Actions

For either immediate or long-term corrective actions, steps comprising a closed-loop corrective action system is employed as follows:

- Define the problem;
- Assign responsibility for investigating the problem;
- Investigate and determine the cause of the problem;
- Assign and accept responsibility for implementing the corrective action;
- Establish effectiveness of the corrective action and implement the corrections; and
- Monitor and verify that the corrective action has eliminated the problem.

Note: This is the same as described as our policy statement found and the procedural outline also described above.

Occurrence of problems, corrective actions employed, and verification that the problem has been eliminated are examined by the QA Officer and/or Laboratory Director.

Historical corrective action items are periodically reviewed during the internal data quality audits to monitor conformity and to identify long-term trends or recurring problems.

13.2 Additional Audits

13.2.1 Internal Audits

When the identification of nonconformance or departures cast doubts on method and/or program compliance, or with policies and procedures established by Alpha, additional audits of the effected areas of activity are initiated as soon as possible. A detailed description of our audit policies and procedures are found in section 14.

13.2.2 External Audits

The need to initiate corrective action may be the result of activities or audits from external sources. Sources include system audits, performance audits, split samples, blind QC samples, and findings from project or data validation review. A description of external audits policies and procedures are also found in section 14.

13.3 Technical Corrective Action

A generalized explanation of probable sources and expected corrective action for each QC measure is included below. A more detailed description is found in individual analytical SOPs in tables identified as Summary of Calibration Procedures and Summary of QC Procedures listing method specific calibration and batch QC criteria. Since many QC problems have unique solutions, the corrective action protocols are not limited to those listed below, and further assessment, based on an individual's experience and knowledge, may be warranted.

13.3.1 The first QC measure focuses on calibrations. Table 13-2 outlines some probable sources of QC problems and expected review procedures.

SOURCES AND EXPECTED REVIEW PROCEDURES FOR CALIBRATIONS TABLE 13-2

SOURCES	EXPECTED REVIEW PROCEDURES
Improperly prepared or outdated standards	Review preparation logs for calculations or dilution errors and use of expired standards
Improperly prepared or outdated check standards	Verify check standard
Poor instrument response	Determine if preventative maintenance is required
Incorrect calculations	Review and verify all calculations
Contamination problems	See Table 13-3

The following is a description of expected corrective actions for calibrations:

- Recalculate calibration curve;
- Prepare fresh standards;

- Re-calibrate instrument;
- Perform preventative maintenance;
- Perform mass calibration and retune;
- Re-analyze all samples bracketing those from the previous acceptable QC check through the next acceptable QC check; and
- Take measures to eliminate sources of contamination.

13.3.2 The second QC measure focuses on blanks. While the goal is to have no detectable contaminants, each method blank is critically evaluated as to the nature of compound interferences and the effect on the analysis of each sample within the batch. The source of the contamination is investigated and measures are taken to minimize or eliminate the problem and affected samples are reprocessed or data is appropriately qualified. Table 13-3 outlines some probable sources of contamination and expected review procedures.

SOURCES AND EXPECTED REVIEW PROCEDURES FOR BLANKS TABLE 13-3

SOURCES	EXPECTED REVIEW PROCEDURES
Contaminated reagents	Verify reagent sources
Environmental cross contamination (sample collection, and sample and analysis conditions)	Review sample handling and storage protocols
Improper or incomplete laboratory or field decontamination procedures	Review cleaning protocols
Contaminated sample containers	Verify source and storage conditions
Contaminated source water	Verify water source

The following is a description of expected corrective actions for blanks:

- Take measures to determine the source of the problem and eliminate future problems such as discarding reagents, revising protocols, performing preventative maintenance, or changing the use of interfering chemicals.
- Review data with respect to reported contamination levels. If the concentration of a target analyte is found in the blank at or above the reporting limit, AND the concentration in the blank is greater than 1/10th of

the amount measured in the associated sample batch, then the associated samples should be re-extracted, the client notified, and resampled or the data footnoted.

- If sample concentrations are significantly higher than blanks, or contaminants are not detected in the sample, then report the sample data and flag the analytes by reporting the concentrations in the blank and if required, footnote the analytical data.

13.3.3 The third QC measure focuses on spikes, surrogate spikes, and internal standards. Table 13-4 outlines some probable sources of QC Problems and expected review procedures.

SOURCES AND EXPECTED REVIEW PROCEDURES FOR SPIKES, SURROGATE SPIKES, AND INTERNAL STANDARDS TABLE 13-4

SOURCES	EXPECTED REVIEW PROCEDURES
Error in calculation	Review and recheck all calculations
Error in preparing or using spike solution	Review all preparation logs and analytical logs for proper dilutions, solvents, etc.
Outdated standards	Review expiration dates and standard preparation logs
Contamination problems	See blanks above
Poor instrument response	Determine if preventative maintenance is required

The following is a description of expected corrective actions for spikes, surrogate spikes, and internal standards:

- Take measures to eliminate contamination problems, reprocess or reextract samples, and reanalyze as necessary;
- Perform required maintenance and revise PM schedules;
- Review preparations, calculations, and record keeping to determine if additional training or more stringent protocols are required; and,
- If the sample matrix produces consistently unacceptable recoveries, and none of the sources discussed above are responsible for the problem, then the sample should be re-extracted and re-analyzed. If re-analysis produces the same results, then the associated samples should be reported with a footnote to qualify the results.

13.3.4 The fourth QC measure focuses on duplicates. The Table 13-5 outlines some probable sources of QC problems and expected review procedures.

SOURCES AND EXPECTED REVIEW PROCEDURES FOR DUPLICATES TABLE 13-5

SOURCES	EXPECTED REVIEW PROCEDURES
Non-representative sample	Review sample collection procedures
Error in calculations	Recheck calculations
Contamination problems	See blanks above
Error in preparing or using spike solutions	Review all preparation logs and analytical logs for proper dilutions, solvents, etc.
Outdated standards	Review expiration dates and standard preparation logs
Poor instrument response	Determine if preventative maintenance is required

The following is a description of expected corrective actions for duplicates:

- Report data with a footnote and explanation;
- Revise sample collection or sample processing procedures to assure a representative sample;
- Take measures to eliminate contamination problems; and
- Reprocess and re-analyze the sample set.

13.4 CLIENT NOTIFICATION OF NONCONFORMITY

13.4.1 Nonconformance Associated with Sample Receiving

There are many potential levels of sample nonconformance which may be the result of the submitted sample or a laboratory error. In general, if a sample is received and noted that it contains a nonconforming item, then the client is notified of the samples nonconformance, see Appendix C. It is the responsibility of Alpha to identify and notify the client of the sample nonconformance. Subsequently once the client has been notified it is the responsibility of the client to determine the final status of that sample.

13.4.2 Nonconformance Associated with Analytical Data

13.4.2.1 It is Alpha's policy to report, to the extent possible, samples only if all quality control measures are acceptable.

13.4.2.2 Nonconformance associated with analytical data production is not always black and white, but is an issue of the significance of the nonconformity.

13.4.2.3 Critical QC Elements

Analytical data associated with the following items are not released as final data until the nonconforming item is technically reviewed and if possible, all associated data is re-analyzed with the analytical QC in control or the data appropriately footnoted. These critical items are:

- BFB or DFTPP;
- Initial calibration;
- Calibration verification;
- Internal standards;
- Method blank; and
- LCS recovery.

13.4.2.4 Reporting Nonconforming Data Results Associated with Critical QC Elements

It is our first priority to identify the problem, correct the problem, and if possible, re-analyze all associated samples prior to releasing data.

a) If data are analyzed during a nonconforming situation, and it is impossible to re-analyze those affected samples; then it is the decision of the client, if possible, to decide the fate of that data.

b) If the data is to be released, then at a minimum all affected data are footnoted with a description of the failed QC parameters.

c) If the problem can not be corrected in a timely manner they are re-analyzed on a second instrument. It is one of the primary objectives of our laboratory contingency plan to have redundant back-up instruments available for just this type of case.

13.4.2.5 Less Critical QC Elements

There are additional analytical QC items which are not as critical. These items are generally attributed to the sample matrix which may cause analytical QC parameters to fail. These less critical QC elements are described as follows:

- The ending calibration fails for one or more compounds;
- One or more surrogates are not recovered within the QC limits of acceptability; and
- Matrix Spike recovery values are not within the QC limits of acceptability.

13.4.2.6 Reporting Nonconforming Data Results Associated with Less Critical QC Elements

a) If these less critical QC criteria fails, then a decision is made regarding the scientific defensability, technical soundness, and end users data quality objectives, whether these samples will be re-analyzed or not.

b) Most of the time these problems are matrix related and re-analysis will confirm the nonconformity is matrix related by the repeated QC failure.

c) In either case this data is footnoted with a description of the failed QC parameters and the data is released.

QUALITY ASSURANCE MANUAL
VOLUME I

Section 14

System and Technical Audits

14.0 SYSTEMS AND TECHNICAL AUDITS

14.1 DEFINITIONS

Audit - a systematic evaluation to determine the operational quality of a particular system or function.

System audits - verify compliance with our laboratories quality system (e.g., QA Manual, Vol I and II) based on the NELAC Quality System. Examples of these types of audits would include audits such as sample acceptance policies, and sample tracking procedures.

Technical audits - verify compliance with method-specific requirements, as well as operations related to the test method (e.g., sample preparation).

Note: NELAP makes a distinction between the two types of internal audits, however, in practice most internal audits are verifying the operational quality of the entire laboratory (i.e., both system and technical audit elements are intertwined).

14.2 INTERNAL AUDITS

14.2.1 Internal audits are an independent check used to verify that laboratory policies and procedures continue to comply with the requirements of the quality system as defined by the NELAP standards and detailed in this QA Manual.

14.2.2 Internal audits are conducted to encourage staff members to adopt good quality assurance practices at all levels of the organization. Staff members are also encouraged to use these audits as an educational opportunity.

14.2.3 The internal audit program addresses all elements of the quality systems, including the environmental testing activities and is conducted on an annual basis.

14.2.4 It is the responsibility of the QA Officer to plan, organize and schedule internal audits. Audits not conducted by the QA Officer or carried out by trained and qualified personnel who are, wherever resources permit, independent of the activity to be audited.

14.2.5 These audits take into account reports from laboratory personnel, the outcome of recent internal audits, assessments of external auditing agencies, the results of inter-laboratory comparisons or proficiency tests, changes in the volume and type of work undertaken, feedback from clients, corrective actions, and other relevant factors.

14.2.6 Audit Findings and Corrective Actions

14.2.6.1 When audit findings cast doubt on the effectiveness of the operations or validity of the test results, corrective actions are taken and clients

are notified if investigations indicate results were affected. All internal audit review finding and any corrective actions that may arise from them are documented accordingly.

14.2.6.2 The time frame for notifying clients is based on the magnitude of the problem and its impact on the defensibility and use of the data.

14.2.6.3 If corrective actions were taken, follow-up audits are conducted to verify and record the implementation and effectiveness of the corrective action taken.

14.2.7 Preventative Action

14.2.7.1 Preventive action is a pro-active process used to identify opportunities for improvement rather than a reaction to the identification of problems or complaints.

Section 13 is a description of corrective actions and is the reactionary process after a problem has been identified. This section, section 14 describes the audit and review process which, by its very nature, is a preventive action procedure.

14.2.7.2 Once potential sources of nonconformance, either technical or concerning the quality system, is identified, preventive action is taken. If preventive action is required, a plan of action is developed, implemented and monitored to reduce the likelihood of the occurrence of such nonconformances and to take advantage of the opportunities for improvement.

The procedure as described in section 13, Corrective Action, is the same basic procedure as used for preventive actions.

14.3 INTERNAL SYSTEMS AUDITS

14.3.1 Quality Assurance Manual Audit

The EPA requires that each laboratory must have a written and approved Quality Assurance Manual as well as individual analytical Standard Operating Procedures. The EPA and NELAP specifies the QA Manual must present in specific terms, the policies, organizations, objectives, functional activities, and specific QA/QC activities designed to achieve the data quality goals of specific methods or projects.

14.3.1.1 One of the primary duties and responsibilities of the QA Officer is to prepare, review, approve, revise and distribute the Quality Assurance Manual, Standard Operating Procedures and other technical

documents. The QA manual, including Volume I and Volume II, is reviewed annually for accuracy and adequacy, and updated as appropriate.

14.3.1.2 All staff members are required to attend annual training sessions covering selected material outlined in the chapters, or sections, contained in Volume I of the QA Manual. This required training is described in the training SOP. Internal system audits are typically conducted simultaneously with this training to encourage feedback and to address any shortcomings with the QA Manual and related procedures, see internal audit schedule.

14.3.1.3 The documentation that internal systems audits have been conducted regarding Vol I of the QA Manual, is outlined in Table 14-1 and is available for external audit and reviews.

14.3.2 Staff Audits

Training and auditing of the systems and procedures described in Volume II of the QA Manual are generally conducted directly with the staff members assigned to those procedures.

14.3.2.1 These audits are conducted with individual staff members covering the various aspects of their work or work related activities that have a bearing on the overall quality of the data produced. Internal staff audits consist of observations and verification to the adherence of approved practices and procedures. Deviations are noted and discussed with the affected staff members.

14.3.2.2 The documentation that internal system audits have been conducted regarding Vol II of the QA Manual, is outlined in Table 14-2 and is available for external audit and reviews.

14.4 INTERNAL TECHNICAL AUDITS

14.4.1 Internal systems audits tend to focus on laboratory procedures rather than data quality. Therefore, these types of systems audits do not completely address and identify potential data quality issues and problems.

Data quality (technical) audits are conducted for the purpose of determining whether data of acceptable quality is being generated. There are three general types of technical audits:

- SOP document audits,
- Methods audits, and

- Data and records audits.

14.4.2 SOP document are reviewed for accuracy and adequacy annually or whenever procedural method changes have occurred and updated as appropriate. In addition, methods audits are conducted simultaneously with the SOP document audits. The documentation that internal technical audits have been conducted and audit schedules are outlined in Table 14-3 and 14-4. Documentation of specific audit topics are outlined in Tables 14-5 and 14-6.

14.4.3 Records and Data Audits

An internal records audit is conducted to verify the QA record systems is functioning properly and is being adequately filed and maintained for protection and accessability. Records audit are also conducted to ensure data packages as generated by Alpha are adequate and fulfill the QA deliverables package as requested by the client or project. The QA Officer typically reviews records to verify the following general items:

- QA contents,
- QA format, and
- Completeness of data package in relation to the appropriate deliverable requirement.

14.5 PERFORMANCE EVALUATION REVIEWS

14.5.1 Alpha Analytical participates in a proficiency-testing program to help ensure our laboratory has adequate quality control procedures in place for monitoring the validity of environmental test methods and procedures.

14.5.2 It is a policy of Alpha and a NELAC requirement that laboratories participate in two single-blind, single-concentrate Proficiency Testing (PT) studies, per year for each field of testing to maintain accreditation.

14.5.3 Performance Evaluation (PE) samples are purchased and prepared as follows:

14.5.3.1 Performance evaluation samples are obtained from a laboratory accredited as a provider of Proficiency Testing (PT) samples, under the auspices of the National Institute of Standards and Technology (NIST), the USEPA and the National Voluntary Accreditation Program (NVLAP);

14.5.3.2 Aqueous samples are typically prepared in analyte-free water or prepared as whole volume samples by the PT provider, and soil samples are typically sent in a pre-spiked soil matrix.

14.5.3.3 These are blind PE samples; therefore, the analysts is not aware of the

analyte concentration values in the PE audit sample. PE samples are inserted into the routine stream of laboratory sample analysis.

14.5.4 Performance Evaluation Findings and Corrective Actions

If Alpha's PE study results, determined by score of pass/fail criteria is deemed fully acceptable, corrective actions are not required. However, if Alpha's performance is determined to be unacceptable on any individual fractions, then corrective actions are taken to locate the problem, identify the problem, implement corrective actions and to document theses corrective actions. Once the problem has been identified and the corrective action implemented, a remedial or supplemental PE sample is analyzed for that fraction.

14.6 GENERAL REVIEWS

14.6.1 Internal audits and reviews are conducted not only on PE samples, and QA documents and procedures; but in addition, other quality control procedures are continuously reviewed to ensure quality data is being provided to clients. The following quality control procedures are regularly reviewed:

- Use of certified reference material or second source for QC sample analysis,
- Replicate testing such as quarterly QC samples, and/or annual DOC studies,
- Re-testing of retained samples, and
- Calculation of results for different parameters of a sample (i.e. comparing gravimetrically determined TDS results with a cross check calculation using conductivity data).

14.7 ANNUAL MANAGEMENT REVIEW

14.7.1 The analytical quality systems and all other ancillary quality systems are reviewed annually by management to ensure its' continuing suitability and effectiveness. If systems are found to be ineffective; than this review will discuss and introduce necessary changes or improvements to the quality systems and/or laboratory operations.

14.7.2 This review takes into account:

a) the suitability of policies and procedures;

b) reports from management and supervisory personnel;

c) the outcome of recent internal audits;

d) corrective and preventive actions;

e) assessments by external bodies;

f) the results of inter-laboratory comparisons or proficiency tests;

g) changes in the volume and type of work undertaken;

h) client feedback;

i) complaints; and

j) other relevant factors such as quality control activities, resources and staffing.

14.7.3 The documentation that management reviews have been conducted are outlined in Table 14-7.

14.8 EXTERNAL AUDITS

14.8.1 External Systems Audit

External audits are conducted by individual clients or the various regulatory agencies (i.e., state certifying agencies, EPA regional agencies, etc.). This is an on-site inspection and review of our quality control system. Their visit to the laboratory is to review and discuss any shortcomings and discrepancies in an actual sample walk through. Audits performed by an external Quality Assurance Officer normally will address all applicable elements of this QA Plan or contract requirements as it pertains to their QAPP or SOW. It is Alpha's policy to comply fully with audits conducted by certifying agencies, regulatory agencies and clients.

14.8.2 External Performance Audits

External performance audits are Performance Evaluation (PE) samples submitted and analyzed as unknown sample concentrates as double-blind samples. These PE samples are typically obtained from proficiency test (PT) providers and submitted as samples within the clients normal sample stream.

Internal System Audit
Document Review
QA Manual Volume I
Table 14-1

Section	Audit Schedule (suggested)	Year		Year Additional Review (if required)	
		Review		Review	
		Date	Revision No.	Date	Revision No.
Section 1	January (week 1)				
Section 2	January (week 1)				
Section 3	January (week 1)				
Section 4	January (week 3)				
Section 5	January (week 3)				
Section 6	February (week 1)				
Section 7	February (week 1)				
Section 8	February (week 3)				
Section 9	February (week 3)				
Section 10	March (week 1)				
Section 11	March (week 1)				
Section 12	March (week 3)				
Section 13	March (week 3)				
Section 14	April (week 1)				
Section 15	April (week 1)				
Section 16	April (week 1)				
Section 17	April (week 1)				
Section 18	April (week1)				

Comments:

Internal System Audit
Document Review
QA Manual Volume II
Table 14-2

Section	Audit Schedule (suggested)	Year		Year Additional Review (if required)	
		Review		Review	
		Date	Revision No.	Date	Revision No.
Appendix A	November (week 1)				
Appendix B	November (week 2)				
Appendix C	April (week 3)				
Appendix D	November (week 4)				
Appendix E	Jan./April (week 3)				
Appendix F	December (week 2)				
Appendix G	January (week 1)				
Appendix H	December (week 4)				

Comments:

Internal Technical Audit
Document Review
QA Manual Volume III
Table 14-3

SOP	Method	Comments	Audit Schedule (suggested)	Year		Year Additional Review (if required)	
				Review		Review	
				Date	Revision No.	Date	Revision No.
E.20	524.2		May (week 1)				
E.30	Pesticides		April (week 2)				
E.31	PCBs		April (week 4)				
E.33	VOCs		May (week 4)				
E.34	SVOCs		June (week 1)				
E.35	PNA (SIMs)		June (week 2)				
E.36	Alcohols (SIMs)		June (week 3)				
E.37	TPH-DRO		June (week 4)				
E.38	TPH-GRO		July (week 1)				
E.50	TCLP		July (week 2)				
E.51	SPLP		July (week 3)				
E.52	STLC		July (week 4)				
E.55	ASE (3545)		July (week 4)				
E.56	Liq-Liq (3510)		July (week 4)				

Comments:

Internal Technical Audit
Document Review
QA Manual Volume III
Table 14-4

SOP	Method	Comments	Audit Schedule (suggested)	Year		Year Additional Review (if required)	
				Review		Review	
				Date	Revision No.	Date	Revision No.
E.60	Metals		August (week 1)				
E.64	Organic Acids		August (week 3)				
E.65	Anions		August (week 4)				
E.66	Perchlorate		August (week 4)				
E.67	TOC		August (week 3)				
E.70	3015		August (week 2)				
E.71	3051		August (week 2)				
E.72	200.2		August (week 2)				
E.75	Conductivity		September (week 1)				
E.76	pH		September (week 1)				
E.77	Ammonia/TKN		September (week 2)				
E.78	Turbidity		September (week 2)				
E.80	TDS/TSS/TS		September (week 3)				
E.81	% Moisture		September (week 3)				
E.82	1664A		September (week 4)				
E.85	Alkalinity/Acidity		September (week 4)				
E.90	Chromium VI		October (week 1)				
E.92	Sulfide		October (week 1)				
E.93	Chlorine		October (week 2)				
E.94	COD		October (week 2)				
E.95	Total-P		October (week 3)				
E.96	Fe		October (week 3)				

Comments:

Internal Data Quality Audit
Checklist
Table 14-5

Item	Date Completed	Comments	Initial
1) Method review			
2) CAR external auditiors review			
3) SOP review			
4) IDC review			
5) MDL review			
6) Standards review			
7) Data Package review			
8) PE review			
9) Data Quality Audit review			
10) Analyst training			
11) Report review			
12) DQO review			
13) QC Summary Report review			
14) Bench records review			
15)			
16)			

Comments:

Internal Data Quality Audit
IDC/MDL Review
Table E.14-6A

Date:_____ Method:_____
Analyst: _____ Instrument:_____
Peer: _____ Matrix:_____

DESCRIPTION	Y/N/NA	Corrective Action Due Date	Corrective Action Completion Date	Comments
1) Initial Demonstration of Capability				
a) Was an IDC performed for this method by this analyst?				
b) Was each target analyte included at the required concentrations?				
c) Was each target analyte evaluated for spike value, found value, average percent recovery, standard deviation and percent relative standard deviation?				
d) Does the average percent recovery and standard deviation of each analyte meet the method specified acceptance range?				
e) Is the IDC documented on the standard form with the correct information and required signatures?				
2) Method Detection Limits				
a) Was an MDL study performed for this method by this analyst?				
b) Was each target analyte and data point included?				
c) Was the MDL study generated using the preparatory and cleanup procedures routinely used on samples?				
d) Were any data points deleted from the MDL study?				
e) Was each target analyte evaluated for spike value, found value, average percent recovery, standard deviation and calculated MDL?				
f) Is calculated MDL higher than the spike concentration, and if so was the study repeated at a higher concentration?				
g) Is the calculated MDL greater than 1/10 of the spike concentration, and if not was the study repeated at a lower concentration.				
h) Was a MDL verification check standard analyzed at approximately 2 times the MDL? And was the check standard detected or have a signal to noise ratio greater than 3?				
i) Is the calculated MDL higher than the LOQ, and if so was the study repeated at a lower level or the LOQ elevated above 3 times the MDL?				
j) Was a LOQ verification check standard analyzed at 1-2 times the LOQ and if so were the recoveries within the LCS windows of acceptability?				

Internal Data Quality Audit
Calibration Review
Table E.14-6B

Date:_____ Method:_____
Analyst: _____ Instrument:_____
Peer: _____ Matrix:_____

DESCRIPTION	Y/N/NA	Corrective Action Due Date	Corrective Action Completion Date	Comments
3) Initial Calibration Data				
a) Was an initial calibration performed for each target analyte?				
b) Were all target analytes included in the calibration standard?				
c) Were the concentration values used for each analyte in the calibration table or curve appropriate for the method and do the concentration values in the method table match the actual standard concentrations?				
d) Are analytes reported by GC/MS assigned the right characteristic ions or isotopes by ICP/MS?				
e) Are GC or IC retention time windows correctly calculated?				
f) Is a second GC confirmation column or alternate detector used for analyte confirmation?				
g) Are multi response analytes being evaluated for pattern match?				
h) Was peak integration performed properly with no indication of improper data manipulation?				
i) Were all manual integrations properly documented with a before and after chromatogram and appropriate explanation?				
j) Does the low level standard have a signal to noise response greater than 3?				
k) Are integration routines used on calibration points acceptable?				
l) Do calibration points either high or low need to be deleted from the IC?				
m) Does IC meet method criteria for the chosen mathematical model?				
n) Are the same instrument conditions used for IC the same used for production analysis?				

Notes:

Internal Data Quality Audit
Calibration Review
Table E.14-6B
(Continued)

Date:_____ Method:_____
Analyst: _____ Instrument:_____
Peer:_____ Matrix:_____

DESCRIPTION	Y/N/NA	Corrective Action Due Date	Corrective Action Completion Date	Comments
4) Instrument Performance Check (IPC)				
a) Was the appropriate IPC analyzed? 1) BFB or DFTPP tune standard for GC/MS 2) Metals tune standard for ICP/MS 3) GC or IC method specific IPC	1) 2) 3)			
b) Was the GC/MS or ICP/MS tune standard analyzed and checked each 12 hours of sample analysis or method required frequency?				
c) For GC/MS are ion abundance and relative ion abundance within the method acceptance criteria?				
d) For ICP are mass calibration, resolution and RSD within method criteria?				
e) For IC or GC methods, does the ICP meet method criteria?				
5) Initial Calibration Verification (ICV)				
a) Was an ICV performed using a standard independent from the IC?				
b) Was a midpoint concentration value used for the ICV?				
c) Are the % recovery values acceptable? (Typically evaluated against the CV criteria?				
6) Calibration Verification (CV)				
a) Are the concentration values appropriate for the CV?				
b) Are high and low concentration values being used for GC methods?				
c) Do assigned concentration values match the actual concentration values provided with the calibration standard?				
e) Are % difference or % recovery values for each target analyte or CCC within method criteria?				

Notes:

Internal Data Quality Audit
Data Package Review
Table E.14-6C

Date:_____ Method:_____
Analyst: _____ Instrument:_____
Peer: _____ Matrix:_____

DESCRIPTION	Y/N/NA	Corrective Action Due Date	Corrective Action Completion Date	Comments
7) Method Blank (MB) [Negative Control]				
a) Are analytes present above the LOQ in the blank? If so did this affect any of the associated samples?				
8) Laboratory Control Spike (LCS) [Positive Control]				
a) Are the appropriate analytes and spike levels included in the LCS?				
b) Was the LCS prepared independently from the IC or from a second source?				
c) Do the assigned analyte concentrations match the values from the source?				
d) Do the % recovery range of each analyte compare with method stated or laboratory derived acceptance ranges?				
9) Matrix Spike (MS) [Sample Specific Control]				
a) Is the same spike mix and spike levels used in the LCS also used in the MS?				
b) Do MS/MSD analytes meet acceptable RPD criteria?				
10) Sample Data				
a) Are surrogates and internal standards recoveries within the method criteia?				
b) If not was sample re-analyzed or was sample data appropriately footnoted?				
c) Were second column confirmation, GC retention time windows, elution order, and pattern recognition criteria correctly used for reported analytes by GC?				
d) Were concentrations for found analytes calculated and reported correctly?				
11) Standards Preparation				
a) Are all standards traceable to the Certificate of Analysis?				
b) Were all standards completely documented with lot numbers, expiration dates, correct concentration units, solvents, initials etc.?				
c) Was the DOC/MDL/ICV/LCS/MS prepared and clearly documented from a standard source independent from the IC?				

Management Review
Table 14-7

Date:_____

Personnel Present:_____/_____/_____/_____

Review Items	Specific Items of Interest	Comments
a) Suitability of policies and procedures		
b) Reports from managerial and supervisory personnel		
c) Outcome of internal audits		
d) Corrective and preventive actions		
e) Outcome of external audits		
f) Results of PE data results		
g) Changes is volume and types of work		
h) Client feedback/complaints		
i) Other		
Recommended Changes		

QUALITY ASSURANCE MANUAL
VOLUME I

Section 15

Quality Assurance Reports

15.0 QUALITY ASSURANCE REPORTS

15.0.1 Quality assurance reports are designed to keep staff members informed of the performance of QA/QC activities. Quality assurance reporting documents the quality control and quality assurance activities in the laboratory and provides communications and an accountability link among analysts, management and clients. Analytical report formats, which include selected quality control data and evaluations, are referred to as Quality Control Reports or QA deliverables. These provide a direct link between the analyst and the data user concerning the quality of the data.

15.0.2 In some instances, projects need to pay attention to particular quality assurance controls and assessment. In such situations Alpha will provide technical guidance and, if requested, periodic quality assurance reports to keep the project on target toward achieving those quality goals. These reports, both verbal and written, may include subjects that address the validity and documentation of data generation activities.

15.0.3 QA reports typically list significant problems and discuss the solutions and corrective actions implemented concerning QA/QC activities. QA reports may include such things as internal and external audits, QA/QC summary data sheets associated with a batch of analytical samples, PE sample results, etc.

15.1 QUALITY CONTROL REPORTING

15.1.1 Data reported for quality control, including MDL studies will have at least three significant figures unless specified otherwise in the method (i.e., any analytical result being used for quality control calculations should carry three significant figures).

15.1.2 Reported quality control data needs to be expressed in the proper units, i.e. the same units as the samples.

15.1.3 A typical final analytical report does not include quality control information. That information is most typically reported with its associated batch or summary QC data report.

15.2 INTERNAL QA REPORTS

Internal QA reports are distributed as necessary to keep staff members informed of the performance of QA/QC activities. This information is provided in the form of verbal communication, formal memorandums, or reports to ensure sound QA/QC practices.

15.3 DATA DELIVERABLES

In some specific situations, samples from a project may need to be technically evaluated by a third party review. Methods of analysis, SOW, QAM and other documents are used to

assist the evaluator in the technical review of analytical data generated by our QA program. Data deliverables is the process of gathering and collating analytical data in a manner which helps organize the data in a logical sequence. Table 15-2 through 15-5, gives guidance on collating and organizing a data deliverables package. Data deliverables may be project specific; therefore, it is important to organize the data deliverables specific to the SOW.

QA Summary Reports
DQO Reference Table 15-1

Method	Surrogate Window of Acceptability	LCS Window of Acceptability	MS Window of Acceptability	Matrix
200.8	Not Required	Method Specified	Method Specified	Water
524.2	Method Specific	Method Specified	Not Required	Water
608	Laboratory Derived	Method Specified	Method Specified	Water
624	Laboratory Derived	Method Specified	Method Specified	Water
625	Laboratory Derived	Method Specified	Method Specified	Water
6020	Not Required	Laboratory Derived	Laboratory Derived	Water/Soil
8015B-DRO	Laboratory Derived	Laboratory Derived	Laboratory Derived	Water/Soil
8015B-GRO	Laboratory Derived	Laboratory Derived	Laboratory Derived	Water/Soil
8081A	Laboratory Derived	Laboratory Derived	Laboratory Derived	Water/Soil
8082	Laboratory Derived	Laboratory Derived	Laboratory Derived	Water/Soil
8260B	Laboratory Derived	Laboratory Derived	Laboratory Derived	Water/Soil
8270C	Laboratory Derived	Laboratory Derived	Laboratory Derived	Water/Soil

Example
GC/MS Level IV Deliverables
Table 15-2

Item #	Deliverables	Page
1	Case Narrative	Page_____ through _____
2	Table of Contents	Page_____ through _____
3	Chain of Custody	Page_____ through _____
4	Sample results with analysis and extraction/preparation dates	Page_____ through _____
5	Raw data which includes chromatograms and quantitation reports	Page_____ through _____
6	Summary of MS/MSD/Duplicate recoveries and control limits (linking native samples)	Page_____ through _____
7	Raw data associated with the MS/MSD/Duplicate which includes chromatograms and quantitation reports (linking native samples)	Page_____ through _____
8	Summary of LCS recoveries and control limits	Page_____ through _____
9	Raw data associated with the LCS which includes chromatograms and quantitation reports	Page_____ through _____
10	Summary of method blank results	Page_____ through _____
11	Raw method blank data which includes chromatograms and quantitation reports	Page_____ through _____
12	Summary of internal standard areas/RT's, and summary of surrogate recoveries	Page_____ through _____
13	Summary of initial calibration data (RF, and %RSD)	Page_____ through _____
14	Raw data associated with the initial calibration which includes chromatograms, quantitation reports, and the calibration plots, indicating correlation coefficients if required	Page_____ through _____
15	Summary of continuing calibration data (% Difference reports from calculated concentrations, and from RRF)	Page_____ through _____
16	Raw data associated with the continuing calibration which includes chromatograms and quantitation reports	Page_____ through _____
17	Summary of instrument tuning (listing associated samples and injection times) for all applicable analytical shifts, including those in which initial calibration levels, QC samples, and client samples were analyzed	Page_____ through _____
18	Instrument sequence/injection logs	Page_____ through _____
19	Extraction/preparation logs and sample dilution logs	Page_____ through _____

Example
ICP/MS Level IV Deliverables
Table 15-3

Item #	Deliverables	Page
1	Case Narrative	Page_____ through _____
2	Table of Contents	Page_____ through _____
3	Chain of Custody	Page_____ through _____
4	Sample results with analysis and digestion/preparation dates	Page_____ through _____
5	Raw data which includes quant reports	Page_____ through _____
6	Summary of MS/MSD/Dup recoveries and control limits (linking native samples)	Page_____ through _____
7	Raw data associated with MS/MSD/Dup which includes quant reports (linking native samples)	Page_____ through _____
8	Summary of LCS/LCSD recoveries and control limits	Page_____ through _____
9	Raw data associated with LCS/LCSD which includes quant reports	Page_____ through _____
10	Summary of method blank results	Page_____ through _____
11	Raw method blank data which includes quantitation reports	Page_____ through _____
12	Summary of IC data (CPS, and Linear Regression Equations)	Page_____ through _____
13	Raw data associated with the ICwhich includes quant reports and the cal plots, indicating correlation coefficients if required	Page_____ through _____
14	Raw data associated with ICV which includes quant reports.	Page_____ through _____
15	Raw data associated with the ICSA/ICSB which includes quantitation reports.	Page_____ through _____
16	Raw data associated with ICB/CCB which includes quant reports.	Page_____ through _____
17	Summary of continuing calibration data	Page_____ through _____
18	Raw data associated with the CV which includes quant reports	Page_____ through _____
19	Summary of instrument tuning	Page_____ through _____
20	Instrument sequence/injection logs	Page_____ through _____
21	Digestion/preparation logs	Page_____ through _____

QUALITY ASSURANCE MANUAL
VOLUME I

Section 16

Laboratory Reports and Reporting Procedures

16.0 LABORATORY REPORTS AND REPORTING PROCEDURES

16.1 DATA REPORTING

16.1.1 Policy

It is Alpha's policy to report environmental test results accurately, clearly, unambiguously and objectively, and in accordance with any specific instruction in the test method. Analytical test data is reported on a final analytical test report which summarizes all the information requested by the client and that which is necessary for the interpretation of the test results and all information required by the method.

16.1.2 Test Reports

The generation of analytical data requires the use of computerized data systems for acquisition, storage, retrieval, and reporting of data. After the data has been acquired, reduced, and reviewed, it is then transcribed onto a final analytical report. For most analytical final reports, the report will include the following information:

a) Title: "Analytical Report,"

b) Alpha's Name and Address,

c) A unique serial number (project identification) at the bottom of the report, and page number,

d) Title of project or job number,
   - i. Client address,
   - ii. Client phone number,
   - iii. Point of contact,

e) Analytical method,

f) Sample identification,
   - i. Alpha Analytical identification number,
   - ii. Client identification number,

g) Dates
   - i. Date and time sample collected,
   - ii. Date and time sample received,
   - iii. Date sample analyzed,

   Note: If the method specified time of sample extraction or analysis is less than 48 hours from sample collection, than both the date and time analyzed are on the final report.

h) Sample matrix,

i) Test results,
   i. Reporting limits,
   ii. Concentration units,
   iii. List of compounds analyzed,
   iv. Observations or comments such as failed quality control,

j) Signature or approval block and date of issue.

16.1.3 Test Report Description

16.1.3.1 Footnotes or Data Qualifiers

Data is reported when the sample analysis occurred during periods that the calibration and systems were in-control. If a quality control measure is found to be out-of-control, and the data are to be reported, then the failed QC measure is reported with the appropriate data qualifiers.

16.1.3.2 Concentration Units

All numerical results are reported in terms of concentrations (i.e., µg/Kg for soils or µg/L for waters) in the environmental sample.

16.1.3.3 Reporting Limits

Reporting limits are required for all methods to evaluate method performance. All values less than the reporting limit are reported as Not Detectable, "ND". Reporting limits are dependent on the matrix of the sample that is being tested. Interferences frequently require sample dilution, which may change the analytical reporting limit.

16.1.4 Test Report Format

16.1.4.1 Final reports and reporting formats are designed to facilitate the analytical data review process. These reports are formatted for specific regulatory programs and designed to display information accordingly.

16.1.4.2 Final reports may contain multiple analyses from a set of samples with the same type of analysis on a single report.

16.1.4.3 Final reports may contain analytical information from several methods of analysis from the same sample.

16.1.4.4 Reports can be customized to virtually any client request or QAPP specific request. Not only can reports be customized, data can also be reported on a number of different spreadsheets or databases (i.e., Excel) and transmitted electronically.

16.1.5 Amendments to Test Reports

16.1.5.1 Amendments to analytical reports after it has been issued, is clearly stated that the report is an amended report. The amended report clearly states that the amended report replaces the original report with the date of issue of the original report in order to avoid any possible confusion. Finally the amended report clearly indicates the reason for amending the original report and is usually expressed as a footnote.

16.1.6 Analytical Reports Signature Block

The following personnel have the authority to sign final analytical data reports and to approve or disapprove other final analytical data reports that do not require a signature block such as Electronic Data Deliverables (EDD) or other data packages.

1) Laboratory Director
2) Quality Assurance Officer
3) Laboratory Manager

16.1.7 Verbal Analytical Data Release

The following personnel have the authority to verbally release final analytical data to clients that has previously been signed:

1) Laboratory Director,
2) Quality Assurance Officer,
3) Laboratory Manager,
4) Director of Client Services,
5) Project Coordinators,
6) Supervisors, and
7) LIMS Administrator

16.2 SIGNIFICANT FIGURES

16.2.1 Definition

Significant figures is the count of the number of digits in a number which properly represents a measured quantity when the number is expressed in scientific notations.

16.2.2 Purpose

When properly rounded, the result of a measurement is expressed so that the last digit remaining shows where the uncertainty in the measurement begins. The nature of the measurement process, accounting for all cumulative errors from consecutive operations, determines the number of significant figures.

16.2.3 Methods

There are two methods used to signify uncertainty. The most definitive technique is to follow the measured value with the ± sign and the amount of uncertainty (e.g., 10 ± 2). The less informative and more widely used method is to indicate the degree of uncertainty by the number of significant figures in the reported value. The last figure shown is the one in which there is uncertainty.

16.2.4. Procedure

The proper use of the concept of significant figures requires adherence to some conventions.

16.2.4.1 Rules of Significant Figures

Zeros may be significant digits, for example 5$\underline{0}$, 2.$\underline{0}$, or 5$\underline{0}$5. However, there are two different functions for which zeros are not considered significant digits.

a) Zeros may flag a decimal, for example $\underline{0}$.52.

b) Zeros may also define magnitude, for example 50$\underline{0}$, 5$\underline{0}$, or 0.$\underline{0}$5.

When reporting data which follows the conventions for significant figures, zeros will not be added to make each number have the same number of digits past the decimal point (i.e., we report 520 not 520.0)

16.2.4.2 Rounding Rules

In reporting results, rounding to the correct number of significant figures occurs only after all calculations and data manipulations are completed. Premature rounding can significantly affect the final result. When the calculation or instrument gives more figures than needed, it is necessary to round off. The following rules shall be used:

Rule 1: If the next digit beyond the rounding point is less than

5, leave the previous digit unchanged (e.g., 21.4 becomes 21).

Rule 2: If the next digit beyond the rounding point is greater than 5, increase the previous digit by one (e.g., 21.6 becomes 22).

Rule 3: If the next digit beyond the rounding point is equal to 5, with no digits other than zero following the 5, round the previous digit to the nearest even number (e.g., 21.5 and 22.5 both become 22).

Rule 4: If the next digit is a 5 followed by other digits, then treat the case as in rule 2 - for greater than 5 (e.g., 21.51 becomes 22).

Rule 5: If there are not enough numbers to get to the required number of significant figures, for example 2.3 when working with three significant figures, do not add extra zeros.

Rule 6: When performing calculations, carry at least one extra significant figure through the process and round only the final result. Rounding data before a calculation introduces a cumulative error. Carrying at least one extra digit minimizes this error.

16.3 CONTRACT LABORATORY PROGRAM (CLP) DATA QUALIFIERS

16.3.1 To the extent possible, samples are reported only if quality control measurements are acceptable. If a quality control measure is found to be out of control, and the data are to be reported, the failed QC measure is reported with the appropriate footnote or data qualifier.

16.3.2 Many times CLP data qualifiers do not accurately describe or represent the associated sample problem. In these cases custom footnotes or footnotes requested by a state agency which more accurately describe the sample situation is appended to the bottom of the associated sample reports.

16.3.3 The CLP describes a set of data qualifiers that are often requested by the end user. The following definitions provide brief explanations of the CLP qualifiers assigned to results in the data review process. Additional data qualifiers may be requested by data validators when evaluating data usability.

U - Undetected at the limit of detection. The associated data value is the limit of detection, adjusted by any dilution factor used in the analysis.

J - Estimated: The analyte was positively identified; the quantitation is an estimation.

N - Nontarget analyte: The analyte is a tentatively identified compound (using mass spectroscopy).

NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte.

R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

B - Blank contamination: The analyte was detected above the reporting limit in an associated blank.

Q - One or more quality control criteria failed. Data usability should be carefully assessed by the project team.

Note: The Q footnote is a DoD footnote only.

QUALITY ASSURANCE MANUAL
VOLUME I

Section 17

List of Acronyms and Abbreviations

17.0 LIST OF ACRONYMS AND ABBREVIATIONS

A

AAI	Alpha Analytical, Inc.
ACS	American Chemical Society
ALS	Automatic liquid sampler
A2LA	American Association for Laboratory Accreditation
APHA	American Public Health Association
ASCII	American Standard Code Information Interchange
ASE	Accelerated solvent extraction
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association

B

BFB	4-bromofluorobenzene
BLK	Blank
BN	Base/neutral
BNA	Base/neutral acid
BOD	Biological oxygen demand
BTEX	Benzene, toluene, ethyl benzene, xylene

C

C	Concentration
CAS	Chemical Abstract Service
CCC	Calibration check compounds
CV	Calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Calibration factor
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COD	Chemical oxygen demand

D

DAD	Diode-array detector
DCBP	Decachlorobiphenyl
DCO	Document control officer
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene

DDT	Dichlorodiphenyltrichloroethane
DFTPP	decafluorotriphenylphosphine
DHS	Department of Health Services
DI	De-ionized
DOC	Demonstration of Capability
DoD	Department of Defense
DQO	Data quality objective
DRO	Diesel range organics

E

EC	Electrolytic conductivity
ECD	Electron capture detector
EDB	Ethylene dibromide
EDD	Electronic diskette deliverables
EDL	Estimated detection limit
EICP	Extracted ion current profile
EMSL	Environmental Monitoring Support Laboratory
EPA	Environmental Protection Agency
EQL	Estimated quantitation limits
ERM	Environmental Resource Management

F

FID	Flame ionization detector
FRB	Field reagent blank
FSP	Field sampling plan
FTB	Field transfer blank

G

G	Glass
GC	Gas chromatography
GC/MS	Gas chromatography/mass spectroscopy
GLP	Good laboratory practice
GRO	Gasoline range organics
GS	Gas spike

H

HCl	Hydrochloric acid
HDPE	High density polyethylene
HNO_3	Nitric acid
HP	Hewlett Packard

HPLC	High-performance liquid chromatography
H_2SO_4	Sulfuric acid

I

IB	Instrument blank
IC	Inorganic carbon
ICL	Inner control limit
ICP	Inductively coupled plasma
ICP/MS	Inductively coupled plasma-mass spectrometer
ICS	Interference check standard
ICV	Initial calibration verification
ID	Identification
IDC	Initial demonstration of capabilities
IOC	Inorganic compounds
IPC	Instrument performance check
IS	Internal standard

K

K-D	Kuderna-Danish

L

LC	Liquid chromatography
LCL	Lower control limit
LCS	Laboratory control sample
LFB	Laboratory fortified blank
LFM	Laboratory fortified matrix
LIMS	Laboratory information management systems
LPC	Laboratory performance check sample
LRB	Laboratory reagent blank
LSC	Liquid sample concentrator
LUFT	Leaking underground fuel tanks

M

MB	Method blank
MBAS	Methylene blue active substances
MDL	Method detection limit
MeOH	Methanol
$MeCl_2$	Methylene chloride
MRL	Method reporting limit
MS	Matrix spike

MSD	Matrix spike duplicate
MSD	Mass selective detector
MTBE	methyl-tert-butyl ether

N

N	Normal
N_2	Nitrogen
NA	Not applicable
NaCl	Sodium chloride
NaOH	Sodium hydroxide
$Na_2S_2O_3$	Sodium thiosulfate
Na_2SO_3	Sodium thiosulfite
Na_2SO_4	Sodium sulfate
NBS	National Bureau of Standards
ND	Not detected
NEDTS	Navy Environmental Data Transfer Standard
NEIC	National Enforcement Investigations Center
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NDEP	Nevada Department of Environmental Protection
NH_4Cl	Ammonium chloride
NIH	National Institute of Health
NIOSHA	National Institute of Occupational Safety and Health Administration
NIST	National Institute of Standards and Technology
NPD	Nitrogen phosphorus detector
NPDES	National Pollution Discharge Elimination System
NPOC	Non-purgeable organic carbon
NVLAP	Nevada Laboratory Accreditation Program

O

OJT	On-the-job training
ORO	Oil range organics
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste Environmental Regulations

P

P	Polyethylene
PAH	Polynuclear aromatic hydrocarbon
PARCC	Precision, accuracy, representativeness, comparability, and completeness

PCB	Polychlorinated biphenyl
PE	Performance evaluation
PFE	Pressurized fluid extraction
PHP	Potassium hydrogen phthalate
PI	Principle investigator
PID	Photo ionization detector
POC	Point of contact; purgeable organic carbon
ppb	Parts per billion
ppm	Parts per million
PQL	Practical quantitation limit
PSI	Pounds per square inch
PT	Proficiency testing
PTOB	Proficiency testing oversight body
PTPA	Proficiency testing provider accreditor

Q

QA	Quality assurance
QAMS	Quality assurance management system
QAP	Quality assurance plan
QAPP	Quality assurance project plan
QAO	Quality assurance officer
QC	Quality control
QCS	Quality control sample

R

R	Recovery
RAAS	Robotic arm automatic sampler
RCRA	Resource Conservation and Recovery Act
RF	Response factor
RIC	Reconstructed ion chromatograph
RL	Reporting limit
RPD	Relative percent difference
RRF	Relative response factor
RRT	Relative retention time
RSD	Relative standard deviation
RT	Retention time

S

S	Soil
SARA	Superfund Amendments and Reauthorization Act
SB	Storage blank

SCO	Sample custody officer
SD	Standard deviation
SDWA	Safe Drinking Water Act
SLC	Software life cycle
SOP	Standard operating procedure
SOW	Statement of work
SPCC	System performance check compound
SPE	Solid phase extraction
SPLP	Synthetic precipitation leaching procedure
SQAP	Software quality assurance plan
SRS	Self regenerating suppressor
STD	Standard Deviation
STP	Sample tracking plan
SVOC	Semivolatile organic compound

T

TAT	Turn-around time
TB	Trip blank
TCL	Target compound list
TCLP	Toxicity characteristic leaching procedure
TCMX	Tetrachloro-meta-xylene
TDS	Total dissolved solids
THMs	Trihalomethanes
TIC	Tentatively identified compound
TOC	Total organic compounds
TPH	Total petroleum hydrocarbon
TS	Total solids
TSS	Total suspended solids

U

UCL	Upper control limit
USEPA	United States Environmental Protection Agency
UV	Ultraviolet

V

V	Volume
VOA	Volatile organic analysis
VOC	Volatile organic compound
VOST	Volatile organic sampling train

W

W	Water
WET	Waste extraction test
WP	Water Pollution Study
WPCF	Water Pollution Control Federation
WS	Water Supply Study

Z

ZHE	Zero headspace extraction

17.1 SYMBOLS

°C	degrees Celsius
g	gram
Kg	kilogram
L	liter
µg	microgram
µl	microliter
mg	milligram
ml	milliliter
mm	millimeter
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
ng	nanogram
nm	nanometer
oz	ounce
µg/Kg	micrograms per kilogram
µg/L	micrograms per liter

QUALITY ASSURANCE MANUAL
VOLUME I

Section 18

Glossary of Terms

18.0 GLOSSARY OF TERMS

The following definitions are used in the text of the NELAP Quality System and Alpha's Quality Assurance Manual.

Acceptance Criteria - Specified limits placed on characteristics of an item, process, or service defined in required documents.

Accreditation - The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one.

Accuracy - the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) ans systematic error (bias) components which are due to sampling and analytical operations.

Aliquot - a discrete, measured, representative portion of a sample taken for analysis.

Analyst - the designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying the required laboratory practices and other pertinent quality controls to meet the required level of quality.

Analyte - a chemical component for which analysis is conducted.

Analytical Method - a set of written instructions completely defining the procedure to be adopted by the analyst in order to obtain an analytical result.

Audit - a systematic check to determine the quality of operation of some function or activity. Audits may be of two basic types; 1) performance/internal audits in which quantitative data are independently obtained for comparison with routinely obtained data in a measurement system; or 2) system/external audits of a qualitative nature that consist of an on-site review of a laboratory's quality assurance system and physical facilities for sampling, calibration and measurement.

Autozero - zeroing the instrument (typically a spectrophotometer for inorganic analysis) at the proper wavelength. It is equivalent to running a standard blank with the absorbance set at zero.

Bar Graph Spectrum - a plot of the mass-to-charge ratio (m/e) versus relative intensity of the ion current.

Batch - environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lots of reagents. A **preparation batch** is composed

of one to 20 environmental samples of the sample matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Blank - a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurment process to establish a zero baseline or background value and is sometimes used to adjust or correct routing analytical results.

Blind Sample - a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

4-Bromofluorobenzene (BFB) - the compound chosen to establish mass spectral instrument performance for volatile analyses.

Calibration - a set of operations that establish the relationship between values of quantities indicated by a measuring instrument or measuring system and the corresponding values realized by standards.

Calibration Curve - the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument responses.

Calibration Standard - a substance or reference material used to calibrate an instrument.
Certification - approval by a certifying agency to use an analytical method for analysis of specific analytes following submission of a performance data package.

Certified Reference Material (CRM) - a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body.

Chain of Custody - a record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; preservation; and requested analyses.

Comparability - confidence with which one data set can be compared to another.

Confirmation - verification of the identity of a component through the use of an approach with a different scientific principle from the original method.

Conformance - an affirmative indication or judgment that a product or service has met the

requirements or the relevant specifications, contract, or regulation; also the state of meeting the requirements.

Control Samples - samples introduced into the train of environmental samples as monitors of the performance of the analytical method.

Corrective Action - the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.

Data Audit - a qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Data Quality - totality of features and characteristics of a data set that bears on its ability to satisfy a given purpose.

Data Reduction - the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc. and collation into a more useable form.

Data Validation - a systematic process for reviewing a body of data against a set of criteria to provide assurance that the data are adequate for their intended use. Data validation consists of data editing, screening, checking, auditing, verification, certification, and review.

Decafluorotriphenylphosphine (DFTPP) - a compound chosen to establish mass spectral tuning performance for semi-volatile analysis.

Demonstration of Capability - a procedure to establish the ability of the analyst to generate acceptable accuracy.

Detection Limit - the lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

Document Control - the act of ensuring that documents are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Dry Weight - the weight of a sample based on percent solids. The weight after drying in an oven.

Duplicate - a second aliquot of a sample that is treated the same as the original sample in order to determine the precision of the method.

Equipment Blank - usually an organic or aqueous solution that is free of analytes and is transported to the sampling site, opened in the field, and poured over or through the sample collection device, collected in a sample container, and returned to the laboratory. This serves as a check on sampling device cleanliness.

Extractable - a compound that can be partitioned into an organic solvent from the sample matrix and is amenable to gas chromatography. Extractables include BNA, pesticide and PCB compounds.

Field Blank - a sample to which no analytes of interest have been added. It is transported to the sampling site and back to ensure that no contamination is introduced during shipment. This sample may be opened near the sampling location to determine if air-borne contaminants are contributing to the sample contaminations.

Field Duplicate - two samples, collected at the sample site, that are treated exactly the same throughout field and laboratory procedures. Analysis of field duplicates provides a measure of the precision associated with sample collection, preservation and storage, as well as with laboratory procedures.

Finding - an assessment conclusion, referenced to a regulatory standard and supported by objective evidence that identifies a deviation from that regulatory requirement.

Heavy Metals - metallic elements with high atomic weights, such as mercury, chromium, cadmium, arsenic, and lead. They can damage living things at low concentrations and tend to accumulate in the food chain.

Holding Time - the maximum times that samples may be held prior to analysis and still be considered valid or not compromise. The time elapsed from the time of sampling to the time of extraction or analysis as appropriate.

Hydrocarbons - any of a series of chemical compounds that consist entirely of carbon and hydrogen.

Initial Calibration - the analysis of analytical standards for a series of different specified concentrations; used to define the linearity and dynamic range of the response of the instrument to the target compounds.

Inspection - an activity such as measuring, examining, testing or guaging one or more characteristics of an entity comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic.

Instrument Blank - a clean sample processed through the instrumental steps of the measurement process; used to determine instrument contamination.

Instrument Performance Check - a solution of method analytes, used to evaluate the performance of the instrument system with respect to a defined set of method criteria.

Interferents - substances which affect the analysis for the analyte of interest.

Internal Standards - a known amount of standard added to a test portion of a samples as a reference for evaluating and controlling the precision and bias fo the applied analytical method.

Laboratory Control Sample (LCS) - a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyte-specific precision and bias or to assess the performance of all or a portion of the measurement system.

Laboratory Duplicate - aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently.

Laboratory Fortified Blank (LFB) - an aliquot of laboratory reagent water to which known quantities of the method analytes are added in the laboratory. The LFB is analyzed exactly like a sample, and its purpose is to determine whether the method is in control and whether the laboratory is capable of making accurate and precise measurements.

Laboratory Fortified Matrix (LFM) - a sample prepared by adding a known mass of target analyte to a specified amount of the matrix sample for which an independent estimate of target analyte concentration is available. LFM spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Limit of Detection (LOD) - an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte and matrix specific and may be laboratory dependent.

Limit of Quantitation (LOQ) - the minimum levels, concentrations, or quantities of a target analyte that can be reported with a specified degree of confidence.

Linear Dynamic Range - (Inorganic Analysis) the concentration range over which the ICP or IC analytical curve remains linear.

Matrix - the predominant material of which the sample to be analyzed is composed. For most purposes, a sample matrix is either water or soil/sediment.

Matrix Spike - a sample prepared by adding a known mass of target analyte to a specified amount of the matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate - a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of precision of the recovery for each analyte.

Method Blank - a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit (MDL) - one way to establish a limit of detection, defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDL is statistically determined from analysis of samples in a given matrix containing the analyte at a predefined low concentration level.

National Environmental Laboratory Accreditation Conference (NELAC) - a voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP.

National Environmental Laboratory Accreditation Program (NELAP) - the overall National Environmental Laboratory Accreditation Program of which NELAC is a part.

Negative Control - measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Nonconformance - an indication or judgement that a product or service has not met the requirements of the relevant specifications, contract or regulation; also the state of failing to the requirements.

Outlier - an extreme observation that is shown to have a low probability of belonging to a data population.

Percent Difference (%D) - an arithmetic calculation to compare two values. The percent difference indicates both the direction and the magnitude of the comparisons, i.e., the percent difference may be either negative, positive, or zero.

Percent Moisture - an approximation of the amount of water in a soil/sediment sample obtained by drying an aliquot of the sample at 105°C. The percent moisture determined in this manner also includes contributions from all compounds that may volatilize at 105°C, in addition to water.

Percent Solids - the proportion of the solid in a soil sample determined by drying an aliquot of the sample.

Performance Audit - the routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Performance Evaluation (PE) Sample - a sample of known composition provided by a third party (unknown composition by the laboratory) used to evaluate laboratory performance.

Positive Control - measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision - the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preservation - refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

Proficiency Testing - a means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

Proficiency Testing Oversight Body/Proficiency Testing Provider Accreditor (PTOB/PTPA) - an organization with technical expertise, administrative capability and financial resources sufficient to implement and operate a national program of PT provider evaluation and oversight that meets the responsibilities and requirements established by NELAC standards.

Proficiency Testing Program - the aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories.

Proficiency Testing Study Provider - any person, private party, or government entity that meets stringent criteria to produce and distribute NELAC PT samples, evaluate study results against published performance criteria and report the results to the laboratories, primary accrediting authorities, PTOB/PTPA and NELAP.

Proficiency Test Sample (PT) - a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.

Protocol - a detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) which must be strictly followed.

Purge and Trap (device) - an analytical technique (device) used to isolate volatile organics by stripping the compounds from water or soil by a stream of inert gas, trapping the compounds on a porous polymer trap, and thermally desorbing the trapped compounds onto the gas chromatographic column.

Quality Assurance (QA) - an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Assurance Project Plan (QAPP) - a formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.

Quality Control (QC) - the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

Quality Control Sample - a sample used to assess the performance of all or a portion of the measurement system. QC samples may be Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking.

Quality Manual - a document stating the management policies, objectives principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality System - a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products, and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying our required QA and QC.

Random Error - the deviation in any step in an analytical procedure that can be explained by standard statistical techniques.

Raw Data - any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study.

Reagent Blank (method reagent blank) - a sample consisting of reagents, without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all the subsequent steps to determine the contribution of the reagents and of the involved analytical steps.

Reagent Water - water in which an interferant is not observed at or above the minimum reporting limit for the parameters of interest.

Reconstructed Ion Chromatogram (RIC) - a mass spectral graphical representation of the separation achieved by a gas chromatograph; a plot of total ion current versus retention time.

Recovery - a determination of the accuracy of the analytical procedure made by comparing measured values for a fortified sample against the known spike values.

Reference Material - a material or substance one or more properties of which are sufficiently will established to be used for calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Reference Standard - a standard, generally of the highest quality available at a given location, from which measurements made at that location are derived.

Relative Percent Difference (RPD) - an analytical technique used to compare two values. The relative percent difference is based on the mean of the two values, and is reported as a relative value.

Replicate Analyses - the measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval.

Resolution - the separation between peaks on a chromatogram, calculated by dividing the height of the valley between the peaks by the average peak height of the two peaks being resolved, multiplied by 100.

Retention Time Window - usually defined as three times the standard deviation of the absolute or relative RT of an analyte, positioned around a defined absolute retention time.

Sample - a portion of material to be analyzed that is contained in single or multiple containers and identified by a unique sample number.

Sample Number - (AAI Sample Number) - a unique identification number designated by Alpha for each sample. The sample number appears on the final report which documents information on that sample.

Selectivity - the capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances.

Semi-volatile Compounds - compounds amenable to analysis by extraction of the sample with an organic solvent. Used synonymously with Base/Neutral/Acid (BNA) compounds.

Sensitivity - the capability of a method or instrument to discriminate between measurement

responses representing different concentrations of a variable of interest.

Serial Dilution - the dilution of a sample when corrected by the dilution factor, the diluted sample must agree with the original undiluted sample within specified limits.

Significant Figures - the number of digits used to express a result in scientific notation. All digits are expected to be known definitely, except the last digit, which may be in doubt.

Spike - a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard - the document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies.

Standard Deviation - the positive square root of the expected value of the square of the difference between a random variable and its mean.

Standard Method - a test method issued by an organization generally recognized as competent to do so.

Standard Operating Procedure (SOP) - a written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

Standard Reference Material (SRM) - a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method.

Supervisor - the individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses.

Surrogate - a substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them for quality control purposes.

System Monitoring Compounds - compounds added to every blank, sample, matrix spike, matrix spike duplicate, and standard for volatile analysis and used to evaluate the performance of the entire purge and trap, gas chromatograph/ mass spectrometer system. These compounds are brominated or deuterated compounds not expected to be detected in environmental media.

Target Analyte - specific analytes reported for every sample analyzed by a given method.

Target Concentration - known spiked concentration.

Technical Director - individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory.

Tentatively Identified Compounds (TIC) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds, or surrogates. These peaks are subjected to mass spectral library searches for tentative identification.

Test Method - an adoption of a scientific technique for performing a specific measurement as documented in a laboratory SOP or as published by a recognized authority.

Traceability - the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.

Tune - an injected standard required by the method as a check on instrument performance for mass spectrometry.

Twelve-hour Time Period - the twelve (12) hour time period for GC/MS system tuning and standard calibrations which begins at the moment of injection of the DFTPP or BFB. The time period ends after 12 hours has elapsed according to the system clock.

Validation - the confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

Verification - confirmation by examination and provision of evidence that specified requirements have been met.

Volatile Compounds - compounds amenable to analysis by the purge and trap technique. Used synonymously with purgeable compounds.

Work Cell - a well-defined group of analysts that together perform the method of analysis. The members of the group and their specific functions within the work cell must be fully documented.

Appendix A

Personnel

1.0 Personnel

1.1 General Requirements for Laboratory Staff

1.1.1 Technical staff positions are filled with personnel that fulfill the necessary requirements of education, training, technical knowledge, and experience for their assigned functions. This includes a general knowledge of laboratory operations, test methods, quality assurance/quality control procedures and records management.

1.1.2 In accordance with our training policies and procedures, Alpha maintains documentation that certifies technical personnel have the appropriate educational and/or technical background to perform all accredited test procedures.

1.2 Staffing Policies

1.2.1 It is Alpha's policy to have a laboratory organized with sufficient managerial staff with the authority and resources needed to discharge their duties.

1.2.2 It is Alpha's policy to hire personnel which have appropriate education and/or On-the-Job-Training (OJT) adequate to perform their job duties.

1.2.3 It is Alpha's policy to conduct a training program that includes initial and continuing training of laboratory personnel.

1.2.4 It is Alpha's policy to ensure the competence of technical staff personnel who operate analytical equipment, evaluate results, and sign test reports.

1.3 Personnel Responsibilities

1.3.1 It is the responsibility of the trainee to ensure they have received adequate initial and continuing training and the documentation of that training to achieve and maintain skills commensurate with their responsibilities.

1.3.2 It is the responsibility of all staff personnel to comply with all quality assurance/quality control requirements that pertain to their technical function in the laboratory.

2.0 Personnel Qualifications

2.1 Technical Director

2.1.1 Definition

The technical director means a full-time member of staff who exercises actual day-to-day supervision of the laboratory operations for the associated fields of accreditation and reporting of results.

2.1.2 Working Status

Technical directors who are absent for a period of time exceeding 15 consecutive calendar days must designate another full-time staff member meeting the qualifications of the technical director to temporarily perform this function.

If this absence exceeds 65 consecutive calendar days, the primary accrediting authority is notified in writing.

2.1.3 Titles

The title of such person(s) may include but is not limited to:

a) Laboratory Director;
b) Technical Director;
c) Laboratory Supervisor
d) Laboratory Manager; and
e) Quality Assurance Officer.

2.1.4 Duties

Technical director(s) minimum duties include:

a) monitoring standards of performance in QA/QC;
b) monitoring the validity of the analyses performed; and
c) monitoring the data generated to assure reliable data.

2.1.5 Qualifications of Technical Directors

2.1.5.1 Laboratory Director

The Laboratory Director must have a bachelors degree in chemical, environmental, biological sciences, physical sciences or engineering, with at least 24 college semester credit hours in chemistry and at least 2 years of experience in environmental analysis.

A masters or doctoral degree may be substituted for 1 year of experience or a BS degree in a science or science related field plus 10 years of analytical experience may be substituted for the chemistry credit requirement.

2.1.5.2 Laboratory Manager

The Laboratory Manager must have a bachelors degree in chemical, environmental, biological sciences, physical sciences or engineering and at least one year of experience in environmental analysis. The Laboratory Manager must have a working knowledge of quality assurance principals.

2.1.5.3 Qualifications of Quality Assurance Officer

The Quality Assurance Officer must have a bachelors degree in chemical, environmental, biological sciences, physical sciences or engineering with at least 24 college semester credit hours in chemistry and at least 2 years experience in environmental analysis.

A masters or doctoral degree may be substituted for 1 year of experience or a BS degree in a science or science related field plus 10 years of analytical experience may be substituted for the chemistry credit requirement.

2.3 Qualifications of Technical Staff

2.3.1 It is the responsibility of Alpha's management to formulate the goals with respect to education, training and skills of the technical and non-technical staff members.

2.3.2 Alpha's training program specifies the training policies and procedures for identifying the training needs and providing training of personnel. The qualification of all staff members is a combination of education, experience and training and are critical element in maintaining the qualifications of our staff.

2.3.3 Laboratory Analyst

The Laboratory Analyst must have a bachelors degree in science or a science related field and at least 1 year of experience in environmental analysis. If the analyst is responsible for the operation of analytical instrumentation, they must complete specialized training offered by the manufacturer or another qualified training facility or served a minimum of a six month apprenticeship under an experienced analyst.

2.3.4 Laboratory Technicians

The Laboratory Technician must have at least a high school diploma or equivalent, completed the in-house training program under an experienced

analyst/technician and must have served a minimum of a six month apprenticeship under an experienced analyst/technician.

2.3.5 Laboratory Apprentice

The Laboratory Apprentice is a laboratory analyst or technician who has not fulfilled either the educational or experience requirements and is performing the job duties of one of those positions. The apprenticeship requirements are judged on a case-by-case basis. However, all employees performing job duties as an Apprentice are required to be under the direct tutelage of a senior Analyst or Technician who reviews all data or work produced until such time that the educational and experience requirements can be met.

Appendix B

Field Sampling Plan

Appendix B

Standard Operating Procedure

SOP B.1
Field Sampling Plan

1.0 FIELD SAMPLING PLAN (FSP)

1.1 Alpha is not generally responsible for sample collection. For most sites, specific work plans or Quality Assurance Project Plans (QAPPs) and SOP's are developed and designed for each unique site. However, when Alpha does collect samples for analysis, it follows the procedures outlined in this section, the Field Sampling Plan.

1.2 The FSP has been written to assure uniformity and consistency of the sampling procedures. The FSP should be implemented at the sampling site when no other field sampling plan has been developed by the field engineers. These procedures should be performed during all phases of the sampling plan.

1.3 The objective of the FSP is to discuss subjects and sampling protocols that need to be controlled in the field to ensure the validity of the test results. Generalized field procedures used in the FSP are described by SOP's to be followed while performing field work.

1.4 The scope of the FSP includes descriptions of sampling documentation, sampling procedures, decontamination procedures and field QC procedures. Discussions of data quality objectives, laboratory quality control, sample labeling, shipment and custody records, and quality assurance oversight are provided in the Quality Assurance Manual.

1.5 Management Review of Potential New Work

1.5.1 Before sampling is performed at any site, the Project Manager should meet with a representative of Alpha Analytical to establish the sampling methodology to be employed, and the tests which will be performed on the samples. A sample collection plan should be determined, areas of responsibility delineated and a logistical plan developed.

1.5.2 After the planning meeting, the appropriate laboratory personnel are alerted of the need for specific laboratory analyses. Laboratory personnel are then provided with the information required to satisfy all specifications outlined in the Statement of Work (SOW) or QAPP. In addition, the logistical criteria such as sample containers, sample volume, preservatives, transportation and the appropriate numbers and types of QC samples needed is finalized, and finally the laboratory is assessed to ensure we have the appropriate facilities and resources to complete the project.

Appendix B

Standard Operating Procedure

SOP B.2
Field Sampling Documentation

1.0 FIELD SAMPLING DOCUMENTATION

1.1 Sample integrity begins from the time the sample is actually taken. Typically, a bound logbook is used to record all pertinent information regarding the sampling trip to ensure proper and complete documentation.

2.0 STANDARD OPERATING PROCEDURE

2.1 The logbook must contain information to distinguish samples and sample locations from any other. Entries into the logbook should include the following:

- Client/Project name for which the sampling is being conducted,
- Matrix sampled (i.e. groundwater, soil, etc.),
- Specific sampling location in sufficient detail to allow re-sampling at the same location,
- Sampling date and time,
- Sample depth,
- Method of sampling,
- Volume of water removed during well purge,
- Sample type taken (e.g., duplicate, split or field blank),
- Analytes of interest,
- Preservation techniques,
- Field Sample ID,
- Significant observations made during the sampling process,
- Field measurements taken,
- Decontamination procedures; and,
- Printed name and signature of the person performing the sampling.

2.2 Sampling situations vary widely and no general rules can specify the extent of information that must be entered in a logbook or standardized form. However, records should contain sufficient information so that someone can reconstruct the sampling activity without relying on the collector's memory.

Prior to the collection of any samples, the sampling location should be verified using site maps if available. If discrepancies are noted, sampling locations should be verified with the Project Coordinator before sampling.

Appendix B

Standard Operating Procedure

SOP B.3
Quality Control Field Samples

1.0 QUALITY CONTROL FIELD SAMPLES

1.1 The following quality control samples should be collected to ensure the reliability and integrity of field and analytical data for water and soil samples.

2.0 STANDARD OPERATING PROCEDURE

Section 11 of the QA plan addresses both laboratory and field QC samples to include purpose, frequency, preparation procedures, acceptance criteria, and corrective actions.

2.1 Water QC Samples

Table B.3-1 lists the number and types of aqueous field QC samples that should be collected for each sampling event.

2.1.1 The same type of QC samples should be collected for groundwater and surface water samples. Field duplicates and three types of quality control blanks are typically used (trip blanks, field blanks and equipment blanks).

2.1.2 Trip Blanks are typically only prepared when VOC field samples are taken and consist of a sample bottle filled with organic free water. Trip blanks are prepared in the laboratory and sent out in the field. Trip blanks are transported to the site in the same ice chest used in the field and transported back to Alpha along with samples obtained in the field.

2.1.3 Equipment/Rinsate Blanks are used to ensure non-dedicated sampling devices (bailers, filtering equipment, pumps, etc.) have been effectively decontaminated. Field equipment are rinsed with reagent free water, collected and transferred to a sample bottle for future analysis.

2.1.4 Field blanks consist of reagent free water placed in a sample container at the laboratory and treated as a sample in all respects, including exposure to sampling site conditions, storage, preservation and all analytical activities. The purpose of the field blank is to determine if method analytes or other interferences are present in the field environment.

2.1.5 Duplicates should be collected and analyzed on a ten percent basis. The relative percent difference between duplicate measurements should provide an estimate of sampling precision.

2.1.6 Matrix spike/matrix spike duplicates are the only samples which requires additional sample volume. When determining sampling logistics make sure this is taken into consideration.

TABLE B.3 - 1
SUMMARY OF QUALITY CONTROL SAMPLES

	Field QC	
Sample Type	**Target Frequency %**	**Comment**
Trip Blank		1 per cooler for VOC's / Analyze as needed
Equipment/Rinsate Blanks	10%	1 per analysis per day / analyze as needed
Field Blanks		1 per source per event analyzed for VOC's as needed
Field Duplicates	10%	ensure adequate volume
	Laboratory QC	
Sample Type	**Target Frequency %**	**Comment**
Duplicate	5%	1 per analytical method
Blank		1 per analytical or extraction batch
Matrix Spike/Matrix Spike Duplicate	5%	1 per analytical method
Surrogate Spike	Method Specific	Method Specific
Laboratory Control Spike	5%	1 per analytical or extraction batch

2.2 Soil/Solid QC Samples

Table B.3-2 lists the number and types of soil field QC samples that should be collected for each sampling event.

2.2.1 Trip Blanks should be sent with each cooler when volatile organic analysis is required. The trip blanks should be analyzed for volatile organics only.

2.2.2 Equipment/Rinsate Blanks should be used to ensure non-dedicated sampling equipment has been effectively decontaminated. Samples should be collected each day soil sampling is conducted. Only a representative number should be analyzed. Additional blanks may be analyzed if a problem is perceived.

2.2.3 Field Duplicates should be collected at a frequency of ten percent of the total number of soil samples collected. Field duplicates are collected and analyzed to determine the precision of field sampling.

TABLE B.3 - 2
SUMMARY OF QUALITY CONTROL SAMPLES

	Field QC	
Sample Type	**Target Frequency %**	**Comment**
Trip Blank		1 per cooler for VOC's / Analyze as needed
Equipment/Rinsate Blanks	10%	1 per analysis per day / analyze as needed
Field Duplicates	10%	ensure adequate volume
	Laboratory QC	
Sample Type	**Target Frequency %**	**Comment**
Duplicate	5%	1 per analytical method
Blank		1 per analytical or extraction batch
Matrix Spike/Matrix Spike Duplicate	5%	1 per analytical method
Surrogate Spike	Method Specific	Method Specific
Laboratory Control Spike	5%	1 per analytical or extraction batch

Appendix B

Standard Operating Procedure

SOP B.4
Volatile Sampling Technique - 524.2

1.0 VOLATILE SAMPLING TECHNIQUES - 524.2

1.1 This sampling procedure is written specifically for those samples requiring analysis by method 524.2 under the Safe Drinking Water Act.

1.2 Reference

Methods for the Determination of Organic Compounds in Drinking Water, USEPA, EMSL, Cincinnati OH, Supplement III; EPA-600/R-95/131, Method 524.2, Revision 4.1, 1995.

2.0 STANDARD OPERATING PROCEDURE

2.1 Collect samples in triplicate using 40mL clear VOA vials. If samples are suspected to contain residual chlorine add approximately 25mg of ascorbic acid per 40ml of sample to the sample bottle before filling, (pre-preserved in the laboratory).

2.2 Adjust the pH of all samples to < 2 at the time of collection (field preserve), but after dechlorination, by carefully adding two drops of 1:1 HCL for each 40mL VOA vial. Seal the sample vial and mix for 1 minute. Do not mix the ascorbic acid with HCL in the sample bottle prior to sampling.

2.3 When sampling for Trihalomethanes (THM's) analysis only, acidification may be omitted if sodium thiosulfate (3mg per 40ml sample) is used to dechlorinate the sample. This exception to acidification does not apply if ascorbic acid is used for dechlorination.

2.4 If a sample foams vigorously when HCL is added, discard the sample. Collect a set of samples but do not acidify them. These samples must be flagged as "not acidified" and must be stored at 4°C. These samples must be analyzed within 24 hours of collection time if they are to be analyzed for any compounds other than THM's.

2.5 Place the septum, teflon side down, on the sample, and screw on the cap without dislodging the septa.

2.6 Invert the sample and lightly tap the lid to ensure the absence of entrapped air bubbles. If air bubbles are trapped in the vial, add additional sample until sample container is free of air bubbles.

2.7 As each VOA vial is filled, enter the sample information on the label and pack the vial in the shipping container at 4 degrees C. Samples must be refrigerated at the time of collection and maintained at that temperature, analyze within 14 days of collection. Samples not received at the laboratory on the day of collection must be packaged for shipment with sufficient ice to ensure they will be at 4°C on arrival at the laboratory.

Table B.4 - 1
Sample Preservation and Holding time Table
Method 524.2

Description	Sample Volume	Dechlorination	Sample Preservation	Analysis Holding time
Full List Compounds	3 x 40mL	25mg ascorbic acid per 40mL sample	pH<2, 2 drops 1:1 HCL Field preserved cool 4°C	14 days
Full list, sample foams when HCL is added (carbonaceous waters)	3 x 40mL	25mg ascorbic acid per 40mL sample	No acid	Analyze within 24 hours
THM's only	3 x 40mL	25mg ascorbic acid per 40mL VOA vial	pH<2, 2 drops 1:1 HCL Field preserved cool 4°C	14 days
THM's only	3 x 40mL	Sodium Thiosulfate 3mg/40mL sample	No acid	14 days
THM's only, sample foams when HCL is added, (carbonaceous waters)	3 x 40mL	Sodium Thiosulfate 3mg/40mL sample	No acid	14 days

2.8 Never allow the sample to freeze during transportation. If samples are refrigerated with ice, pack the vials to ensure contact between the ice and sample vials are minimized to avoid potential freezing.

2.9 Never filter VOC samples.

2.10 Never sample for volatile organics near a running motor or any type of exhaust system because discharged fumes and vapors may contaminate the sample.

2.11 VOC samples may also be contaminated by diffusion of volatile organics through the septa during shipment and storage. To monitor possible contamination, a trip blank prepared from reagent grade water, is carried throughout the sampling storage, shipping and analytical process. Additional QC samples may be collected (i.e., field blanks, rinse blanks, field duplicates, etc.), but should be considered on a case-by-case basis.

2.12 When sampling from a water tap, open the tap and allow the system to flush until the water temperature has stabilized usually about 5 to 10 minutes. Adjust the flow to about 500 ml/min and collect the samples from the flowing stream.

2.13 When sampling from an open body of water, fill a wide mouth bottle or a beaker with sample from a representative area, and carefully fill sample bottles from the container.

Appendix B

Standard Operating Procedure

SOP B.5
Volatile Sampling Technique - 624/8260

1.0 VOLATILE SAMPLING TECHNIQUE-WATER (624/8260B)

1.1 There are several requirements common to most VOC sampling events. Overall care must be taken in regard to equipment and, container handling, storage, decontamination, and record keeping.

1.2 Reference

1.2.1 Method 624: Purgeables, Federal Register 43250, Volume 49, NO.209, October 26, 1984 as updated in 40CFR Part 136, Appendix A.

1.2.2 Method 8260B: Volatile Organic Compounds by GC/MS, Revision 2, December 1996, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Final Update III, 1996.

2.0 STANDARD OPERATING PROCEDURE

2.1 Sample Collection

Samples must be collected in glass containers with zero head-space. At a minimum, aqueous samples should be collected in 40 mL (nominally 43 mL) VOA vials in triplicate. While sampling, completely fill sample vials full such that they form a meniscus at the top of the vial taking care not to flush out the preserving agents.

2.1.1 Sample vials should not contain any bubbles exceeding 5 - 6mm (pea sized) as they may cause significant degassing and loss of volatiles.

2.1.2 Place the septa, teflon side down, on the sample, and screw on the cap with out dislodging the septa.

2.1.3 Invert the sample and lightly tap the lid to ensure the absence of entrapped air bubbles. If air bubbles are trapped in the vial, add additional sample until sample plus the duplicate vials are free of air bubbles.

2.1.4 Never filter VOC samples.

2.1.5 Never sample for volatiles near a running motor or any type of exhaust system because discharged fumes and vapors may contaminate the sample.

2.1.6 VOC samples may be contaminated by diffusion of volatiles through the septa during shipment and storage. To monitor possible contamination, a trip blank is carried throughout the sampling, storage, shipping and analytical process. Additional QC samples may be collected (i.e., field blanks, rinse blanks, field duplicates, etc.), and should be considered on a case-by-case basis.

2.1.7 When sampling from a water tap, open the tap and allow the system to flush until the water temperature has stabilized usually about 5 to 10 minutes). Adjust the flow to about 500 ml/min and collect the samples from the flowing stream.

2.1.8 When sampling from an open body of water, fill a wide mouth bottle or a beaker with sample from a representative area, and carefully fill sample bottles from the container.

2.1.9 If protective gloves are used, they should be clean, new, disposable, and nitrile. Gloves should be changed between sampling events to prevent the possibility of cross-contamination. Care should be taken to prevent the sample from touching the gloves while filling the containers or touching the inside of the container with the gloves.

2.2 Sample Dechlorination

If samples contain residual chlorine they must be dechlorinated with sodium thiosulfate prior to sample acidification.

2.2.1 Method 624 suggests 10 mg per 40 mL sample volume is sufficient to dechlorinate a water sample which contains up to 5 mg/L residual chlorine. If a sample contains residual chlorine greater than 5 mg/L, sodium thiousulfate is added proportional to the concentration of residual chlorine.

2.2.2 Method 8260B suggests 0.008% (3.2mg per 40ml) sodium thiosulfate.

2.3 Sample Preservation

Adjust all samples to a pH of < 2, by carefully adding, a suggested volume, of four drops of 1:1 HCl for each 40 mL vial. Seal the vial and mix by inverting the vial several times. Sample vials may be preserved prior to field sampling for ease of use; however, it is incumbent upon the sampler to ensure the proper pH has been achieved.

2.3.1 Method 624 - acidification is only required in sample being analyzed for the aromatic compounds.

3) Clarification: All samples should be preserved with HCl acid regardless of method. Samples not preserved with HCl should be analyzed within 24 hours or footnoted accordingly.

2.4 Sample Storage

2.4.1 Both water and soil samples should be refrigerated at ≤6°C from the time of collection. Samples that will not be received at the laboratory on the day of

collection must be packaged for shipment with sufficient ice to ensure a temperature of ≤6°C will be maintained on arrival at the laboratory.

2.4.2 Never allow the samples to freeze during transportation. If samples are refrigerated with ice, pack the vials to ensure contact between the ice and sample vials are minimized to avoid potential freezing.

2.5 Sample Holding Time

Water samples must be analyzed within fourteen days of sample collection. Soil samples must be extracted and analyzed within fourteen days of sample collection.

Note: See VOC appendix for soil sample variations by method 5035A.

2.5.1 Method 624 - samples which are not being analyzed for aromatic compounds and are non-acidified must be analyzed within 7 days of sample collection.

Sample Collection, Preservation and Holding Time for Volatile Organics
Table B.5-1

Method	Matrix	Sample Collection Container	Volume Sample	Preservation	Holding Time
624	Water	40mL VOA vial, glass with Teflon septa.	3x40mL	pH<2; HCl, Cool ≤ 6°C 10mg per 40mL $Na_2S_2O_3$	14 days to analyze
8260B	Water	40mL VOA vial, glass with Teflon septa.	3x40mL	pH<2; HCl, Cool 4°C 0.008% $Na_2S_2O_3$	14 days to analyze
8260B	Solid	Brass tube or 8oz wide mouth glass container	Brass tube or 8oz glass jar	Cool 4°C	14 days to extract and analyze See note above

Appendix B

Standard Operating Procedure

SOP B.6
Soil Sampling Technique

1.0 SOIL SAMPLING TECHNIQUE

1.1 Soil or sediment samples are typically collected in 8oz/250 ml or 4oz/125mL wide-mouth glass bottles according to the prescribed protocol below.

2.0 STANDARD OPERATING PROCEDURES

2.1 Fill each container, as a grab sample or by using a sampling device, with the soil sample. Avoid aeration of the sample to minimize the loss of volatile organic compounds if VOC methods are to be taken from the same sampling containers.

2.2 As each container is filled, enter the applicable information on the label and pack the bottle in the shipping container at ≤6°C. Samples must be refrigerated at the time of collection and maintained at that temperature until analysis. Samples not received at the laboratory on the day of collection must be packaged for shipment with sufficient ice to ensure a temperature of ≤6°C on arrival at the laboratory.

2.3 Never sample near a running motor or any type of exhaust system because discharged fumes and vapors may contaminate the sample.

2.4 Samples may also be contaminated by the use of non-dedicated sampling equipment such as a scoop or split sampling device. To monitor possible contamination a rinse/equipment blank should be collected each day soil sampling is conducted and analyzed for the compounds of interest.

2.5 If protective gloves are used they should be clean, new, disposable, and nitrile. Gloves should be changed between sampling events to prevent the possibility of cross-contamination. Care must be taken to prevent the sample from touching the gloves while filling the containers or touching the inside of the container with the gloves.

Appendix B

Standard Operating Procedure

SOP B.7
Semi-volatile Water Sampling Technique

1.0 SEMI-VOLATILE SAMPLING TECHNIQUE - WATER

1.1 When sampling water for semi-volatile organic compounds, samples are typically collected in 1 liter amber bottles according to the prescribed protocol below. In addition to the following procedures, overall care must be taken in regard to equipment and container handling, storage, decontamination, and record keeping.

2.0 STANDARD OPERATING PROCEDURE

2.1 Collect all samples in duplicate by slowly filling each container, minimizing the amount of sediment collected, so that the head space is no greater than the threaded portion of the neck.

2.2 Add the appropriate preservatives to the samples as described in the QA manual. It is important the right amounts of preservative be added by checking the pH, residual chlorine etc. for this verification. Cap the bottles with a Teflon lined cap and invert the sample to ensure the preservatives are well dispersed in the sample.

2.3 As each bottle is filled, enter the applicable information on the label and pack the bottle in the shipping container at $\leq 6°C$. Samples should be refrigerated at the time of collection and maintain refrigeration until extraction. Samples not received at the laboratory on the day of collection must be packaged for shipment with sufficient ice to ensure a temperature of $\leq 6°C$ is maintained on arrival at the laboratory.

2.4 Never allow the sample to freeze during transportation. If samples are refrigerated with ice, pack samples such that contact between the ice and sample bottles are minimized to avoid potential freezing.

2.5 Precautions must be taken to limit the contamination of samples from outside sources. Hands should be washed and gloves worn prior to sampling. The order of sampling should be from the least contaminated well to the most contaminated well.

2.6 When sampling from a water tap, open the tap and allow the system to flush until the water temperature has stabilized (usually about 5 to 10 minutes). Adjust the flow to about 500 ml/min and collect the samples from the flowing stream.

2.7 Samples from springs, surface water or other open bodies of water should be collected as grab samples. These samples should be carefully collected to minimize the turbulence and amount of sediment collected with the water samples.

2.8 If protective gloves are used, they should be clean, new, disposable, and nitrile. Gloves should be changed between sampling events to prevent the possibility of cross-contamination. Care must be taken to prevent the sample from touching the gloves while filling the containers or touching the inside of the container with the gloves.

Appendix B

Standard Operating Procedure

SOP B.8
Ground Water Sampling - Monitoring Wells

1.0 GROUNDWATER SAMPLING - MONITORING WELLS

1.1 Monitoring wells are particularly important to understanding the hydrology and remediation efforts at a project site. Well information is used to define the geochemical baseline and it is therefore extremely important to sample each well exactly the same. The following procedures incorporate the necessary aspects of sampling QA and should be used each time a monitoring well is sampled.

2.0 STANDARD OPERATING PROCEDURE

2.1 Whenever feasible, wells not expected to be contaminated should be sampled first, followed by wells with increasing levels of contamination.

2.2 In most wells, a submersible pump, if available, should be used to facilitate purging. The pump is generally powered by a portable generator. The generator must be operated down wind and as far away as possible from the actual sampling location. Actual samples to be submitted for analysis should be taken by a bailer. In low-yield wells, purging and sampling should be conducted by bailing.

2.3 Immediately prior to well purging and sample collection activities, the static water level below the top of the well casing should be measured with an electronic sounder and recorded in the logbook. Water levels should be recorded to the nearest 0.01 foot.

2.4 Measure and record the depth from the top of the casing to the bottom of the sediment/water interface. Subtract the depth to top of the water from the depth to the bottom of the sediment/water interface and determine the height of standing water in the casing.

2.5 Measure the well diameter and determine the water volume using the following equation:

$$\text{well volume} = (\text{pi})\ (r^2)\ (h)$$

Where;

r = radius measured in feet
h = height of water measured in feet
pi = 3.141

Well volume calculated in cubic feet. The conversion of cubic feet to gallons is:

$$1\ ft^3 = 7.48 \text{ gallons}$$

2.6 Prior to sample collection purge three well volumes from the well. Purging and sampling should be performed in a manner that minimize the agitation of sediments in the water column and to reduce the potential of organic chemical volatilization.

2.7 If the well goes dry during purging, it is assured of removing all water which has prolonged well casing or air contact. If the recovery rate is quick, allow the well to recover to its original level before subsequent purging of the well. If water recovery is very slow, samples should be taken when sufficient water is available.

2.8 Samples for volatile organics should be collected first and immediately sealed in 40mL VOA vials with no head space. All samples should be checked for the presence of bubbles that may bias the analytical data. Samples for volatile organics should not be homogenized, composited or filtered.

2.9 All samples should be taken in pre-cleaned containers. Semi-volatile samples should be placed in 1 liter amber glass bottles in duplicate, volatile organic samples should be sampled in three 40 ml VOA vials and metals or inorganic parameters should be sampled in 125 to 1000 ml polyethylene containers. Add the appropriate preservatives and cap the sample containers for storage and transportation to the laboratory.

2.10 Refrigerate all samples in an ice chest at $\leq 6°C$ immediately after sampling and deliver to the laboratory as soon as possible.

2. 11 In addition to the record keeping requirements of the QA plan, the following information should be recorded each time a well is purged and sampled:

- Depth to water before and after purging,
- Well casing volume calculations,
- Condition of each well,
- Apparent thickness of any floatable hydrocarbon layer; and
- Any required field parameter (i.e., pH, EC, temperature).

2.12 All non-dedicated purging and sampling equipment should be decontaminated between wells. In addition, non-dedicated bailers should be rinsed once with well water prior to collecting a sample.

Appendix B

Standard Operating Procedure

SOP B.9
Field Decontamination and Waste Disposal

1.0 FIELD DECONTAMINATION AND WASTE DISPOSAL

1.1 Sampling equipment must be cleaned prior to and after each use to minimize cross contamination of samples. Good house-keeping practices are reflected in the analysis of clean equipment/rinsate blanks.

2.0 STANDARD OPERATING PROCEDURE

2.1 Equipment Decontamination

2.1.1 Sampling equipment should be cleaned prior to sample collection, in a controlled environment, preferably at the laboratory and transported to the field pre-cleaned and ready to use. Sampling equipment should be cleaned between sample locations, and at the end of sampling activities. Large HDPE drums should be used to hold wash and rinse solutions. The following general decontamination procedure should be used when collecting field samples:

- Clean all sampling equipment with tap water and a non phosphate detergent such as Alconox or Detergent-8. Brush if necessary to remove particulate matter or surface film,
- Rinse thoroughly with tap water,
- Rinse thoroughly with deionized or distilled water. Enough water should be used to insure all surfaces are flushed with water,
- Rinse twice with hexane or methanol. One rinse may be used as long as all surfaces are thoroughly wetted with free flowing solvent,
- Rinse thoroughly with deionized or distilled water,
- Rinse with organic free water and allow to air dry, and
- Clean sampling equipment should be wrapped in aluminum foil or protected by other means to prevent contamination during storage or transportation to the field.

2.2 Disposal of Field Waste Material

All discarded material or other objects should be handled in a way to minimize waste and to preclude the potential for spreading contamination or causing litter to be left on-site.

The major waste material generated during field activity is purged well water and fluids collected during decontamination.

2..2.1 Well Purge Water

All water collected from monitoring wells should be collected in approved containers. The containerized liquids should be handled according to the analytical results of the well water. Those waters purged from existing wells showing the presence of contaminants, should also be containerized and handled accordingly.

2.2.2 Decontamination Water

Similar to purged well water, water generated from decontamination activities should also be containerized, sampled and handled according to approved disposal procedures.

Appendix B

Standard Operating Procedure

SOP B.10
Sample Packing and Transportation

1.0 SAMPLE PACKING AND TRANSPORTATION

1.1 Samples taken in the field must be packaged in a manner to prevent breakage, or cross-contamination during transportation to the laboratory. Samples must be refrigerated with sufficient ice to ensure a temperature of < 6°C on arrival at the laboratory.

2.0 STANDARD OPERATING PROCEDURE

2.1 Samples should be segregated by site, sampling location, or by sample analysis type during the packing of coolers. Sample segregation may follow this scheme or any other scheme that is sensible and well thought out. These schemes are dependent on the levels of contamination present, the number of bottles to be transported, the size of the bottles etc.

2.2 VOC samples from different sources may be placed into the same cooler to reduce the number of required trip blanks.

2.3 All samples requiring thermal preservation should be packed in thoroughly insulated coolers with wet ice.

2.4 Samples in breakable containers should be packed with material such as bubble wrap or foam sleeves to prevent breakage.

2.5 Sample coolers should be sealed with strapping tape or other means to prevent tampering. Custody seals may also be placed on the container lids.

2.6 Packed samples should be delivered to the laboratory by the sampling team or common carrier. If sent by a common carrier, all documentation (transmittal forms, bills-of-lading, COC's etc.) should be sealed and placed inside the shipping containers prior to sealing it. It is recommended to place all forms inside a plastic bag and tape it to the underside of the cooler lid.

2.7 Secondary Containment

2.7.1 To prevent melted ice from leaking out of the sample cooler during transportation, it is recommended to encapsulate all samples and cooler ice in a garbage bag. This is accomplished by double bagging the ice-chest and unfolding the garbage bags lining the bag in the cooler. Place all samples, packing material etc. in the first of the two garbage bags. This first or inner garbage bag is then pigtailed and tied.

2.7.2 If a temperature blank is to be used, place the blank in the second garbage bag. To prepare a temperature blank Place a temperature blank which contains a thermometer in a 40 ml VOA vial into a larger 500 ml HDPE (plastic)

container. The plastic container filled with water acts as secondary containment as well as providing a much larger thermal mass to help stabilize the temperature readings. Finally, pre-cool the temperature blanks prior to placement into the coolers. Reducing the thermal mass of a volume of water from ambient temperature to < 6°C takes approximately 4 to 6 hours. Therefore pre-cooling the temperature blank will help expedite the thermal transfer.

2.7.3 Place crushed ice not block ice in the second garbage bag, filling the remaining space of the cooler to produce contact with the ice and the samples that are in the first garbage bag.

2.7.4 Tie the second garbage bag which now contains the first garbage bag with samples, the temperature blank and the loose ice and prepare to shipment to the laboratory.

Appendix C

Sample Tracking Plan

Appendix C

Standard Operating Procedure

SOP C.1
Sample Tracking Plan

1.0 SAMPLE TRACKING PLAN (STP)

1.1 The Sample Tracking Plan is a set of SOPs designed and written specifically for maintaining the integrity of a sample throughout its life at Alpha. These SOPs are strictly followed during all phases of the sample's stay at Alpha.

1.2 The STP includes procedures for the transportation, receipt, handling, protection storage, and disposal of samples, including the procedures necessary to protect the integrity of the sample, and to protect the interests of the laboratory and client.

1.3 Sample tracking and the maintenance of custody starts with the sample collection activities in the field and continues throughout the sample's progress in the lab. Sample collection is the responsibility of the field sampler; however, once the samples arrive at the laboratory, sample custody is turned over to our laboratory.

1.4 We cannot control the custody or the maintenance of custody until it arrives at our laboratory. Therefore, standard chain of custody procedures are typically used for all samples unless otherwise required.

1.5 Sample integrity is an equally important factor in all samples, regardless of sample type.

1.6 The Sample Custody Officers (SCO) is responsible for the implementation of the STP. This responsibility includes assuring that the proper handling and documentation of all samples are performed according to the SOPs described in this plan. Occasionally, a QAPP or SOW will require additional or different procedures to be followed for their samples.

Appendix C

Standard Operating Procedure

SOP C.2
Sample Identification

1.0 SAMPLE IDENTIFICATION

1.1 Alpha Analytical, Inc. has developed a system for uniquely identifying samples to ensure traceability of samples while in the possession of Alpha Analytical, Inc. and to maintain sample identity while in-house. Each sample received is assigned a unique lab ID number.

2.0 STANDARD OPERATING PROCEDURE:

2.1 The sample identification assigned to a sample is retained throughout the life of the sample at the laboratory.

2.2 The sample identification system is specifically designed and operated to ensure that samples cannot be confused physically or when referred to in records or other documents.

Once samples have been assigned a sample identification number, this identification is retained for the sample, sub-samples, subsequent extracts, and/or digestates related to that original sample.

2.3 The sample identification system is specifically designed to accommodate the grouping of sample (e.g., SVOC grouping from TPH-P) and the transfer of samples within and from the laboratory.

2.4 The Alpha Analytical Identification (AAI) is generated to assign a unique identification code to each sample container received by the laboratory.

1) Clarification: NELAC notes the use of container shape, size, or other physical characteristics, such as amber glass, or purple top is an unacceptable practice. Since we use a unique ID system this is not an issue but is stated only to make the point.

2.5 The AAI number assigned to each sample container is also the same ID used to unequivocally link the sample containers, extracts, etc. to the ID assigned in the field by the sampling team.

This link is unequivocally established using the Chain of Custody where the relationship between the field ID and laboratory ID are defined.

2.6 The laboratory ID is placed on the sample container using a durable sample label.

2.7 Sample containers and extract vials are labeled with a lab ID number in the following format:

XXXYYMMDDSC- ZZ

Where:

XXX represents a 3-letter prefix unique to each individual client,

YY refers to the last two digits of the year,

MM refers to the month,

DD refers to the day,

SC refers to the sample custodian who logged in the sample, and

ZZ refers to the sample number

For example: JDI09011030-05 would be a sample belonging to John Doe Incorporated. The sample was received on January 10, 2009 and logged in by the assistant SCO assigned to ID number 30. The -05 means this is the fifth sample in the sample set.

2.8 This lab ID number is used by Alpha Analytical for continuous identification of the sample from receipt to completion of analysis. Samples which are received as a fraction or subsequently extracted in the laboratory are identified using the lab ID number and a suffix identifying the sample type, whether its a matrix spike, matrix spike duplicate, etc.

Appendix C

Standard Operating Procedure

SOP C.3
Labeling Field Samples

1.0 LABELING FIELD SAMPLES

1.1 To ensure sample integrity, Alpha uses company labeled tags on samples. This tag is designed to make all entries visible on a white background, and is used to discourage the use of non-waterproof labeling material.

2.0 STANDARD OPERATING PROCEDURE:

2.1 Alpha provides customized waterproof labels to be used in the field. This is the preferred procedure; however, not all clients use our containers or sampling materials. These labels should be affixed to the sample containers and completed using waterproof ink. If necessary, clear tape can be placed over the label. Alpha encourages the use of these labels to help our staff visually check and verify labels through continuity and standardization. Each label can be completed with the following information:

a) Analysis requested,
b) Preservation type,
c) Sample location,
d) Clients identification,
e) Date and time sampled, and
f) Alpha's sample identification.

2.2 Not all information is essential on the label. However, the following information is strongly recommended:

- Preservation Type,
- Client's Identification, and,
- Date and Time sampled.

Appendix C

Standard Operating Procedure

SOP C.4
Sample Receiving and Project/Client Communication

1.0 SAMPLE RECEIVING AND PROJECT/CLIENT COMMUNICATION

1.1 Sample receiving and project/client communication go hand-in-hand and is difficult to separate the two activities since one is associated with the other. The following synopsis discusses, in general terms, the primary activities associated with these procedures. The procedural order may vary somewhat, but this is generally the proper sequential order used to receive in-coming samples.

2.0 STANDARD OPERATING PROCEDURE

2.1 Background

2.1.1 Client Information

Specific project information is communicated throughout the laboratory using the "Client Information" menu in the Omega database. Whenever a change/policy is made by the client, it is recorded in this menu. The specific policy changes are entered and the name of the person making the request is recorded. The person typing the requests initials and dates the entry to indicate who typed the change and when the change was made.

2.1.2 Work Order Information

All client contacts for a particular work order are typed in this menu of the Omega database, initialed and dated by the person typing the request. The work order information is then printed and placed in the main file folder. This menu is similar to the Client Information screen; however, this screen is used for a particular work order only and the Client Information screen is used for policies that apply to entire projects.

2.1.3 Sample Receipt Checklist

A sample receipt checklist is automatically created for every work order/chain-of-custody that comes into the laboratory. After logging the samples into the Omega database, the sample receipt checklist is printed and faxed or e-mailed to the client immediately. The checklist identifies any sample integrity issues associated with a particular group of samples or work order and gives the client instructions on communicating with the laboratory how to resolve those abnormalities/nonconformities.

2.2 Sample Receiving Procedure

2.2.1 Alpha's manual chain-of-custody is completed and signed by both the relinquishing and receiving parties.

2.2.2 Samples are given a unique sample identification number.

2.2.3 Information described on the manual chain-of-custody is entered into the Omega LIM System.

2.2.4 Samples are labeled.

2.2.5 Documentation of Sample Integrity and Compliance

Upon receipt of the sample, the condition, including any abnormalities or departures from normal or specified conditions in the environmental test method, is recorded on the sample receipt checklist. The client is consulted and the conversations documented by the use of the sample receipt checklist for the following general items:

- When there is doubt as to the suitability of a sample for a particular environmental test,
- When a sample does not conform to the description provided, or
- When the test required is not specified in sufficient detail.

If doubt exist, the sample receipt personnel, consults the client for additional instructions and records those discussions before completing the sample receipt protocols.

2.2.6 A master file and method specific colored file folders are created which include a LIMS generated sample report indicating the target analyte list.

2.2.7 If the client has specific requirements associated with a work order, the client's comments are typed into the LIMS "Work Order" or "Comments" information section and this is printed out and placed into all associated files.

2.2.8 Samples and file folders are disseminated throughout the laboratory.

2.2.9 A copy of the chain-of-custody and the sample receipt checklist is faxed or e-mailed as a pdf file to the client.

2.2.10 The faxed or e-mailed confirmation report is placed into the master file.

2.2.11 If the chain-of-custody and/or sample receipt checklist sent by fax or e-mail to the client does not initiate changes to the chain-of-custody within one day, that is confirmation the chain-of-custody and associated information is correct without error.

If the fax or e-mail of the chain-of-custody and/or sample receipt checklist initiates a response, then those phone conversations, amendments to the chain-of-custody or other communications are annotated to the master and associated method files.

2.3 Subcontract Laboratories

It is Alpha's policy to subcontract out analytical services not performed by Alpha, to laboratories that have been certified by the appropriate state agencies, methods, and programs to the best of our ability.

2.3.1 If samples can not be analyzed in-house, then the sample custodian must determine if the client has specified a subcontract laboratory.

2.3.2 If a subcontract laboratory has not been identified by the client, then the sample custodian must review the subcontract laboratory register and determine which laboratory is most suitable to subcontract the work to.

This determination should take into account such things as; appropriate laboratory certification, methods of analysis, capabilities, is the subcontract laboratory capable of receiving the samples and reporting the data with the specified data quality objectives etc.

1) Clarification: The DoD and Navy requires subcontract laboratory work to be approved by the Navy. Since the Navy and DoD does not produce a listing of certified/approved laboratories, it is of most importance to ensure when subcontracting samples, that the laboratory has the required approval.

2.3.3 During the sample receipt process, samples are identified and segregated to be subcontracted. All sample receipt and COC protocols are followed for subcontracted sample analysis.

2.3.4 After the subcontract laboratory has been chosen, a subcontract chain-of-custody and a subcontract sample receipt checklist is sent along with the samples.

2.3.5 Once the samples have been received in the subcontract laboratory's facility, a return copy of the sample receipt checklist is requested.

Alpha request this checklist be returned to document and identify any potential abnormalities/nonconformities with the samples and gives the sub-contract laboratory instructions on communicating with our SCO if the samples are acceptable or not.

Thus we have confirmation regarding the subcontracted samples' receipt, preservation, holding time and any other potential problems prior to the commencement of sample analysis by the subcontractor.

2.4 Service to Clients

The environmental testing business is a service oriented business, requiring a large amount of interaction with our clients. It is in our best interest, to emphasis the importance of conducting client communication in an environment that is professional, informational and confidential.

2.4.1 It is Alpha's policy to cooperate with our clients or their representatives to clarify the client's request and to monitor the analytical performance in relation to the work performed on their project, and to provide this service in a climate that ensures confidentiality to other clients.

2.4.2 Service to clients is a proactive engagement with our clients which requires staff to notify clients of problem situations such as:

a) incorrect, obsolete or improper method requests;

b) the need to optimize methods to ensure data quality objectives are met for difficult matrix or poor performing analytes;

c) lack of project guidance documents, such as a QAPP, or the need for clarification of requirements in the document; and

d) problems with sampling or analysis that may impact results (e.g., improper preservation of sample).

2.5 Customer Complaints

It is Alpha's policy to respond to complaints and/or problems in a reasonable time frame and in a cordial manner that is both polite and professional to the customer.

2.5.1 Customer complaints are directed to the sample custodian supervisor. These complaints are documented in the customer complaint logbook. Customer complaint documentation includes information such as:

a) client name,
b) date,
c) complaint,
d) information on who received the complaint,
e) a remedy of those complaints, and
f) initials of the Sample Coordinator or person receiving that complaint.

2.5.2 If complaints can be resolved immediately than the remedy for that particular complaint is documented. Conversely, if the complaint can not be resolved immediately, and the remedy is more complicated, than the sample custodian supervisor relinquishes the duty of finding a remedy to the complaint to the laboratory manager.

2.5.3 The documentation of customer complaints, the response to these complaints, and their resolution is useful information to improving the quality of our client service. This information, as part of our quality system, helps identify patterns of problems and is important in formulating a corrective response to those problems.

2.6 Document Confidentiality

2.6.1 All sample documents to include phone conversations, electronic data deliverables, faxes or work order information is strictly confidential and will only be released to the client or Principal Investigator (PI) who originally requested the sample analysis.

Persons or organizations requesting such information may only receive the information upon approval to release the data. If there are any doubts concerning the identity of the organization or authority, then they must show proof of identification before releasing information. This is documented by the SCO, see Fig C.4-1.

REPORT RELEASE REQUEST

To: _____ **Fax:** _____

From: _____ **Date:** _____

RE: _____

Please respond

Work Order Number:

_____ is requesting the above listed report/s. Due to client confidentiality we are unable to release these report/s without your written permission. Please sign below and fax back to us at (775) 355-0406 if we are allowed to fax the above named report/s requested.

Thank you,
Alpha Analytical

_____
your signature

Fig C.4-1

Appendix C

Standard Operating Procedure

SOP C.5
Sample Containers, Preservation, Holding Times and General Sample Receipt Protocols

1.0 SAMPLE CONTAINERS, PRESERVATION, HOLDING TIMES AND GENERAL SAMPLE RECEIPT PROTOCOLS

1.1 Once samples are received it is important to verify and document the sample has maintained its integrity and is in compliance with the requested test method. This SOP is used in conjunction with the Sample Receipt Checklist to document sample integrity.

2.0 STANDARD OPERATING PROCEDURE

2.1 Introduction

Sample integrity issues are most often written into the methods of analysis. This would include such issues as sample collection, preservation and holding time. These items may be critical to the final data results and are important factors that must be addressed by the field sampler and verified in the laboratory.

For instance, if samples are collected and thermally cooled in the field, but had an inadequate amount of wet ice added and are received at the laboratory without ice and are warm; then sample integrity has been lost and the sample is noncompliant with the particular test method as data results may now be compromised.

2.2 Documentation of Sample Integrity and Method Compliance

Upon receipt of the sample, the condition, including any abnormalities or departures from normal or specified conditions in the environmental test method, is throughly checked and documented on the sample receipt checklist.

Sample containers, preservation, holding times, field and laboratory generated COC's, etc. are all reviewed and checked to verify sampling integrity and method compliance.

2.3 Corrective Actions for Non Compliant Samples

2.3.1 If the sample does not meet the sample receipt acceptance criteria, the SCO must retain any correspondence records of conversations concerning the final disposition of the rejected sample; or document the decision to proceed with the analysis of samples not meeting the acceptance criteria. These corrective action decisions are documented as follows:

i. The conditions of these abnormalities must be noted on the COC and/or on the sample receipt checklist.

ii. The sample analysis is appropriately footnoted on the final report.

2.3.2 If sample information errors are discovered, then these errors or discrepancies are recorded on the sample receipt checklist.

2.3.3 The client is faxed a copy or e-mailed the completed COC and the sample receipt checklist. Therefore, an unequivocal accurate record, which documents all laboratory activities is produced and maintained.

2.4 Sample-Receipt-Review-Items to Verify Sample Integrity and Method Compliance

2.4.1 Chain of Custody Information

The following items are reviewed by the SCO to verify the specific COC items are correct and documented.

2.4.1.1 SCO should review and verify the carrier name and ensure accompanying transportation documents are retained.

2.4.1.2 SCO should review and verify the field completed COC is present.

2.4.1.3 SCO should review and verify if custody seals are used and intact on the shipping container.

2.4.1.4 SCO should review and verify if custody seals are used and intact on individual sample bottles.

2.4.1.5 SCO should review and verify if COC was signed by the relinquishing party and signed by Alpha, the receiver.

Note: Sample custody begins with the field sampler. Therefore, technically the field sampler, should also be the first person to relinquish custody as documented on the COC.

2.4.1.6 SCO should review and verify if the COC agrees with the sample labels.

2.4.1.7 SCO should review and verify if the date and time of collection is noted by the client on the COC.

Note: Time stamps should be consistent within a COC; that is use either military or standard time for all data entries and not a mix of the two. If standard time is used, the use of am or pm should also be used to avoid time confusions.

2.4.1.8 SCO should review and verify if an internal or evidentiary COC is requested or required.

2.4.1.9 SCO should review and verify if a subcontract laboratory is required and if so was a subcontract laboratory specified.

2.4.2 Sample Containers

The following items are reviewed by the SCO to verify the specific items relating to samples containers are correct and documented.

2.4.2.1 SCO should review and verify the cooler and the individual samples are intact and in good condition.

2.4.2.2 SCO should review and verify the COC completed in the field matches the sample containers for number of containers, types, field identification etc.

2.4.2.3 SCO should review and verify sample container types and sizes are appropriate for the requested method of analysis.

2.4.2.4 SCO should review and verify the sample volume is appropriate for the requested method of analysis.

2.4.3 Thermal Preservation

The following items are reviewed by the SCO to verify the specific items relating to sample/cooler temperature are correct and documented.

2.4.3.1 SCO should review and verify that the samples are received at the correct temperature.

2.4.3.1.1 Temperature measurements are typically taken through the use of temperature blanks or by using an IR gun. If the IR gun is used, then the temperature of 3 samples are taken and their average is recorded.

2.4.3.1.2 For samples with a specified temperature of 4°C, samples with a temperature range from just above freezing temperature of water to 6°C is acceptable.

Note: The use of blue ice or reusable cold packs is not an acceptable alternative to wet ice.

2.4.3.1.3 Samples that are hand delivered to the laboratory on the same day they are collected may not meet these criteria. In these cases, the samples are considered acceptable if there is evidence that the chilling process has begun such as arrival on ice.

2.4.4 Chemical Preservation

The following items are reviewed by the SCO to verify the specific items relating to sample preservation are correct and documented.

2.4.4.1 SCO should review and verify that the samples are received with the correct preservation.

2.4.4.1.1 Techniques for Verifying Sample Preservation

Samples that are preserved in the field are also checked at the laboratory. Essentially all samples are checked and verified prior to sample analysis or extraction/digestion. There are separate techniques to verify this without contaminating the samples. For instance:

2.4.4.1.1.1 There are multiple vials collected for VOC analysis. The first vial is used to verify and record the sample pH with pH paper. Since this vial is not used for final sample analysis, the pH strip can be dipped directly into the sample vial.

2.4.4.1.1.2 Methods which require a sample extraction have the pre-extraction sample pH checked using pH paper and recorded on the sample preparation logs.

2.4.4.1.1.3 TOC samples are the only universal exception to checking and verify sample preservation at the lab bench. Sample preservation for TOC is verified using pH paper at the time of sample receipt.

2.4.4.1.2 Prevention of Sample Contamination when Verifying Preservatives

Concern over possible contamination of the sample resulting from dipping a probe or a test strip into the sample suggests that a slight modification in how samples are obtained may be in order.

2.4.4.1.2.1 The most common suggestion to field samplers is to take an identical sample, and to use that sample to determine the preservation requirements. For example, if it is found that 2.3 ml of nitric acid is required to lower the sample to a pH <2, then the addition of the same amount of acid to the other sample containers will achieve the correct preservation, without contaminating the sample to be sent to the laboratory.

2.4.4.1.2.2 When only a limited number of sample bottles are taken, sample preservation is checked and documented by placing a sample drop using the disposable pipette or stir rod directly onto the pH paper. The pH paper is not dipped into the sample container in an effort to limit the possibility of contamination by the pH paper.

2.4.5 VOC Methods Requiring No Head Space

The following items are reviewed by the SCO to verify the specific items relating to VOC head-space is correct and documented.

2.4.5.1 SCO should review and verify the VOC sample vials were received with zero head space.

2.4.5.1.1 Sample vials should not contain any bubbles exceeding 5 - 6mm (pea sized) as they may cause significant degassing and loss of volatiles. Conversely, sample vials containing bubbles smaller then 5-6 mm in size (total head-space) are acceptable.

2.4.5.2 SCO should review and verify aqueous VOC samples were collected in 40 mL (nominally 43 mL) VOA vials in triplicate.

2.4.6 Sample Holding Time

The following items are reviewed by the SCO to verify the specific items relating to sample holding time is correct and documented.

2.4.6.1 SCO should review and verify that the sample were received within the method specified holding time.

2.4.6.2 SCO should review and verify that the samples have a sufficient amount of holding time left to conduct the sample analysis.

Appendix C

Standard Operating Procedure

SOP C.6
Sample Acceptance Policy

1.0 SAMPLE ACCEPTANCE POLICY

1.1 The sample acceptance policy is an SOP which outlines the circumstances under which samples are accepted or rejected.

2.0 STANDARD OPERATING PROCEDURE

2.1 Data from any samples which do not meet the following criteria is flagged to clearly define the nature and substance of the variation. This policy is an important centerpiece for correctly recording the sample receipt checklist and COC documents.

2.2 Chain of Custody

2.2.1 The COC must be properly, fully and completely documented, which includes:

i. sample identification,
ii. sample or project location, i.e. state sample was taken,
iii. date and time of sample collection,
iv. collectors name,
v. preservation type,
vi. sample type, and
vii. any special remarks concerning the sample.

2.2.2 See the following documents for additional details:

- QAM, Vol II, Appendix C, SOP C.7, Manual COC Procedures,
- QAM, Vol II, Appendix C, SOP C.8, LIMS COC Procedures,
- QAM, Vol II, Appendix C, SOP C.9, Internal COC Procedures.

2.3 Sample Labeling

2.3.1 Sample labels are completed using Alpha's sample identification scheme to uniquely identify and label all sample containers.

2.3.2 Sample labels used in the field should be water resistant and field samplers are encouraged to use indelible ink.

2.3.3 See the following documents for additional details:

- QAM, Vol II, Appendix C, SOP, C.2, Sample Identification, and
- QAM, Vol II, Appendix C, SOP, C.3, Labeling Field Samples.

2.4 Sample Containers - See the following documents for details:

- QAM, Vol I, Section 6.4 and Table 6-1 through Table 6-8.

- QAM, Vol, II, Appendix C, SOP C.5, Sample Sample Receipt Protocols.

2.5 Sample Holding Times - See the following documents for details:

- QAM, Vol I, Section 6.6 and Table 6-1 through Table 6-8.
- QAM, Vol, II, Appendix C, SOP C.5, Sample Receipt Protocols.

2.6 Sample Preservation - See the following documents for details

- QAM, Vol I, Sections 6.3 and 6.5, and Table 6-1 through 6-8.
- QAM, Vol, II, Appendix C, SOP C.5, Sample Receipt Protocols.

2.7 Adequate Sample Volume - See the following documents for details:

- QAM, Vol I, Section 6.4 and 6.7, and Table 6-1 through Table 6-8.

1) Clarification: Since Alpha does not take field samples, all sampling supplies are furnished by Alpha to meet the sample acceptance policy criteria.

2.8 New Work

All new work is approved for sample acceptance by either the Laboratory Director or Laboratory Manager. This is a case-by-case approach and is not entirely a QA/QC issue. Items that affect the acceptance of new work include the following:

a) is the work in a state or under an agency with current laboratory approval;
b) in particular, are the requested methods of analysis, methods we are approved for, and are the target analytes, compounds we are approved for and analyze on a normal basis;
d) what are the reporting limits or LOQs requirements;
e) what are the QC requirements;
f) what are the turn around requirements;
g) what is the sample matrix;
h) what are the number of samples to be analyzed, and over what time period will they arrive;
i) do we have the appropriate facilities and resources before commencing the work; and
j) can these samples be analyzed without overly stressing the current staff.

This is not a comprehensive list of questions to be determined, but is a general starting point for all new projects. In addition, these do not answer the business questions regarding payment, pricing etc which are always a factor when evaluating new work.

Appendix C

Standard Operating Procedure

SOP C.7
Manual Chain-of-Custody Procedures

1.0 MANUAL CHAIN-OF-CUSTODY PROCEDURES

1.1 The chain-of-custody can be regarded as a legal document in some situations and should be completely filled out and as error free as possible. All samples received by Alpha are entered into our Sample Tracking System to enhance the legal defensability of all data produced at Alpha. Samples are documented on a chain-of-custody form and signed by both the client and laboratory. This document formalizes the sample transaction and is critical to the maintenance of sample custody.

2.0 STANDARD OPERATING PROCEDURE

2.1 The Sample Custodian handles and/or processes samples dropped off at the laboratory or sample shipments, including pickup of samples at Reno-Tahoe International Airport, bus station, Federal Express, UPS, or other carrier service within Alpha Analytical's geographic area. The Sample Custodian is available to receive sample shipments at any time the delivery service is operating, including weekends.

2.1.1 Alpha's manual COC record is completed with the following information:

a) Client name, address, phone/FAX number,
b) Who the report should be addressed to,
c) Sampler,
d) Date Sampled,
e) Time of collection,
f) Matrix,
g) Lab identification number,
h) Client identification/sample description,
i) Number of containers,
j) Analysis requested, and
k) All necessary signatures/dates/times.
l) Billing Information
m) PO #, PWS #, Job # or any additional information

Note: The log-in person should be consistent when annotating times, (i.e., use either standard time or military time) and if standard time is chosen, use am and/or pm when applicable.

2.1.2 Examine the condition of the sample and note in the comments section:

a) The integrity of the sample container,
b) The amount of sample for the analysis,
c) The presence of air bubbles in VOA vials,
d) Whether the sample was preserved according to the method prescribed preservation, and
e) Note any other irregularities with sample condition.

2.1.3 Compare all documents (client vs. laboratory) to verify information. In the event errors are discovered, record the discrepancies in the remarks section.

2.1.4 Issue the yellow copy to the client, and retain the white copy as the laboratory's copy.

2.1.5 All entries made on this document must be filled out in ink.

2.1.6 Samples received in the absence of the Sample Custodian or other designated recipients are placed in their appropriate refrigerator until the correct personnel are available to process the samples according to established protocol.

Appendix C

Standard Operating Procedure

SOP C.8
LIMs Generated Chain-of-Custody Procedures

1.0 LIMS GENERATED CHAIN-OF-CUSTODY PROCEDURES

1.1 Once samples have been manually logged-in to the laboratory they are also entered into the LIM system. Essentially, the same information used in the original manual chain-of-custody is used to complete the log-in procedures for the LIM system.

2.0 STANDARD OPERATING PROCEDURE:

2.1 The Omega system is entered from the main computer menu by double clicking the Omega icon. When the log-in prompt appears, type "System" and click the "O.K."button. This procedure will take you to the main Omega IV menu. From this menu, double click "Work Orders."

2.2 To add a sample, double click the "Add" key in the lower left-hand corner of the screen and amend the order numbers to correspond with the correct sequence:

Lead SCO: 1-19
1st Assistant SCO: 20-39
2nd Assistant SCO: 40-59
3rd Assistant SCO: 60-79
4th Assistant SCO: 80-89
5th Assistant SCO: 90-99

2.3 Sample Log-in Procedure

2.3.1 Alpha's LIMS generated Chain-of-Custody record is completed with the following information:

a) Client name, address, phone/FAX number;
b) Who the report should be addressed to;
c) Sampler;
d) Date Sampled;
e) Time of collection;
f) Matrix;
g) Lab identification number;
h) Client identification/sample description;
i) Number of containers;
j) Analysis requested; and
k) All necessary signatures/dates/times.
l) Billing Information
m) PO #, PWS #, DWR #, Job # or any additional information

2.3.2 Click once in the "Client Sample ID' box and enter the clients' three letter code. The company name, point-of-contact, address, phone and fax numbers will automatically appear.

2.3.3 The sample Turn-Around-Time (TAT) is automatically indexed to 10 days for all samples. If a TAT is shorter than 10 days is required, amend the TAT box as needed.

2.3.4 If a project name is required click the "Order Name" box and type the project name.

2.3.5 Double click the "Received" box and a calender will appear with the current date. Double click the date and the system will automatically enter the date. Enter the sample state from the pull-down menu.

2.3.6 Double click the "Date Due" box and the system will count ahead the number of days selected in the TAT box (excluding weekends) and automatically enter the information.

2.3.7 Click on the "Login" key and enter the sample ID for the first sample.

2.3.8 Open the "Collection Date" box and enter the appropriate information. This information should be written on the sample label - otherwise, ask the client.

2.3.9 If a sample time is provided, double space after the date sampled and enter the correct information converted to military time.

2.3.10 Open the sample "Matrix" box and enter the appropriate information. This information may be typed by hand or entered by clicking the down arrow key adjacent to the matrix box, and selecting the proper matrix.

2.3.11 Enter the number of sample containers currently being logged-in. There is a tab labeled "Bottle Information". Enter the type and number of bottles provided for each sample.

2.3.12 Click once in the "Test Groups" box. Enter the appropriate test and click the down arrow key next to the box to view the list of possible choices. Tests are segregated by state and test method.

2.3.13 Trip Blanks

2.3.13.1 Many sample coolers will have associated Trip Blanks. Trip Blanks are treated as separate samples.

2.3.13.2 For "Client Sample ID" type in Trip Blank.

2.3.13.3 Enter a TAT that corresponds to the sample being logged-in.

2.3.13.4 Enter the collection date which corresponds to the earliest sample date on the chain-of-custody.

Trip Blank collection dates are entered in this fashion to prevent the LIM System from creating an artificial holding time problem. The true Trip Blank preparation date should be listed on the vial label.

2.3.13.5 TB original preparation date information and the place of origin are then entered into the comments section.

2.3.13.6 Trip Blanks are normally not analyzed unless requested by the client. Therefore, under "Test Groups" type "Hold". This will tell the analyst that the sample should not be analyzed.

2.3.14 For each new sample, click the "Add Sample" box and repeat the sample log-in procedure starting with a new client ID.

2.3.15 Add any additional comments in the "Comments" box on the "Main" Screen by clicking on the box and typing the relevant information. Information such as rush TAT, California samples, special QA/QC, etc. are entered into this section.

2.3.16 If a client has a Purchase Order (PO) number, click the "Invoice Info" box at the top of the screen and enter the PO number.

2.3.17 Print the chain-of-custody by clicking the "WO COC" button at the top of the screen.

2.3.18 The analyte list then needs to be generated. Click on "Print Test" and put in the sample number to be printed. Staple the analyte list on the inside cover of the appropriate test folder.

2.3.19 Laboratory ID labels are then generated for the sample containers. Click on the "Labels" button, enter the number of bottles present for each sample and print the labels.

2.3.20 When all relevant information has been entered, click the "out-the-door" box at the lower right hand corner of the screen and exit.

Appendix C

Standard Operating Procedure

SOP C.9
Internal Chain-of-Custody Procedures

1.0 INTERNAL CHAIN-OF-CUSTODY PROCEDURES

1.1 Occasionally the use of internal COC protocols may be required by some clients and/or programs. This SOP is designed to supplement the record keeping system as discussed in various sections of the QAM.

2.0 Standard Operating Procedure

2.1 Internal COC Client Management

It must be stated and understood in the strongest terms that the use of this SOP will be implemented only when specifically requested by the client. This request must be documented on the Sample Receipt Checklist and acknowledged by the client. If the client does not request or acknowledge that this requirement is needed, then the normal record keeping system has precedence and is the system of choice.

1) Clarification: A complete evidentiary COC begins at sample collection, unless otherwise specified by the client, and ends after laboratory analysis of the sample is completed and the sample is ready for disposal. Samples are disposed of in accordance with the normal sample disposal procedures.

2.2 Internal Chain-of-Custody

The internal COC record is designed to produce an intact, continuous record of the physical possession, storage and disposal of samples, sample aliquots and extracts. For ease of use, samples, sample aliquots and extracts are referred to as samples.

2.2.1 A sample is in someone's custody if:

a) it is in one's actual physical possession;

b) it is in one's view, after being in one's physical possession;

c) it is one's physical possession and then locked up so that no one can tamper with it; or

d) it is kept in a secured area, restricted to authorized personnel only.

2.2.2 The internal COC record is filled out and should account for all time periods associated with the sample.

2.2.3 The internal COC is also initialed and dated each time an individual physically handles the sample.

2.2.4 Clients usually provide water samples for each analysis; therefore, samples will have more than one bottle. Therefore, when any of the vial/bottles are consumed, the analyst or extraction technician must document the consumption of that vial/bottle (e.g. vial 1/3 consumed) on the internal COC. The vial consumption documentation must also include the date of consumption and the initials of the person that used that vial.

2.2.5 The internal COC contains a "master work order sheet" which is kept in a master logbook. This sheet provides information on when the samples were moved into the primary refrigerator, secondary storage, and the date that the entire sample set was disposed. The same information (except when samples were moved into the primary refrigerator) is recorded for the sample extracts.

This master work order sheet along with the internal COC and the client COC details the custody trail of the samples from the sampling event to final disposal.

2.2.6 The internal COC includes a sign-off sheet for each different test. These sheets are stapled to the inside rear cover of each file folder. The analyst/extraction technician that handles the sample must maintain internal custody by initialing and dating the COC when logging samples in and out of the refrigerator.

2.3 Evidentiary Chain-of-Custody Procedures

2.3.1 The COC procedures as described in C.7 and C.8 are followed completely and error free as possible.

2.3.2 It is important not to break the continual record of physical possession of the samples. Therefore, it is critical to ensure the sampler has signed off or relinquished the samples to either a second party or to the laboratory.

2.3.3 If samples are mailed, then they should be registered with return receipt requested. If samples are sent by common courier, receipts should be retained as part of the permanent COC documentation.

2.3.4 Once samples are received by Alpha, then the responsibilities for the care and custody of the samples are in our hands.

2.4 Sample Disposal

2.4.1 Disposal of the sample will occur 60 days after sample receipt as outlined in the waste disposal SOP.

2.4.2 All conditions of disposal and correspondence between parties concerning the

final disposition of the sample is recorded and retained as part of the permanent record.

2.4.3 Internal COC records indicate the date of disposal, the nature of disposal (i.e. sample depleted, sample disposed of in hazardous waste facility or sample returned to client) and the name of the person who performed the task.

Appendix C

Standard Operating Procedure

SOP C.10
Sample Log-in Ledger

1.0 SAMPLE LOG-IN LEDGER

1.1 Upon arrival at the laboratory, the Sample Custodian completes a LIMS generated COC. From the LIMS generated chain-of-custody a macro routine is used to parce information to be placed in a 3-ring binder called the Sample Log-In Ledger. This is a notebook used to keep a running total of all samples received by Alpha. This ledger is used in conjunction with other Log-in documents to rectify sample receipt problems.

2.0 STANDARD OPERATING PROCEDURE:

2.1 NELAC Requirements

2.1.1 NELAC requires the Sample Log-In Ledger to record the following minimum information:

i. client name,
ii. date and time of sample receipt,
iii. laboratory sample identification, and
iv. signature or initials of the person making the entries.

2.1.2 NELAC also requires the following additional information to be unequivocally linked between the COC and Sample Log-In Ledger.

i. The client/field identification on each container is linked to the laboratory identification.

ii. The date and time of sample collection is linked to the sample container and to the date and time of sample receipt.

iii. The requested analyses is linked to the laboratory identification.

iv. Any comments resulting from inspection for sample rejection is linked to the laboratory identification.

2.2 Since the Sample Log-In Ledger is parced from the LIMS generated COC essentially any information contained on the COC can be unequivocally linked to COC log in records.

2.2.1 All COC and sample log-in records/information are entered into our LIM system and stored as permanent archived records. These records are easily retrieved upon request and readily available to all staff members who will process the samples.

2.2.2 The Sample Log-In Ledger records the following information:

a) initials,

b) date of sample receipt,

c) laboratory's sample identification,

d) client's sample identification,

e) matrix type,

f) analysis requested,

g) Turn-Around-Time (TAT),

h) date sampled,

i) temperature upon sample receipt,

j) work order comments, and

k) any additional comments.

2.3 Approximately every 2 weeks the SCO or assistant SCO activates the Sample Log-In Ledger macro and initiates a computer parcing routine which identifies the requested information as stated above.

All samples and associated sample information entered into the LIMS, regardless of the person whom actually logged-in the sample, will be printed out in chronological order.

Once this information is printed, the SCO or Assistant SCO checks the information for accuracy, paginates and initials the ledger.

Appendix C

Standard Operating Procedure

SOP C.11
Sample Storage Procedure

1.0 SAMPLE STORAGE PROCEDURE

1.1 Alpha maintains sample integrity through disciplined sample processing and storage procedures. All samples received by the lab are placed in the appropriate storage area immediately after log in. If the sample is removed from the storage area for extraction or analysis, this activity is documented in the technician's extraction or the analyst's instrument logbooks. Therefore, samples can be tracked in the laboratory by reconstructing historical data.

2.0 STANDARD OPERATING PROCEDURE

2.1 Samples requiring thermal preservation are stored under refrigeration which is ± 2°C of the specified preservation temperature unless method specific criteria exists. For samples with a specified storage temperature of 4°C, storage at a temperature of above freezing point of water to 6°C is acceptable. Freezer temperatures are kept within an ideal temperature of -10 °C to -20 °C and are maintained according to their particular use.

2.2 The samples removed from the shipping container are stored in their original containers unless damaged. Damaged samples are disposed of in an appropriate manner and documented.

2.3 Alpha maintains a large inventory of refrigerators and freezers in order to facilitate proper segregation of samples, extracts, standards, etc. which require thermal preservation according to the specifications in the test methods.

2.3.1 General Storage Considerations - the following items are isolated from one another and stored separately to prevent environmental and/or chemical cross contamination:

1) samples,
2) standards,
3) extracts and digests, and
4) solvents and reagents.

2.3.2 Food Storage - food is isolated and stored separately to prevent any possibility of contaminating food from environmental samples, or chemicals used in the analysis of samples.

2.3.3 Samples Storage - samples are stored away from all standards, reagents, food and other potentially contaminating sources. In addition, the following considerations are used when isolating samples from itself.

1) class of analytes to be measured;
2) volatiles are completely isolated from all other types of sample streams
3) samples suspected of containing high levels of volatile organics are

further isolated from other volatile organic samples; and

4) method of analysis.

2.3.4 Extracts and Reagents Storage - these chemical streams are stored from one another as well as storing and isolating them from samples to prevent cross contamination. In addition these chemical streams are isolated and stored away from food to prevent contaminating the food and causing a health issue.

2.4 All samples are placed in cold storage until they have been analyzed, and then held for a minimum of sixty days.

2.5 Disposal records are maintained to demonstrate that samples have been properly disposed of, in accordance with Federal, State and local regulations.

TABLE C.11 -1
SAMPLE AND EXTRACT STORAGE AREA

Analysis Requested	Matrix	Refrigerator Identification
624 / 8260	Water	SAR- 1B
"Suspect high contamination"	Water/ Soil	SAR- 2C
8270 / 8081 / 8082	Water/Soil	SAR- 3A
8015-DRO (2^{nd} and 3^{rd} vials) / TOC	Water	SAR- 4B
VOC Trip Blanks	Water	SAR- 5D
Purgeables in Air	Air	SAF - 6B
8015-DRO	Water/Soil	SAR- 7A
624 / 8260	Water	SAR- 8A
Inorganic	Water/Soil	SAR- 9B
524.2	Water	SAR- 10A
VOC	Soils	SAR- 11A
624 / 8260	Water	SAR- 12A
Inorganic	Water/Soil	SAR- 13A
DOD	Water/Soil	SAR- 14A
Incoming samples (sample receipt)	Water/Soil	SAR- 15A
Dissolved Gases	Water/Soil	SAR- 16A
Organic Acids	Water/Soil	SAR- 17A

Appendix C

Standard Operating Procedure

SOP C.12
Sample Tracking Procedure

1.0 SAMPLE TRACKING PROCEDURE

1.1 Sample tracking is a fundamental responsibility of the SCO. This person must, at any given time, know where a particular sample or client file is located and have the ability to track the samples analytical progression through the laboratory. The large number of samples in-house requires a procedure for tracking and documenting this activity.

2.0 STANDARD OPERATING PROCEDURE

2.1 The SCO must properly fill out a COC, identify, label and store all samples upon receipt, according to established SOPs.

2.2 Once this activity has taken place, multiple copies of the COC are made and placed in various locations.

2.3 A master client-file is then generated for the purpose of tracking analytical data produced by the various analyses. Each sample or group of samples from an individual client is given a client file with the client and sample identification written on the folder's tab. Each method of analysis has its own folder and is discriminated between methods by the file folder color. Table C.12-1 is a listing of file folder colors associated with a particular method of analysis.

2.4 Bin World

2.4.1 Bin World is a part of the physical tracking system used in conjunction with the master files to carry out the sample tracking procedure. Bin World is a set of various discrete bins associated with a given day used to segregate primary sample streams. The various discrete bins include:

- Other lab data only,
- Alpha + other lab,
- Alpha only,
- Alpha 5-day,
- Amendments, and
- Rush.

2.4.2 Master files are placed in the Bin World according to the discrete primary sample stream. Secondly, master files are placed in Bin World according to their "due date". This enables client data to be tracked effectively according to due date.

2.4.3 If the analytical data is not produced in a manner reflective of the client requested due date, or if QA/QC data is to be sent at a later date, then the master file is relocated to another set of discrete bins. There are four primary areas which may delay final data production and therefore have an associated

bin. They are as follows:

- Delayed Alpha reports,
- Delayed Inorganic reports, and
- Needs QC Alpha / Inorganic.

2.5 Master Files

2.5.1 A master file is generated for each group of samples represented by a single COC. A manilla file folder is used for this master file. If the client is requesting a single method of analysis, then the master file is generated using the same file folder color as the color used for the requested method of analysis. The master file is labeled with the sample identification number attached to the folders tab. The master file initially contains the following items:

- the manually produced, hand written COC;
- the LIMS generated COC;
- if samples were received using courier service, then any information such as air bills, bills-of-landing is included;
- nonconformance letter / sample receipt checklist;
- faxed confirmations that the sample submitting party has received, and was notified of, the sample receipt Checklist;
- client communications in regards to special requests or changed orders; and
- any other relevant information.

2.6 Analytical Files

2.6.1 Once the analytical file folders are generated they are placed in the extraction or analytical lab depending upon the matrix and analysis requested. This gives the extraction chemist or the analyst two places to check and verify samples information; 1) the client file; and 2) the LIMS System.

2.6.2 The extraction chemist or analyst will then perform the required work and place the relevant data in the client folder. If the data can be uploaded, it is then uploaded into the LIM system which will indicate the work has been completed.

2.6.3 Once the analysis has been completed, the client file is reviewed by several staff members. This is a rigorous four tiered review to ensure the data has been calculated, evaluated and reported correctly.

2.6.4 Once the analytical report has been signed, the method files and all of their associated analytical data is then collected into the master file.

2.6.5 The DCO and SCO both monitor the master file to determine and physically

track the status of analytical data. This procedure continues until all data has been produced and physically collected in the master file.

2.6.6 Final analytical data is then faxed or e-mailed and a hard copy is sent to the client.

File Folder Tracking Table
Table C.12-1

Analytical Method	File Folder Color
524.2	Yellow
8260 (Water) / (Soil)	Brown/Lavender
624	Blue
8010 / 601 / (Water) / (Soil)	Blue
8081/8082 /608 /(Water)/ (Soil)	Orange
8270 / 625 / (Water) / (Soil)	Red
TPH-Purgeable (Water) / (Soil)	Lavendar
TPH-Extractable (Water) / (Soil)	Green/Red
TCLP Volatiles	Blue
TCLP Pest / Herb/ Sv	Gray
S / O Separators (11 Regulated)	Blue
TOC	Pink
Methanol	White
Metals	Gray
Wet Chemistry	Teal/Pink
Gravimetric	Maroon
COD/Phosphourus	Navy Blue
Anions	Light Blue
Perchlorate	White
Methane	White
Organic Acids	Yellow

Appendix C

Standard Operating Procedure

SOP C.13
Sample Custody Procedure

1.0 SAMPLE CUSTODY PROCEDURE

1.1 The maintenance of custody defines who is responsible for sample integrity at any given time. The responsibility of sample custody changes during the sample's life in the laboratory. Sample custody is documented on bench logs, analysts logs and other QA documents while in the laboratory, from receipt until sample disposal.

2.0 STANDARD OPERATING PROCEDURE

2.1 The following narrative describes the change of sample custody and responsibility during normal laboratory activities.

2.1.1 The Sample Custody Officer is responsible for sample receipt and placing samples in the correct cold storage facility.

2.1.2 Sample custody changes when an extraction technician or analyst removes that sample from storage. Samples will remain in that person's custody until returned to storage.

2.1.3 Once the sample arrives at the lab bench, the analyst or technician records all procedures completed on the sample in the proper logbooks.

2.1.4 The remaining sample or extract is returned to the appropriate storage facility and custody returns to the Sample Custodian.

2.1.5 Those samples requiring security are stored in a locked storage area, with the Sample Custodian or a designated analyst having access. Sample custody remains that person's responsibility at all times.

Appendix C

Standard Operating Procedure

SOP C.14
Submission of Final Analytical Data as a PDF File by E-mail

1.0 SUBMISSION OF FINAL ANALYTICAL DATA AS A PDF FILE BY E-MAIL

1.1 An e-mail of the original data scanned as a pdf file is the preferred method of relaying client information. The following procedures outline the steps taken when e-mailing client information.

2.0 STANDARD OPERATING PROCEDURE

2.1 Analytical Data Verification

2.1.1 DCO should review and verify the analytical folder disseminated to the various analysts; match the final report generated by the report writer.

2.1.2 DCO should review and verify the analytical folder was correctly placed in the appropriate master file located in Bin World under the day the reports are due.

2.1.3 DCO should review and verify the final analytical reports match the requested methods of analysis on the COC.

2.1.4 DCO should review and verify that all analytical data and final reports are included in the master file.

2.1.4.1 If the master file is not complete, place the analytical folders with their reports standing up in the master file and place them in the Bin World under the day the reports are due.

2.1.4.2 If at the end of the day, folders have not been completed, then place the master file in the appropriate secondary bin (e.g. delayed data, needs inorganic results, etc.).

2.1.5 DCO should review and verify clients specific instructions. These "Client SOPs" need to be checked for special reporting instructions before removing the master file from the due date bin to the secondary bins. These special reporting instructions include such things as: "e-mail results as soon as possible," etc.

2.1.6 If a master file is complete, it is ready for e-mailing. The master file is then removed from the Bin World and placed in the "Reports to be E-mailed" bin next to the scanner until it is e-mailed.

2.2 E-mailing

2.2.1 Prior to e-mailing, the entire report is scanned as a pdf file and saved in a sub-directory by month using the work order and job name to identify the file.

2.2.2 A permanent record is completed daily which lists all reports e-mailed during that day. This record includes the following:

- Alpha's W.O. number,
- The test being reported, and
- Noting if the final data reported was a completed or partial data report.

2.2.3 Items to be e-mailed include the final reports, and client's original COC. If the client's original COC is amended, then the amended COC is included with the e-mail.

2.2.4 Send the e-mail to the person listed under the "Report Attention" column located on the COC.

2.2.5 Refer to the client specific SOP for any special instructions, such as e-mailing to a group of people.

2.2.6 Once the e-mail process has been initiated, place the reports and COC back into the master file and place this file into the Awaiting Confirmation bin next to the scanner.

2.2.7 After the e-mail confirmation has been issued, stating the e-mail transmission was successful, the confirmation is placed in the master file as part of its permanent record.

2.2.8 Once the reports have been e-mailed, the master file is then forwarded to one of the following areas:

- Client specific QC,
- Electronic Data Deliverables(EDDs),
- Invoicing.

If the folder is not complete, place the folder back in Bin World in one of the secondary bins associated with its deficiency.

2.2.9 Once the daily e-mailing requirements has been completed, the list of e-mailed client reports are entered into the LIM System under

- Work Order, and
- Fax Update

Additionally, the daily permanent record listing all reports e-mailed during that day is archived in a 3-ring binder labeled "E-mailed Report Binder," segregated by month.

Appendix C

Standard Operating Procedure

SOP C.15
Sample Scheduling and Discrepancy Reporting

1.0 SAMPLE SCHEDULING AND DISCREPANCY REPORTING

1.1 The Sample Custody Officer and Supervisors discuss and communicate all sample integrity issues such as sample containers, preservation and holding times with the appropriate personnel to ensure samples are received and documented appropriately. The SCO will also help schedule sample receipt and analysis with the client and notify that person as to any analytical irregularities.

2.0 STANDARD OPERATING PROCEDURE

2.1 The laboratory supervisors will coordinate sample scheduling with the appropriate personnel to maximize economy of effort with the number and types of analysis to be performed.

2.2 The laboratory supervisors will update the client as necessary throughout the analytical process as required by that client.

2.3 Irregularities with sample documentation, or problems encountered during sample analysis will be reported immediately to the laboratory director.

2.4 The director or analysts will document all discrepancies associated with the sample, before the problem is communicated to the client.

2.5 It is the responsibility of the laboratory director to communicate and resolve any out-of-control problems with a client.

2.6 In reporting data discrepancies, the client's sample identification is used both verbally and in correspondence.

Appendix C

Standard Operating Procedure

SOP C.16
Waste Disposal Procedure

1.0 WASTE DISPOSAL PROCEDURE

1.1 Alpha Analytical, Inc. is committed to insuring to our customers and our employees that all wastes generated and/or accepted at the laboratory are disposed of in a proper and responsible manner.

2.0 CLASSIFICATION AND ORIGIN OF WASTE STREAMS

To work within the proper waste disposal program at Alpha, it is important to understand the different waste streams and their proper handling and disposal operations.

2.1 Types of Waste

2.1.1 **Non-Hazardous Waste:** Most materials, solids and liquids, that have not come in contact with solvents can be disposed of as non-hazardous wastes. These include unused soi/water samples, rinse waters, glass containers, etc.

2.1.2 **Hazardous Waste:** Those materials which are listed or characteristic wastes as defined in 40 CFR. Specifically, these include spent solvents, spent soil and water extracts, specific inorganic wastes, fuel samples and any material which comes into contact with large amounts (>10%) of any solvent.

2.2 Origin of Waste Stream

It is important to understand that a hazardous material is not a hazardous waste until its use is no longer viable within the laboratory. Only when a hazardous material is ready for disposal does it become a hazardous waste. Once it becomes a hazardous waste, it must be disposed of within the facility and can not be moved.

Tracking a soil sample for VOC analysis can better explain this concept. An aliquot of soil is removed from a brass sleeve and extracted into Methanol in a 40ml vial. This sample extract can be moved from the lab to the storage area on Freeport Way. The sample remains there for the 60-day retention period required by the client. Once the retention time is complete, the sample extract is ready for disposal and then becomes a hazardous waste. Other wastes, such as waste solvent from the SVOC extraction process has no benefits after the extraction process and therefore becomes a hazardous waste immediately. Because of this, the spent solvents from the SVOC lab must stay within the lab facility and can not be transported to the waste facility on Freeport.

It is important to understand that Alpha holds two EPA manifest sites: the lab facility on Glendale Avenue and the waste facility behind the lab on Freeport Way. All wastes generated within either facility must be manifested and disposed of from that facilities waste stream. If you have any questions regarding the status of a waste or the proper placement of the waste, please contact Randy Gardner for information.

3.0 Waste Streams - Per Facility

3.1 Laboratory Facility

All hazardous waste that is generated in the laboratory facility, located on Glendale Avenue, must be temporarily stored in the waste area of the extraction lab or in the inorganic lab. The wastes that are located in the extraction lab are as follows:

3.1.1 Waste Solvent: All waste solvents, including Methylene chloride, Methanol, Hexane, Ether and any other rinse or spent solvents, are combined and manifested as F listed wastes.

3.1.1.1 Extracted Liquids: All extracted liquids for such analyses as SVOC and Pesticides.

3.1.1.2 Extracted Solids: All extracted solids, or any other solids that come in contact with solvents (i.e. sodium sulfate).

3.1.2 Wastes located in the inorganic laboratory include:

3.1.2.1 Metals Liquid Waste: Waste reagents from colormetric procedures (COD,Cr^{+6}, Sulfide, etc) and other inorganic procedures that produce wastes containing high levels of metals. Such wastes include silver, mercury, hexavalent chrome and other such metals.

3.2 Waste/Storage Laboratory

All samples and sample extracts that are stored in the waste laboratory behind the lab facility (located on Freeport Way) are not classified as hazardous waste until they are ready to be disposed of. Again, all sample and sample extracts stored in the waste area have beneficial use and are stored there in case there is a need for a further analysis or a re-analysis for confirmation purposes. Alpha's general policy is to store these samples and their extracts for 60 days. After the 60-day storage period, the samples are ready to be disposed and therefore have no beneficial use, thus classifying themselves as hazardous waste. The hazardous wastes located in the waste/storage lab are as follows:

3.2.1 Waste Solvent: All solvent waste that has been decanted from the extracted samples. These are typically TPH and VOC soil samples that have been extracted and stored in a 40-ml closed-top vial. This waste solvent is primarily made up of Hexane and Methanol.

3.2.2 Extracted Solids: All extracted solids, or any other solids that come in contact with solvents (i.e. sodium sulfate). Once the solvents are decanted from the TPH or VOC extraction vials, soils are placed in the extracted soils container.

The non-hazardous wastes located in the waste/storage lab are as follows:

3.2.3 Non-extracted Solids: All non-extracted soils, such as duplicate soil containers and unused soil samples are disposed of as non-hazardous waste. These soils are stored in a 55-gallon drum and disposed of as Petroleum Contaminated Soils.

3.2.4 Non-extracted Liquids: All non-extracted liquids, such as duplicate containers and unused samples are treated as non-hazardous waste. Because liquids for TPH-Diesel (EPA Method 8015) use 1 ml of hexane for the extraction, these liquids are separated from the hexane and treated as non-hazardous. These liquids are collected and evaporated as described in the following section.

4.0 Waste Streams - Per Usage

4.1 Usage

Following is a designation of all hazardous and non-hazardous wastes that Alpha deals with in conjunction with its laboratory functions. Also listed are the correct handling and disposal processes.

4.1.1 Waste Solvent: All spent solvent, both chlorinated and non-chlorinated must be disposed of as waste solvent. Several temporary waste containers are available throughout the laboratory. Once full, these containers must be emptied into the 55-gallon drum in the extraction or waste laboratory. The drum is self-contained. It is important that this drum remain under the fume hood at all times and that the drum is never tipped or rolled. Each time solvent is added to this drum, the level must be marked and dated. A weekly visual examination must be made of the drum to ensure that acidic or chlorinated solvents have not corroded the metal barrel. The lids must be kept on the barrels when not in use.

4.1.2 VOC Soil Extracts: Soils being analyzed for volatile organic (VOC) are extracted with methanol. The soils are extracted into methanol in 40 ml vials. After analysis, the extracts are moved to the waste facility for the required retention period. After the retention period, the vials are crushed with the glass crusher and the solid material (both glass and extracted soil) are disposed of as extracted soil. The solvent is screened off and disposed of as waste solvent.

4.1.3 VOC Waters: Those aqueous samples requiring VOC analysis are purged directly onto the instrument and are not solvent extracted with methanol. The purged water, along with the duplicate vials, are crushed with the glass crusher and the solid material (glass vials) are disposed of as non-extracted

soil/solid. The remaining water is screened off and disposed of as non-extracted water.

4.1.4 TPH-E Soil Extracts: Soils being analyzed for TPH-E are extracted with Hexane/Acetone (90/10). The soils are extracted in 40 ml vials. After analyses, the extracts are moved to the waste facility for the required retention period. After the retention period, the vials are crushed with the glass crusher and the solid material (both glass and extracted soil) are disposed of as extracted soil. The solvent is screened off and disposed of as waste solvent.

4.1.5 TPH_E Water Extracts: Those waters that require TPH/E analysis are extracted with Hexane in 40 ml vials. After analyses, the extracts are moved to the waste facility for the required retention period. After the retention period, the vials are crushed with the glass crusher. The water is separated from the solvent and disposed of as non-extracted water and the solvent is disposed of as solvent waste.

4.1.6 Extracted Soil for Semi-volatile Analyses (SVOC, and Pesticides etc): Soils requiring any semi-volatile analysis are solvent extracted with the Dionex ASE extraction unit. These solvent extracts are captured into 40 ml vials. The extracted soil is removed from the ASE extraction containers and are disposed of in the laboratory as extracted soils. Because the extracted soils from the ASE are not retained for further use, they become hazardous waste immediately and can not be moved to the waste facility. ALL ASE extracted soils are manifested from the laboratory facility. After analysis, the extracts and/or autovials are moved to the waste facility for retention. After retention, the vials are crushed with the glass crusher and the solid material is disposed of as extracted soil. The extract is disposed of as waste solvent.

4.1.7 Extracted Liquids for Semi-volatile Analysis (SVOC and Pesticides, etc): Liquids requiring any semi-volatile analysis are solvent extracted. The solvent extract is concentrated down and placed in the appropriate vials. The extracted water is disposed of in the laboratory as extracted water. Because the extracted waters are not retained for further use, they become hazardous waste immediately and can not be moved to the waste facility. ALL such extracted waters are manifested from the laboratory facility. After analysis, the extracts and/or autovials are moved to the waste facility for retention. After retention, the vials are crushed with the glass crusher and the solid material is disposed of as extracted soil and the extract is disposed of as waste solvent.

4.1.8 Auto-vialed Extracts: All samples that require a semi-volatile extraction are transferred into 2ml auto-vials. These auto-vials are then placed on the appropriate instrument and analyzed. After analysis, these vials are moved to the waste facility for retention. After the retention period, they are disposed

of by crushing the vials with the small auto-vial crusher located under the waste fume hood. The solid material is disposed of as an extracted soil/solid. The solvent extract is disposed of as waste solvent.

4.1.9 Inorganic Laboratory Liquid Waste: All extracted and non-extracted waste water from the inorganic shop must be neutralized before being disposed of as a non-hazardous waste.

4.1.10 Inorganic Metals Waste: All reagents that contain hazardous levels of metals. Such wastes include many of the colormetric method wastes from the analysis of COD, Sulfide and Cr^{+6}. These wastes have high levels of Silver, Mercury and Cr^{+6}.

5.0 Storage of Hazardous Waste

5.1 One of the fundemental concepts of hazardous waste management is the 90-day limitation for accumulating and storing hazardous waste on-site before they must be transported off-site for treatment or disposal.

Whereas the 90-day limitation for on-site storage of hazardous waste is a requirement of HW management, it is important to know and understand the exceptions to this rule, namely the *Satellite Rule*. This exception is important in that it would be costly and inefficient for Alpha to accumulate its many different waste streams and to ship dispose of them every 90 days. However, compliance should be followed meticulously. Therefore it is imperative that the rules are understood.

The following is a quick reference summary of the accumulation and storage rules:

5.1.1 On-site storage of HW without a storage facility permit is limited to 90 days unless the generator qualifies for satellite rule accumulation.

5.1.2 The accumulation start date which begins the 90-day period and must be identified on the label of each container is different for large and small quantity generators. If more than 100 kgs (220 lbs or 27 g) of hazardous waste or 1 kg of extremely or acutely hazardous waste are generated at the entire facility, the 90-day period begins when the first drop hits the container. If not, the small quantity generator may accumulate up to these amounts before beginning the 90-day clock.

5.1.3 The *satellite rule* provides relief for generators who qualify by allowing accumulation of up to 55 gallons of hazardous waste (or 1 qt of extremely or acutely hazardous waste) or one year, whichever comes first, at or near the point of generation. This rule allows a reasonable accumulation period for smaller volume waste streams as they are usually generated in the laboratory.

5.1.4 Any facility which stores hazardous wastes over the 90-day period (unless the satellite rule applies) must obtain a permit or variance from the NDEP.

5.2 Accumulation Exemptions: (40 CFR 262.34)

5.2.1 A generator who generates greater than 100 kg but less than 1000 kg of HW in a calendar month may accumulate hazardous waste on-site for 180 days or less without a permit or without having interim status provide that:

1) The quantity of waste never exceeds 6000 kg

2) That requirements of subpart I of 265, except 265.176 are in compliance. These requirements are:

a) The condition of the containers are intact;

b) Stored wastes are compatible;

c) The management of the containers is prudent (i.e., container must be kept closed, and handled with care);

d) The containers must be inspected at least weekly;

e) The containers are clearly labeled and the accumulation dates are legible;

f) At least one employee must be available at all times to respond to an emergency at the facility;

g) The following information must be posted near the telephone:

1) Name and phone number of emergency coordinator;

2) Location of fire extinguishers, spill control material and fire alarms; and,

3) Telephone number of local fire department unless the facility has a direct line through the fire alarm.

3) Alpha must ensure that all employees are thoroughly familiar with proper waste handling and emergency procedures, relevant to their responsibilities during normal facility operations and emergencies.

4) Immediate emergency response levels are:

FIRE: Call the fire department and/or attempt to extinguish it.

SPILL: In the event of a spill, contain the flow of HW to the extent possible, and as soon as is practicable, clean up the HW and any contaminated materials or soil.

OTHER: In the event of a fire, explosion, or other release which could threaten human health outside the facility or when the generator has knowledge that a spill has reached surface water, the SO must immediately notify the National Response Center (800/424-8802). The report must include the following information:

1) Name, address, and USEPA ID generator's number;

2) Date, time and type of incident (spill or fire, etc);

3) Quantity and type of HW involved;

4) Extent of injured; and

5) Estimated quantity and disposition of recovered materials if any.

If the generator meets the above criteria, and must transport his waste, or offer his waste for transport, over a distance of 200 miles or more for off-site treatment, storage or disposal may accumulate HW on-site for 270 days or less without a permit or without having interim status.

6.0 Disposal of Empty Containers

6.1 Containers which are empty and no longer needed must be disposed of properly. Container disposal shall be as directed by 40 CFR 261.7 "Residues of hazardous waste in empty containers." Containers which have held acute hazardous materials as defined in 40 CFR 261.31, 261.32, or 261.33 require special handling. Please contact Randy Gardner for further information and assistance. To assist you in determining if an empty container is regulated, here are some further guidelines.

A container shall be considered "empty" if all the following conditions exist (for this section, a container shall be considered to be a primary container or an inner liner):

6.1.1 The container contained none of the chemicals that are listed in 40 CFR 261.33(e),

6.1.2 All chemicals have been removed that can be removed using practices commonly employed to remove materials from that type of container (i.e. pouring, pumping, aspirating, etc.),

6.1.3 There is less than one inch of residue left in the bottom of the container,

6.1.4 There is less than 3% by weight of residue left in the container (0.3% for >110 gal. containers),

The container shall be considered empty **only** if the container has been triple rinsed *or* cleaned by another method that has been shown in the scientific literature to achieve equivalent removal. If the container has not been cleaned as stated above, the container shall become hazardous waste.

Once a container has been declared "empty" by the above criteria, it can be placed in the normal refuse.

7.0 Waste Area Mechanical Operation

All waste area technicians must have training in the operation of the jaw crusher, pump operation, evaporator operation and storage procedures before being allowed access to the waste area. Following is listing of the equipment in the waste laboratory and their standard operating procedures.

7.1 Waste water evaporator and holding/settling tank operation

7.1.1 The waste water evaporator is designed for the evaporation of non-hazardous wastewater. Utmost care must be given to ensure that hazardous waste, solvents or pure fuel products are not introduced to either the holding tank or the evaporator. Wastewater may be introduced into the evaporator by either discharging directly into the evaporator or by transferring wastewater from the holding tank to the evaporator. The holding tank is designed to prevent sediment transfer directly into the evaporator. In essence it is a settling tank. Once evaporator wastewater has been pumped into the settling tank, a period of no less than twenty four hours of undisturbed settling time is required before the second transfer is initiated from the settling tank to the evaporator. Wastewater directly dumped into the evaporator must be free of sediment or very carefully decanted to eliminate sediment buildup of the evaporation unit. Waste streams that can be evaporated include:

- Mass spectrometer rinse water,
- Client water samples,
- Neutralized inorganic wastewater
- TPH-E water extracts (decanting the hexane solvent layer),
- HPLC waste, except acetontrile waste waters; and,
- Non-extracted lab waters.

7.1.2 The evaporator requires routine maintenance in an effort to keep it as clean as possible and to preclude the build up of heavy metals and salts. Over time

this type of scaling can be harmful to the heating coils. On a three-month frequency, the evaporator water should be cooled, then pumped out and disposed of as non-hazardous wastewater. The evaporator should be thoroughly cleaned including wire brushing scale deposits off the heating coils and sides of the evaporator and thorough checks should be made for cracking or unusual wear. Once a year, the combustion chambers' air to fuel mixture should be checked and adjusted according to the owner's manual specifications. The full maintenance procedure is found in section 4.3 of the owners manual.

7.1.3 Extreme care should be given when transferring wastewater from the crusher to the settling tank and on to the evaporator. This operation may require two people to prevent possible over-spillage.

7.2 Jaw Crusher Operation

7.2.1 The jaw crusher is used for the crushing of 40mL VOA vials and 1 liter bottles. DO NOT crush auto vials or screw cap vials smaller than 20 ml VOA's in the jaw crusher. All crushed glass collected in the lower strainer bin must be triple rinsed with water before being dumped into the trash container.

7.2.2 The jaw crusher is a very powerful piece of equipment. The following safety elements should be followed when operating the jaw crusher:

7.2.2.1 Never operate the crusher without the fan belt and fly wheel shrouds bolted in place. Use common sense when in operation;

7.2.2.2 Do not put your hands near any moving parts;

7.2.2.3 Always ensure no one is near the crusher when the machine is being tuned on;

7.2.2.4 Always use an extender such as a stick or a bar to free glass stuck in the loading chute;

7.2.2.5 Always wear safety glasses;

7.2.2.6 Always wear cotton or leather gloves;

7.2.2.7 Never over fill the hopper. VOA vials will clog the hopper jaws and not feed properly;

7.2.2.8 The hopper lid must be installed to prevent glass from flying out of the hopper when crushing liter and smaller bottles;

7.2.2.9 Remove all liter and large bottle lids prior to crushing;

7.2.2.10 Bottles must be fed into the hopper one bottle at a time with the neck of the bottle towards the jaws;

7.2.2.11 All glass collected in the lower strainer bin must be triple rinsed before dumping into the trash container;

7.2.2.12 Always know what is being placed in the crusher;

7.2.2.13 Never leave uncrushed material in the hopper;

7.2.2.14 Keep the crusher and surrounding area clean and free of litter;

7.2.2.15 Clean all spills immediately;

7.2.2.16 Keep the white crusher "roll-around-bins" as clean and sediment free as possible;

7.2.2.17 Avoid vacuuming sediment in the pick-up hose when transferring water from the white crusher-bins to the settling tank; and,

7.2.2.18 It is mandatory that the crusher's moving shaft be greased after each crushing episode to prevent the jaws from freezing up.

7.3 Auto vial crusher operations

7.3.1 The autovial crusher is used to crush auto vials, and 2 and 8 ml screw cap vials. This operation is preformed under the waste hood to capture solvent vapors. Avoid over filling the hopper and always ensure the discharge hose is securely placed in the solvent waste container under the crusher. The crushed glass is disposed of as extracted soil.

8.0 TPH-E Disposal Procedures

8.1 There are four primary waste streams used in the disposal of TPH samples. They are non-hazardous wastewater, non-hazardous solids, hazardous solids, and solvent waste. The following standard operating procedures describe the disposal practices for each TPH-E waste stream.

8.2 Wastewater

The following TPH-e waste streams are bulked together and disposed of as Non-

hazardous wastewater. These streams include:

8.2.1 Unused Client Water Samples: Unused client water samples are packed in boxes labeled TPH WASTEWATER with the sample receipt date. These boxes are transferred for storage to the waste laboratory. After the required retention, the samples are disposed of as non-hazardous wastewater.

Cold Storage: Refrigerator SAR-4B (duplicate samples)
Cold Storage Sample Removal: 2 weeks from date of sample receipt
Cold Storage Removal frequency: Weekly
Total Storage Period: 60 days from date of sample receipt
Waste stream: Non-hazardous wastewater

Note: Water sample are bulked into the non-hazardous wastewater stream. The containers are crushed. Once crushed, the glass shards are triple rinsed with water and discarded in the trash bin.

8.2.2 Extracted Water: All extracted water is packed in boxes and labeled TPH EXTRACTED WATER with the disposal date. These boxes are transferred for storage to the waste laboratory and placed on shelves marked TPH EXTRACTIONS.

Cold Storage: Refrigerator EXT-37A
Cold Storage Sample Removal: Monthly
Total Storage Period: 60 days from date of sample receipt
Waste Stream: Non-hazardous wastewater

Note: The extracted water is decanted from the vials and the water fraction is bulked with the non-hazardous wastewater and the hexane solvent is bulked with the waste solvent.

8.2.3 TOC Waste: All TOC waste water is treated as non-hazardous wastewater. TOC wastewater is transferred to the waste room for storage, then disposed of as non-hazardous wastewater.

Cold Storage: Refrigerator SAR-4B (duplicate samples)
Cold Storage Sample Removal: 2 weeks from date of sample receipt
Cold Storage Removal frequency: Weekly
Total Storage Period: 60 days from date of sample receipt
Waste stream: Non-hazardous wastewater

8.3 Hazardous Solids

The following TPH waste streams are bulked and disposed of as hazardous solids. Hazardous solid waste stream includes:

8.3.1 Extracted Soils: Soil extracts are packed in boxes labeled TPH SOIL EXTRACTS with the disposal date. Soil extracts are transferred for storage to the waste laboratory. These boxes are stored on the shelves marked TPH EXTRACTIONS.

Cold Storage: Refrigerator EXT-37A
Cold Storage Sample Removal: Monthly
Total Storage Period: 60 days from date of sample receipt
Waste Stream: Hazardous solid and Solvent waste

Note: The hexane is decanted and bulked with the solvent waste. The remaining soil extract and glass containers are crushed together, collected and bulk packed with the hazardous solid waste.

8.4 Non-hazardous Solids

The following TPH-E waste streams are bulked and disposed of as non-hazardous solids. Non-hazardous solid waste stream includes:

8.4.1 Unused Client Soil Samples: Unused client soil samples older than 14 days are transferred for storage to the waste laboratory. The samples are stored in order of date received and are disposed of in accordance to their disposal dates.

Cold Storage: Refrigerator EXT-37A
Cold Storage Sample Removal: 14-days
Total Storage Period: 60 days from date of sample receipt
Waste Stream: Non-hazardous solid

8.5 Pure Fuel Product Samples

8.5.1 Pure product sample are removed for storage to the waste laboraory in sealed paint cans. They are labeled with their disposal date and placed on the Pure Product shelves in the storage area, according to the date of disposal.

Cold Storage: Refrigerator SAR-2B
Cold Storage Sample Removal: Monthly
Total Storage Period: 60 Days from date of sample receipt
Waste Stream: Waste Solvent

9.0 VOC Waste Disposal Procedures

9.1 There are four primary waste streams used in the disposal of VOC samples. They are non-hazardous wastewater, non-hazardous solids, hazardous solids, and waste

solvent. The following SOP describes the disposal practices for VOC samples and their associated wastes.

9.2 Wastewater

The following VOC subwaste streams are bulked together and disposed of as Non-hazardous Wastewater. These waste streams include the following:

9.2.1 Unused Client Water Samples: Unused Client water samples older than 14 days are removed from the refrigerator and packed in boxes labeled VOC NON-EXTRACTED WATER with the date of sample receipt. The VOA rack labels indicating client name and date are removed, and attached to the inside lid of the storage box. These boxes are transferred to the waste area and placed in the storage racks designated for VOC samples. After a period of 60 days from the date of sample receipt, samples are discarded as non-hazardous wastewater.

Cold Storage: Refrigerator SAR-12A
Cold Storage Sample Removal: 2 weeks from date of sample receipt
Cold Storage Removal Frequency: Daily
Total Storage Period: 60 days from date of sample receipt
Waste Stream: non-hazardous wastewater

Note: Water samples are bulked into the non-hazardous wastewater stream. The VOA vials are crushed. Once crushed, these glass shards are triple rinsed with water and discarded in the trash bin.

9.2.2 Mass Spectrometer Rinse Water: The mass spectrometer rinse water is collected from each instrument daily. Rinse water is transferred to the waste room for disposal as non-hazardous wastewater.

Removal Frequency: Daily
Waste Stream: non-hazardous wastewater

9.2.3 Client Drinking Water Samples: VOC drinking waters are removed from the refrigerator every 30 days. Samples are packed into boxes labeled VOC DRINKING WATER with the date of disposal. These boxes are transferred to the sample storage area and retained for 60 days from date of sample receipt. Samples are disposed of as non-hazardous wastewater.

Cold Storage: Refrigerator SAR-10A
Cold Storage Sample Removal: 30 Days from date of sample receipt
Cold Storage Removal Frequency: 30 Days
Total Sample Storage Period: 60 Days from date of sample receipt
Waste Stream: non-hazardous wastewater

Note: Water samples are bulked into the non-hazardous wastewater waste stream. The VOA vials are crushed. Once crushed, these glass shards are triple rinsed with water and discarded in the trash.

9.3 Non-hazardous Solids

The following VOC waste streams are bulked together and disposed of as non-hazardous solids. These waste stream include the following:

9.3.1 Unused Client Soil Samples: Unused Client soil samples older than 14 days are removed from the refrigerator and placed into green plastic tote boxes. Tote boxes are labeled with the date of sample receipt. These tote boxes are transferred to the waste area and placed on shelves. Sample are retained for a period of 60 days from the date of sample receipt. Samples are discarded as non-hazardous solids.

Cold Storage :Refrigerator SAR-11A
Cold Storage Sample Removal: Date of analysis or 2 weeks from date of sample receipt
Cold Storage Removal Frequency: Daily
Total Storage Period: 60 Days from date of sample receipt
Waste Stream: non-hazardous solids

Note: Soil samples and their glass jars are bulked into the non-hazardous solids waste stream.

9.4 Hazardous Solids

The following VOC waste streams are bulked together and disposed of as hazardous solids. These waste streams include the following:

9.4.1 Extracted Soil/Solid Samples: VOC extracts older than 30 days are removed from the refrigerator monthly. The extracts are packed into boxes labeled MEOH SOIL EXTRACTS with the date of disposal. The boxes of extracts are transferred to the sample storage area and placed on designated racks in the waste room. After a storage period of 60 days from date of sample receipt, the extracts are discarded as hazardous solids.

Cold Storage: Refrigerator EXT-36A
Cold Storage Sample Removal: 30 Days from date of sample receipt
Cold Storage Removal Frequency: 30 Days
Total Sample Storage Period: 60 Days from date of sample receipt
Waste Stream: Hazardous Solids and Waste Solvent

Note: The methanol is decanted and bulked with the solvent waste. The remaining soil extract and glass containers are crushed together, collected and bulk packed with the hazardous solids.

9.4.2 Methanolic Air Extracts: Methanol air extracts older than 60 days are discarded every 3 months. The methanol and carbon material in the vials are crushed in the autovial crusher and the resulting glass shards are disposed of as non-hazardous solids.

Cold Storage: Refrigerator SAR-1A
Cold Storage Sample Removal: 60 Days from date of sample receipt
Cold Storage Removal Frequency: 90 Days
Total Sample Storage Period: 60 Day from date of sample receipt
Waste Stream: non-hazardous solids

9.5 VOC Solvent Waste

The following VOC subwaste streams are bulked together and disposed of as Solvent Waste and non-hazardous solids. These subwaste streams include the following:

9.5.1 Solvents and Fuel Products: Client samples containing pure products older than 14 days are removed from the refrigerator monthly. Pure product samples are placed in labeled paint cans. Samples are transferred to the sample storage area and placed on VOC storage racks. After a period of 60 days from the date of sample receipt, samples are discarded as waste solvent.

Cold Storage: Refrigerator SAR-2A
Cold Storage Sample Removal: 14 Days from date of sample receipt
Cold Storage removal Frequency: Monthly
Total Storage Period: 60 Days from date of sample receipt
Waste Stream: Waste Solvent

Note: Pure product samples are decanted and bulked with the solvent waste stream. The glass containers are crushed. Once crushed, these glass shards are triple rinsed with water and discarded in the trash bin.

10.0 Semi-volatile/Wet Lab Waste Disposal Procedure

10.1 There are six primary waste streams used in the disposal of Semi-Volatile wastes extracts and spent samples. They are non-hazardous wastewater, hazardous wastewater, waste solvent, non-hazardous solids, and hazardous solids. The following standard operation procedures describe the disposal practices for Semi-Volatile samples and their associated wastes.

A special note concerning all extracts from the semi-volatile extraction laboratory. All extracts can be moved and stored in all parts of both the laboratory and the

storage area. This is due to the fact that they have a beneficial use within the laboratory (for analysis, both present and future) and are not hazardous wastes until the time that they are ready for disposal.

All solvent-extracted soils and waters, and all waste solvent generated within the extraction laboratory must stay within the extraction laboratory where they were generated. This is due to the fact that these materials do not have any further beneficial use and are ready for disposal.

10.2 Non-hazardous Wastewater

The following semi-volatile waste streams are bulked together and disposed of as non-hazardous wastewater. These waste streams include the following:

10.2.1 Unused Client Water Samples: Unused client water samples older than 14 days are removed from the refrigerator and moved to the waste laboratory. The samples are stored on racks according to their disposal date and disposed of as non-hazardous wastewater.

Cold Storage: Refrigerator SAR-3A
Cold Storage Sample Removal: 14Days from date of sample receipt
Cold Storage Removal Frequency: Daily
Total Storage period: 60 Days from date of sample receipt
Waste Stream: non-hazardous wastewater

10.2.2 Unused TCLP Extracts: Unused TCLP extracts older than 14 days are removed from the refrigerator and moved to the waste laboratory. The samples are stored on racks according to their disposal date and disposed of as non-hazardous wastewater.

Cold Storage: Refrigerator SAR-3A
Cold Storage Sample Removal: 14Days from date of sample receipt
Cold Storage Removal Frequency: Daily
Total Storage period: 60 Days from date of sample receipt
Waste Stream: non-hazardous wastewater

10.3 Hazardous Wastewater

The following semi-volatile waste stream is bulked together and disposed of as hazardous wastewater. This waste stream includes the following:

10.3.1 Solvent Extracted Water Samples: Spent Water samples extracted with >10% solvent are manifested and disposed of in the extraction laboratory under the waste hood.

Solvent Extracted Water Removal: As needed
Waste Stream: Hazardous Wastewater

10.4 Hazardous Solids

The following semi-volatile waste stream is bulked together and disposed of as hazardous solids. This waste stream includes the following:

10.4.1 Extracted Soil Samples: All solvent extracted soils from the ASE extractor must be manifested and disposed of in the extraction laboratory under the waste hood.

ASE Extracted Soil Removal: As needed
Waste Stream: Hazardous Soil

10.4.2 Saturated Extraction Supplies (Sodium Sulfate/Filters, etc):

All solvent extracted soils, filter paper, extraction discs and sodium sulfate from semi-volatile extractions where the materials have come into contact with solvents must be manifested and disposed of in the extraction laboratory under the waste hood.

Removal: As needed
Waste Stream: hazardous Soil

10.5 Non-hazardous Solids

The following semi-volatile extractable waste stream is bulked together and disposed of as non-hazardous solids. This waste stream includes the following:

10.5.1 Unused Client Samples: Unused Client soil samples older than 14 days are removed from the refrigerator and moved to the waste laboratory. These soil containers are placed on racks according to the sample disposal date.

Cold Storage: Refrigerator SAR-3A
Cold Storage Sample Removal: 14 days from date of sample receipt
Cold Storage Removal Frequency: Daily
Total Storage Period: 60 days from date of sample receipt
Waste Stream: Non-hazardous Solids

Note: Soil samples are bulked into the non-hazardous solids waste stream. The wide mouth glass jars are crushed. Once crushed, the glass shards are disposed of along with the soil as non-hazardous soils.

10.6 Waste Solvent (From the Extraction Laboratory)

The following waste streams are bulked together and disposed of as waste solvent. It is again important to emphasis that all waste solvent generated within the extraction lab must be manifested and disposed of from the extraction lab. Those solvents decanted from the stored samples and autovials in the waste laboratory on Freeport must be manifested and disposed of from the Freeport facility. These bwaste streams (from the extraction lab) include the following:

10.6.1 Glassware Rinse Solvent: Glassware solvent rinse, ASE waste solvent, waste solvent from standard preparation, and excess waste solvent from extractions are bulked in the extraction laboratory.

10.6.2 Solvent Extracts: ASE generated semi-volatile solvent extracts older than one month are removed from refrigerator EXT 31B. Extracts are placed into boxes labeled SEMI-VOLATILE EXTRACTS with the sample disposal date. These boxes are placed on racks in the waste laboratory and after a period of 60 days from date of sample receipt, the extracts are discarded as waste solvent.

Cold Storage: Refrigerator EXT-31B
Cold Storage Sample Removal: Monthly
Cold Storage Removal Frequency: Monthly
Total Storage Period: 60 days from date of sample receipt
Waste Stream: Waste solvent.

10.6.3 Semi-Volatile Auto Vials: Once semi-volatile analyses are completed, all auto vials are removed from their respective refrigerators. Autovials are packed into paint cans labeled SEMI-VOLATILE AUTO VIALS with a disposal date. The cans are transferred to the waste laboratory and placed on their appropriate rack and stored for 60 days before disposal.

Cold Storage Autovials: Refrigerator EXT-35B
Total Storage Period: 90 Days
Waste Stream: Waste Solvent, Hazardous Solids

Note: Autovials are crushed while collecting the waste solvent for disposal. The crushed glass is then bulked and disposed with the hazardous solids.

11.0 Inorganic Lab Waste Disposal Procedure

11.1 Inorganic Reagents (From the Inorganic Laboratory): The following waste streams are bulked together and disposed of as D-listed metals waste. This waste stream includes such metals as silver, mercury and chrome. The common wastes that are disposed of in this stream are those waste reagents/extracts associated with COD, Cr^{+6}, Sulfide and other such inorganic analyses.

Appendix C

Standard Operating Procedure

SOP C.17
Review of Requests, Tenders, and Contracts

1.0 REVIEW OF REQUESTS, TENDERS AND CONTRACTS

1.1 Often times new work is associated with a request, tender and/or a contract. This may be a long drawn out and complicated process. Occasionally, new work requires no contract, and samples simply arrive unexpectedly at the sample receiving area. This SOP describes the general procedures for the review of requests, tenders and contracts and the maintenance of those contracts.

2.0 STANDARD OPERATING PROCEDURE

2.1 Review Items

The purpose of this review is to establish that we possess the resources necessary for the performance of the contract or project. Items that affect the review of requests, tenders and contracts for acceptance of new work include the following:

a) are the requested methods of analysis adequately defined, documented and understood;

b) do we have the appropriate facilities and resources to meet the contract requirements to include:

i. do we have the required physical space;

ii. do we have the personnel with the skills and expertise for the performance of the tests in question;

iii. do we have the appropriate information and technical resources;

iv. what are the number of samples to be analyzed, and over what time period will they arrive;

v. can these samples be analyzed without overly stressing the current staff;

vi. are their performance evaluation (PE) samples available for the requested method of analysis; and if not are their QC samples available with know values in order to determine uncertainties of measurement, detection limits, confidence limits, or other essential quality control requirements;

c) can we provide the specified methods of analysis to include:

vii. is the work in a state or under an agency which we have approval;

viii. are the requested methods of analysis, methods we are approved for;

ix. are the target analytes, compounds we are approved for and analyze on a normal basis;

d) can we provide the specified data quality objectives to include:

x. the requested reporting limits or LOQs;

xi. the requested accuracy and precision;

xii. the requested turn around times; and

xiii. are we capable of analyzing the constituents in the requested matrix.

This is not a comprehensive list of questions to be determined, but is a general starting point for all new projects. In addition, these do not answer the business questions regarding payment, pricing etc which are always a factor when evaluating new work.

2.2 Review Result

After the initial request of review is completed, the client is informed of the review results, to include:

a) any potential conflict with ongoing projects;

b) any deficiencies in the request for analysis;

c) any lack of appropriate accreditation status; or

d) the inability to complete the client's work.

2.3 Resolution of Differences

Any differences between the requested contract and our capabilities must be resolved before any work commences. The contract, if one exists, must be acceptable to both the laboratory and client.

Note: NELAC defines a contract as any written or oral agreement when providing a client with environmental testing services.

2.4 Documentation of Review

2.4.1 Records of reviews, including any significant contract changes are retained by

Alpha. Most often these are oral contracts and those changes are documented in the "Client Information" section of the Omega LIM system.

2.4.2 These records may also include ongoing discussions with a client relating to the client's requirements or the results of the work during the period of execution of the project or contract.

2.4.3 For the review of routine and other simple tasks, the date and the initials of the person, in the laboratory, responsible for carrying out the contracted work is considered adequate.

For repetitive routine work, the review is made only once at the beginning of the contract or on-going work under a general agreement with the client, provided that the client's requirements remain unchanged.

For new, complex or advanced environmental testing tasks, a more comprehensive record is maintained.

2.4.4 This contract review also includes any work that is subcontracted.

2.5 Deviations from the Contract

It is Alpha's policy to inform the client of deviations from the contract.

2.6 Contract Amendments

If a contract needs to be amended after work has commenced, the same contract review process is repeated and any amendments are communicated to all affected personnel.

Suspension of accreditation, revocation of accreditation, or voluntary withdrawal of accreditation is reported to the client.

Appendix D

Document Control Plan

Appendix D

Standard Operating Procedure

SOP D.1
Document Control Plan

1.0 DOCUMENT CONTROL PLAN (DCP)

2.0 STANDARD OPERATING PROCEDURE

2.1 The opening statement to our QA manual explains the purpose and objectives of our quality assurance system. These statements are fundamental principals upon which we have built our QA system and upon which policy decisions are made. The QA manual devotes much attention to fulfilling these objectives such as:

- Providing a uniform basis for analytical generation and reporting;
- Assisting in the early recognition of deficiencies which affect the quality of data; and,
- Requiring sufficient documentation to verify the quality of data submitted.

The quality assurance system is only as good as the record keeping system. If historical data can not be maintained and retrieved, and the construction of those historical records are in doubt, than a house-of-cards has been created, and the entire system is brought into question and the data is dubious at best.

2.2 Control of Records

It is a basic policy of Alpha to provide accurate, precise, complete, and representative determinations, and to document sufficient QA/QC of the analytical procedures. The procedure designed to document and maintain these as historical records is the Document Control Plan. This plan has established a set of SOPs written specifically for maintaining uniformity and consistency in support of these goals.

2.3 Record Keeping System and Design

The record keeping system is designed for the identification, collection, indexing, accessing, filing, storing, maintenance and disposal of quality and technical records. These records include reports from internal audits, and management reviews as well as records of corrective and preventive actions.

2.3.1 A major component in the design of the record keeping system is a procedure which allows the historical reconstruction of the laboratory activities that produced the analytical data. The sample history is easily reconstructed through this documentation system. Such records include:

2.3.1.1 **records identifying the person** involved in sampling, sample receipt, sample preparation, calibration and analysis;

2.3.1.2 **information relating to** laboratory equipment, analytical test methods, and related laboratory activities such as sample receipt, sample preparation or data verification;

2.3.2 The record keeping system is designed to facilitate the retrieval of working files and archiving records for inspection and verification purposes. This is accomplished by the following description.

2.3.2.1 All document entries are initialed by the responsible staff member. The reason for the signature or initials is indicated on all quantitation and QC reports by using a stamp indicating the checking of analytical data. This stamp describes the basic activities, and the person responsible for those activities, initials it. The stamp is as follows:

- Result,
- Peer/QC,
- Report, and
- Final

2.3.2.2 All generated data, except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent ink.

2.3.2.3 Entries in records are not to be obliterated by methods such as erasures, overwritten files or other markings. All record keeping corrections are made by a single line marked through the error. The individual making the correction will initial and date the correction. This criteria applies to electronic records as well, to avoid the loss or change of original data.

2.4 Records Management and Storage

2.4.1 All records, certifiates and reports are safely stored and held secure and in confidence to the client.

2.4.2 All records are stored in an environment to prevent damage or deterioration and prevent record loss. Records are stored as follows:

- all records are scanned as pdf files and are electronically stored and filed.; and

- hard copy data is stored off-site with a company specializing in record management.

2.4.3 All records are retained for a minimum of five years.

2.4.4 Records stored or generated by computers are duplicated with either hard copies or write-protected backups.

All electronic data is stored and supported by the hardware and software necessary for the retrieval, see Appendix F for details.

2.4.5 The information necessary for the historical reconstruction of data is maintained with these files. This includes, original observations, (e.g. quantitation reports), calculations and derived data, calibration records and a copy of the test report.

2.4.6 The Document Control Filing System SOP, found in this appendix, describes the identification scheme used to archive and retrieve hard copy data records.

2.4.7 Electronic data is stored and archived in a manner to facilitate retrieval and security. Appendix F, Software Quality Assurance Plan (SQAOP), has two SOP which describes this process, SOP F.3, Data Collection and Storage, and SOP F.7, Data Archiving.

2.4.8 Alpha has established a record management system for control of laboratory notebooks, instrument logbooks, standard logbooks, and other records for data reduction, validation storage and reporting.

2.4.9 Access to archival information maintained off-site is documented with an access log. Archival records are protected off-site, with a company specializing in record management, against fire, theft, loss and environmental deterioration, vermin and, in the case of electronic records, electronic or magnetic sources.

Appendix D

Standard Operating Procedure

SOP D.2
Document Control Filing System

1.0 DOCUMENT CONTROL FILING SYSTEM

1.1 The following procedure is a system designed for identification, collection, indexing, accessing, filing, storing, maintenance and disposal of quality and technical records.

2.0 STANDARD OPERATING PROCEDURE

2.1 Our goal is to keep one year of the current past files in our main filing room. All older files are scanned and archived on the LIMs server.

2.2 Access Log

2.2.1 Access to off-site archival information is documented with an access log. Archival records are protected off-site, with a company specializing in record management, against fire, theft, loss and environmental deterioration, vermin and, in the case of electronic records, electronic or magnetic sources.

2.2.2 The access log also known as the "File Check-out and Return" log book maintained in the main file room.

Any person who retrieves a file is required to sign the access log. When the file is returned, the person returning the file is also required to sign the log to indicate the file was returned.

There are only two people allowed to re-file: Document Control Officer, and Assistant Document Control Officer.

We have specific, designated areas in our main file room for:

- Files that need to be collated,
- Returned files from cabinets,
- New folders ready to be filed in the cabinets.

2.3 Data Retention of Laboratory Support Activities

A description of our data retention policies and procedures is found in SOP D.1, Document Control Plan. The following list describes the activities that are documented and retained.

a) all original raw data, used for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms and other instrument response readout records);

b) the analytical method SOP used for a specific test method to include a description of the specific computational steps used to translate parametric

observations into a reportable analytical value;

c) copies of final reports;

d) archived SOPs;

e) correspondence relating to laboratory activities for a specific project;

f) all corrective action reports, audits and audit responses;

g) proficiency test results and raw data; and

h) results of data review, verification, and cross checking procedures.

2.4 Data Retention of Analytical Records

The essential information associated with data analysis, such as chromatograms, tabular printouts, computer files, analytical notebooks, and run logs are also retained. The specific information retained is as follows:

a) laboratory sample ID;

b) date of analysis and time of analysis, if the holding time is 72 hours or less, or when time critical steps are included in the analysis;

c) instrument identification and instrument operating conditions/parameters;

d) analysis type;

e) all manual calculations, e.g., manual integrations;

f) analyst's or operators's initials/signature;

g) sample preparation including cleanup, separation protocols, sample IDs, volumes, weights, instrument printouts, meter readings, calculations, reagents;

h) sample analysis;

i) standard and reagent origin, receipt, preparation, and use;

j) calibration criteria, frequency and acceptance criteria;

k) data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;

l) quality control protocols and assessment;

m) electronic data, software documentation and verification, software and hardware audits, backups; and

n) method performance criteria including expected quality control requirements.

2.5 Data Retention of Administrative Records

The following administrative records are also retained:

a) personnel qualifications, experience and training records;

b) records of demonstration of capability for each analyst; and

c) a log of names which include the initial and signatures for all individuals who are responsible for signing or initialing any laboratory record.

2.6 Collating Client Folders

The retention of data records mentioned above are retained in a number of locations. A large portion of the data associated directly with the final analytical data results is stored in the client file.

2.6.1 The following information is stored, maintained and retained in the client files as follows:

- Computer generated chain-of-custody,
- Amended chain-of-custody (if present),
- Client chain-of-custody,
- Sub-contract laboratory chain-of-custody (if present),
- Internal/evidentiary chain-of-custody (if present),
- Work order information (if present),
- Sample Receipt checklist,
- Sample Receipt checklist fax confirmation,
- Final Alpha reports,
- Alpha QA/QC (if present),
- Copy of EDD report (if present),
- Final sub-contract lab reports (if present),
- Sub-contract lab QA/QC (if present),
- Alpha invoice-always make sure than an invoice is present,
- Sub-contract lab invoices (if present),
- Raw Data,
- Final report raw data (initials of the analyst indicating final data are indicated on all of the sheets),

- Screen Reports, re-runs, etc. (indicated on the top sheet),
- Air bills,
- Correspondence, and
- Report of e-mail (pdf file) confirmation.

2.7 Files are scanned as pdf files and hard copy data are retained for approximately one year. All data can be accessed from the LIMs server as a scanned electronic copy.

REPORT CHECK-OUT LIST
Table D.2-1

REPORT NUMBER	NAME	DATE CHECKED-OUT	DATE RETURNED

Appendix D

Standard Operating Procedure

SOP D.3
Document Flow

1.0 LABORATORY SAMPLE DOCUMENT FLOW

1.1 This flow diagram is to assist all personnel in understanding document production flow from sample receipt through analysis to the final report.

2.0 STANDARD OPERATING PROCEDURE

2.1 Sample Receipt - Sample Custodian

Documents: Chain-of-Custody, sample receipt checklist, air bills/shipping manifests, and sample receipt log.

2.2 Sample Storage - Sample Custodian

Documents: Refrigerator Temperature Log and evidentiary COC records.

2.3 Sample Preparations - Extraction Chemist

Documents: Semi-volatile extraction logbook, volatile sample extraction logbook, metals digestion logbook, standards reagent logbook, and balance logbooks.

2.4 Sample Analysis - Analyst

Documents: Instrument sequence logs, maintenance logs, quantitation reports, chromatograms, calculations, draft reports, instrument document control logbook, calibration reports, tunes, corrective action reports, and QC data reports.

2.5 Data Review - Lab Director/QA officer.

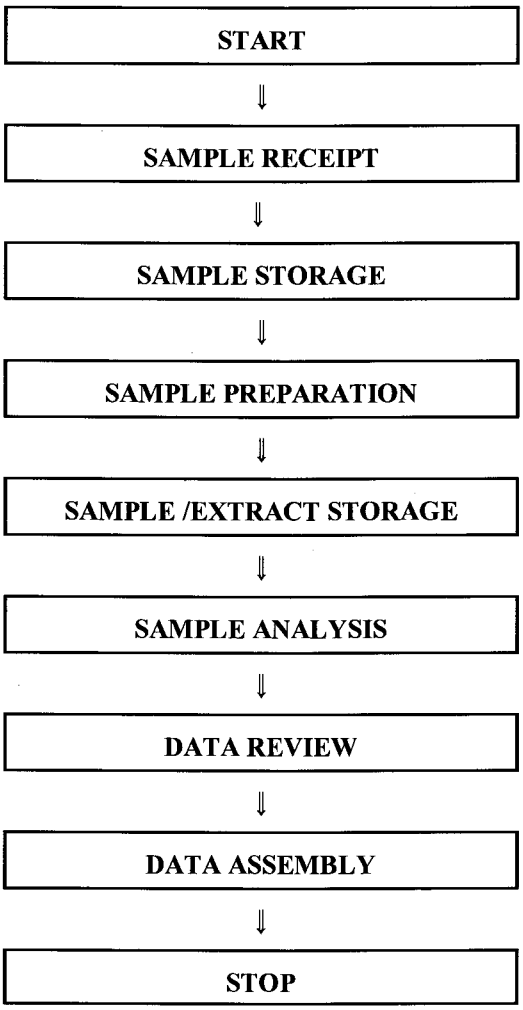
Documents: All previous records, plus: final reports, archived SOPs, correspondence relating to laboratory activities, corrective action reports, proficiency test results and associated raw data and results of data review, verification and cross checking procedures.

2.6 Assembly - Document Control Officer

Documents: All

FIGURE D.3 -1

DOCUMENT FLOW PROGRAM



Appendix D

Standard Operating Procedure

SOP D.4
Procedure for the Preparation, Review, Approval, Revision and Distribution of the QAM, SOP's and other Technical Documents

1.0 PROCEDURE FOR THE PREPARATION, REVIEW, APPROVAL, REVISION AND DISTRIBUTION OF THE QAM, SOP'S AND OTHER TECHNICAL DOCUMENTS

1.1 It is of fundamental importance and a primary objective that our QA manual, SOP's and other technical documents follow strict adherence to established guidelines for their preparation, review, approval, revision and distribution in maintaining uniformity and consistency of laboratory activities and the documentation that these procedures were being followed historically.

2.0 STANDARD OPERATING PROCEDURE

2.1 This procedure is intended to ensure that all records required under the National Environmental Laboratory Conference (NELAC), Chapter 5 Systems, are retained, as well as establishing the procedures for the control and documentation through a document control system.

2.2 This procedure ensures that all standard operating procedures, manuals, or other technical documents clearly indicates the time period for which the procedure or document was in force.

2.3 SOP formats are modeled after suggestions from the National Environmental Laboratory Conference (NELAC). In addition, the USEPA, Quality Assurance Management Staff (QAMMS), has written guidelines and specifications for elements of a QA plan and recommended formats to be followed and, specifies how plans should be reviewed and approved.

2.4 Document Control

All quality system documents such as the QA Manual, SOPs, Quality Assurance Project Plans (QAPP's) and other technical documents are prepared using a document control format placed in the upper right-hand corner of each document page. This document control number uniquely identifies all quality system documents. The document control number includes the following information:

- Laboratory Name,
- Section Number,
- Revision Number,
- Date (of revision), and
- Page number and total pages of the document

Document control is a key element for referencing and archiving active and historical technical procedures.

2.5 Elements of a QA Manual and QAPP

Each of the sixteen items listed below must be considered for inclusion in each QAPP and are the minimum requirements for a QA plan:

1) Title page with provision for approval signature,
2) Table of contents,
3) Project/plan description,
4) Project/plan organizations and responsibility,
5) QA objectives for measurements data in terms of precision, accuracy, completeness, representatives and comparability;
6) Sampling procedures,
7) Sampling custody,
8) Calibration procedures and frequency,
9) Analytical procedures,
10) Data reduction, validation and reporting,
11) Internal quality control checks and frequency,
12) Performance and system audits and frequency,
13) Preventive maintenance procedures and schedules,
14) Specific routine procedures to be used to assess data precision, accuracy and completeness of specific measurement parameters involved,
15) Corrective actions, and
16) Quality assurance reports to management

2.6 Standard Operating Procedure

2.6.1 Analytical SOP's are written for each accredited test method. These are maintained in the Procedure Manual. The Procedure Manual consists of copies of the referenced test method as well as the in-house written analytical SOP. In cases where modifications to the published test method has been made or where the referenced test method is ambiguous or provides insufficient detail, these cases are described in the SOPs as Clarification Boxes. The following elements are addressed and documented in each analytical SOP. They are as follows:

1) Identification of Test Method,
2) Applicable Matrix or Matrices,
3) Method Detection Limit,
4) Scope and Application,
5) Summary of Method,
6) Definitions,
7) Interferences,
8) Safety,
9) Equipment and Supplies,
10) Reagents and Standards,
11) Sample Collection, Preservation, and Storage,
12) Quality Control,

13) Calibration and Standardization,
14) Procedure,
15) Data Analysis and Calculations,
16) Method Performance,
17) Pollution Prevention,
18) Data Assessment and Acceptance Criteria of QC Measures,
19) Corrective Actions for Out-of-Control Data,
20) Contingencies for Handling Out-of-Control or Unacceptable Data, and
21) Waste Management

2.6.2 Non-analytical SOPs are written primarily for those laboratory activities conducive to standardization and procedural formalization. They do not necessarily need to address all 21 elements required for an analytical SOP as stated above.

2.7 Preparation and Responsibilities

2.7.1 Standard Operating Procedures

2.7.1.1 It is the responsibility of the Laboratory Director, QA Officer, Supervisors, and all affected personnel to discuss the need for SOP's and other technical documents.

2.7.1.2 It is the responsibility of the Laboratory Director, Laboratory Manager and QA Officer to ensure that all personnel, either technical or non-technical staff, are implementing the tasks described in an SOP, and/or are made individually aware that changes to an SOP has occurred.

2.7.1.3 SOP's and other technical documents will continue to be written revised and distributed as laboratory activities change with time. A copy (paper or electronic) of the updated SOP is made available in close proximity to the work area of the affected personnel.

2.7.2 QA Manual

2.7.2.1 The QA Officer is responsible for the preparation of a written QA Manual that involves all phases of environmental test measurements. The QA Officer must ensure that the QA Manual contains procedures to document and report sufficient information for the assurance of precise, accurate and complete data generation.

2.7.2.2 It is the responsibility of the Laboratory Director, Laboratory Manager and QA Officer to ensure that all personnel, either technical or non-technical staff, are implementing the tasks described in the QA Manual, and/or are made individually aware that changes to the manual has occurred.

2.7.2.3 The QA Officer is responsible for the annual review of the QA Manual. However, the QA Manual may be revised more often and these revisions to the QA Manual are documented through the distribution of an Addendum to the QA Manual or the distribution of a new complete revision of the QA Manual.

2.7.2.4 The QA Officer is responsible for ensuring a copy (paper or electronic) of the QA Manual is made available in close proximity to the work area of the affected personnel.

2.7.3 QAPP's

2.7.3.1 Project Managers (PMs) working in close coordination with the QA Officer have a responsibility to see that a written QA Project Plan is prepared for projects requesting site/project specific plans. The elements of a QAPP are typically identified from the QA Plan and written as a document independent from the QA Manual.

2.8 Plan Review, Approval and Distribution

2.8.1 Review and Approval

2.8.1.1 The review and approval of quality systems documents are conducted by the Laboratory Director, Laboratory Manager, supervisors and/or the QA Officer.

2.8.1.2 Changes to documents are reviewed and approved by the same function as that performed by the original review.

2.8.1.3 The reviewing person has the authority to access any of the quality system documents and may use any additional pertinent background information upon which to base the review and approval process.

Note: If practical, the altered document or new text may be identified in the document or appropriate attachments.

2.8.1.4 Completion of reviews and approvals are shown by signatures

on the title page of the QA manual and/or a signature block at the end of the technical SOP.

2.8.1.5 The driving force behind revisions of the QA Manual or other technical documents are typically due to:

1) changing regulations regarding certification;
2) updates or revisions to existing methods of analysis;
3) the promulgations of new methods and/or lab procedures;
4) expansions or contractions of analytical capabilities and/or services;
5) changes in general laboratory policies or procedures; and
6) recommendations and/or findings, resulting from on-site laboratory inspections from external and internal audits.

2.8.2 Distribution

2.8.2.1 The QA Officer is responsible for the distribution of the QA manual and associated SOP's. The QA manual will be numbered or inventoried to monitor the distribution of this publication and for the purpose of updating those distributed documents to the affected organizations.

2.8.2.2 The QA Officer is responsible for ensuring only authorized editions of the technical documents, to include the QA manual and analytical SOPS, are available at all locations where operations essential to the effective functioning of the laboratory are performed.

2.8.2.3 The QA Officer is responsible for promptly removing invalid or obsolete documents to ensure against their unintended use.

2.8.2.4 The QA Officer is responsible for retaining for either legal or knowledge preservation purposes, e.g., for their historical value, obsolete documents.

2.8.2.5 The QA Officer is responsible for maintaining a master list identifying the current status and distribution of documents in the quality system to preclude the use of invalid and/or obsolete documents, see Fig D.4-1.

QA Manual Master List
Document Control
Inventory Log

Alpha Analytical, Inc.
Document: QA Manual
Rev:
Date:

Name	Distribution Number	Date Signed Out	Initial		Date Signed In	Initial
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					

Fig D.4-1

Appendix D

Standard Operating Procedure

SOP D.5
Laboratory Training Program

1.0 LABORATORY TRAINING PROGRAM

1.1 This SOP outlines requirements for initial and continuing demonstration of staff proficiency in the methods or procedures which they perform. The ultimate goal of Alpha's training program is to provide comprehensive, effective, consistent and documented training for employees to ensure reliable and efficient job performance.

2.0 STANDARD OPERATING PROCEDURE

2.1 Application and Definitions

2.1.1 Application

Many factors determine the correctness and reliability of environmental test methods performed by Alpha. These factors include contributions from such things as:

a) human factors;
b) accommodation and environmental conditions;
c) environmental test methods and method validation;
d) equipment;
e) measurement traceability;
f) sampling; and
g) the handling of samples.

The total contribution of these factors differ considerably between methods of analysis. These factors are taken into account when developing analytical methods of analysis, the selection of equipment, training and the qualification of the personnel associated with individual methods of analysis. Therefore, our training program is customized to the individuals needs and the degree of difficulty of a particular procedure.

2.1.2 Definitions

2.1.2.1 Required reading- Reading of documents, procedures or publications identified by the Laboratory Director, QA Officer, Supervisor or Trainer as necessary to fulfill the duties of the position.

2.1.2.2 Method/SOP Training- Used to train analysts to perform analyses without the supervision of the Laboratory Director or another qualified analyst. Also used to train any employee to a task implemented through an approved SOP.

2.1.2.3 Seminars- Classroom type training either led by a company representative or analytical/supply vendor.

2.1.2.4 Work Cells - A work cell is considered to be all individuals who see a sample through the complete process of preparation, extraction and analysis.

2.2 Summary

2.2.1 Several types of training tools are used for staff training, including: 1) Required reading, 2) Method/SOP training, 3) Seminars, 4) Vendor supplied training, 5) Individual mentoring by a senior staff member, 6) MDL/IDC studies, 7) Performance Evaluation (PE) samples and 8) Multi-Media Interactive Computer Presentation.

2.2.2 Training files are maintained by each employee for the current year and historical records are maintained by the Training Coordinator. These files contain all associated training documents.

2.2.3 Safety, when not the topic of the training session, will be stressed during the applicable training sessions.

2.2.4 All training conducted by Alpha is documented.

2.3 Responsibilities

2.3.1 Management Responsibilities

It is Alpha's policy that the Laboratory Director, Laboratory Manager, and QA Officer, are responsible for ensuring all staff members are trained accordingly. This is to include:

- initial and on-going or continuing training;
- ensures all staff members are supervised, competent and implementing the procedures described in the QA Manual and Procedural Manul;
- ensures staff members are made aware of changes to an SOP;
- ensures a copy (paper or electronic) of the updated SOP is available in close proximity to the work area;
- maintains current job descriptions for all personnel who manage, perform, or verify work affecting the quality of environmental testing;

- maintains records of the relevant authorization, competence, educational and professional qualifications, training, skills and experience of all technical personnel; and

- makes available the information regarding when the authorization and/or competence is confirmed.

2.3.2 Training Coordinator Responsibilities

The Training Coordinator is responsible for the implementation of the Training Program. The Training Coordinator will remind Trainers to conduct training for each staff member. It is the responsibility of the Training Coordinator to ensure that all historical staff training records are retained. It is the responsibility of the Training Coordinator to ensure that each staff member new and old are assigned the appropriate Trainers. It is the responsibility of the Training Coordinator to ensure that new staff members have been given a laboratory orientation to include required documentation found in the Training SOP.

2.3.3 Trainer Responsibilities

Each staff member is placed under the direct supervision of a senior staff member upon entering employment at Alpha. The senior staff member will conduct an orientation meeting at which time a training guide listing those training requirements will be discussed. The trainer will provide the new staff member with a training log along with this training program document which will list their required annual training. It is the responsibility of the senior staff member to ensure that assigned staff members under their guidance are given adequate training to perform their duties.

Trainers are generally assigned as follows:

- QA Officer will oversee general QA procedures for all staff members;
- LIMS Administrator will oversee all LIMS and PC training;
- GC/MS Supervisor will oversee all GC/MS analysts;
- IC/HPLC Supervisors will oversee all IC/HPLC analysts;
- GC/FID Supervisors will oversee all GC/FID analysts/extraction chemists;
- VOC Prep Supervisor will oversee all VOC extraction chemists;
- SV Prep Supervisors will oversee all SV extraction chemists;
- Metals Supervisor will oversee all metals and wet chemistry chemists;
- Sample Custodian will oversee all personnel associated with these duties; and
- Safety Officer will oversee safety training for all employees.

2.3.4 Trainee Responsibility

It is the responsibility of all Trainees to ensure that they have been adequately trained in their duties as prescribed in the various SOPs. It is the responsibility of the Trainees to ensure all training, to include initial and continuing training, has been properly documented by the Trainer and Training Coordinator.

2.4 Annual Training Requirements

2.4.1 Each staff member who performs sample preparation, analytical procedures or is a technical staff member of a work cell must demonstrate his/her ability to successfully execute each method. In order to qualify to perform a given analytical method, that staff member must, at a minimum, successfully process an IDC study. After initial qualification on a given method, staff proficiency is demonstrated on a continuing basis. At least annually each staff member who performs a method must successfully produce a continuing demonstration of capability study.

2.4.2 Laboratory Ethics/Fraud Prevention and Data Integrity Program

Training courses in ethical and legal responsibilities including the potential punishment and penalties for improper, unethical or illegal actions are conducted and documented on an annual basis.

2.4.3 Laboratory Ethics/Fraud Prevention and Manual Integration Program

Training is conducted annually for all analysts regarding manual integration. This training outlines the use of manual integrations, how manual integrations are to be produced, documentation of manual integrations, analysts responsibilities and the potential penalty for improper, and/or unethical use of manual integrations.

2.5 Procedure

2.5.1 Seminars

Seminars are used to train employees on general topics such as health and safety. Seminars are generally conducted by the Laboratory Director, QA Officer or a Laboratory Supervisor.

Seminar topics and course objectives will be approved by the Laboratory Director, QA Officer or Supervisors.

Seminar attendance will be assigned by the Laboratory Director, QA Officer or Supervisors, and notices will be sent to all affected employees.

Upon completion of the seminar, the individual conducting the seminar will ensure the seminar is documented on the individual training records of all attendees.

2.5.2 Required Reading

Required reading is used to convey important information to the staff. Required reading is of two types: 1) reading which does not require attendance at a seminar or "hands on" experience; and 2) reading which is part of mandatory attendance at a seminar. Typical required reading would be such things as: 1) EPA regulatory information; 2) company polices; 3) technical articles; and 4) SOPs which the employee performs. The trainer will document these requirements.

2.5.3 Method/SOP Training

This form of training is used for new employees, training of analysts for new methods and SOPs, and on-going training. The training is documented on their individual training records.

2.5.4 Vendor Training

Employees may be trained by a Vendor representative either at our facility or off-site. If this training is conducted at our facility, the training is documented on their individual training record.

2.6 Training

2.6.1 General

Each new employee is given a personal laboratory notebook. This notebook is a standard laboratory notebook for employees to use as they deem necessary. Alpha encourages employees to write notes in this logbook which may help them understand the required material.

In addition, each employee is given a Personal Training Logbook. This is a standardized logbook used by all employees to document laboratory wide required training. General topics to be included in a Personal Training Logbook include:

- dates and descriptions of training,
- Detailed information regarding the training topics discussed,
- Changes to a method/SOP or general laboratory practice or policy,
- Audit deficiencies, and
- Documentation of annual training.

All training is assigned by the Laboratory Director, QA Officer or Supervisor. All new employees will be under the direct supervision of a senior staff member for their initial and continuing training. SOP training for non-analysts are under the direct supervision of a senior staff member.

2.6.2 Initial Demonstration of Proficiency

A new analyst/extraction chemist is one who has not met the training requirements for a method or any analyst/extraction chemist who has not performed the method for greater than 1 year. Before a new analyst/extraction chemist can perform work independently on a method, the following steps should be completed:

- the analyst/extraction chemist will read all pertinent QA and method SOPs, EPA methods, manual or other documents as assigned by the trainer;
- the analyst will perform a minimum of 2-4 analytical sequences under the direct supervision of an experienced analyst;
- the extraction chemist will perform a minimum of 2-4 extraction batches under the direct supervision of an experienced extraction chemist; and
- the analyst will complete the outlined training tasks, including an MDL/IDC study.

2.6.3 Continued Demonstration of Proficiency

Each analyst/extraction chemist who has met the initial training criteria for a method must demonstrate and document continued proficiency by at least one of the following once per year:

- acceptable performance of a blind sample;
- another demonstration of capability, i.e. in-house PE;
- successful analysis of a blind performance sample on a similar test method using the same technology (e.g., GC/MS Volatiles by purge and trap for methods by either 524.2, 624 or 5035/8260); or
- at least 4 consecutive laboratory control samples with acceptable levels of precision and accuracy.

Training/Continuing Education Program

Statement of Training Responsibilities:
I have received, read, understood and will implement all relevant items described in the QA Manual, Revision No. 16.0 and all relevant addendums.

Signature:_____
Employee:_____ **Date:**_____
Years in Service:_____ **Issued:**_____
Department: _____ **Supervisor:** _____

#	Training Code	Description	Training Time	Date Completed	Employee Initial	Trainer Initial
1	RR/SEM	**QAM Vol. I, Section 3.0** General Statement of Policy				
2	RR/SEM	**QAM Vol. I, Section 4.0** Organization and Responsibility				
3	RR/SEM	**QAM Vol. I, Section 5.0** Quality Assurance Objectives				
4	RR/SEM	**QAM Vol. I, Section 6.0** Sampling Procedures				
5	RR/SEM	**QAM Vol. I, Section 7.0** Sample Custody				
6	RR/SEM	**QAM Vol. I, Section 8.0** Analytical Procedures				
7	RR/SEM	**QAM Vol. I, Section 9.0** Calibration Procedures and Frequency				
8	RR/SEM	**QAM Vol. I, Section 10.0** Instrument Maintenance				
9	RR/SEM	**QAM Vol. I, Section 11.0** Quality Control Checks				
10	RR/SEM	**QAM Vol. I, Section 12.0** Data Reduction, Validation and Reporting				
11	RR/SEM	**QAM Vol. I, Section 13.0** Corrective Actions				
12	RR/SEM	**QAM Vol. I, Section 14.0** Performance and System Audits				

Continuing Education Program

Employee: _____ **Issued:** _____

#	Training Code	Description	Training Time	Date Completed	Employee Initial	Trainer Initial
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Continuing Education Program

Employee: _____ **Issued:**_____

#	Training Code	Description	Training Time	Date Completed	Employee Initial	Trainer Initial
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						

Continuing Education Program

Employee: _____ **Issued:** _____

#	Training Code	Description	Training Time	Date Completed	Employee Initial	Trainer Initial
51						
52						
53						
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						

Continuing Education Program

Employee: _____ **Issued:** _____

#	Training Code	Description	Training Time	Date Completed	Employee Initial	Trainer Initial
76						
77						
78						
79						
80						
81						
82						
83						
84						
85						
86						
87						
88						
89						
90						
91						
92						
93						
94						
95						
96						
97						
98						
99						
100						

Certification
of
Initial/Continued Proficiency Requirement

Alpha Analytical, Inc.
255 Glendale Ave., Ste 21
Sparks, NV 89431

I the undersigned, **CERTIFY** that:

1) I have read, understood, and agree to perform the most current version of the test method, standard operating procedure and to keep current the initial and continued proficiency requirements for the following:

Method	**SOP**			**Initial**
	Doc No	**Revision**	**Date Issued**	
EPA Method 524.2	E.20			
EPA Method 608/8081A	E.30			
EPA Method 8082	E.31			
EPA Method 624/8260B	E.33			
EPA Method 625/8270C	E.34			
EPA Method 8270C SIMs	E.35			
EPA Method 8260B SIMs	E.36			
EPA Method 8015B/D-DRO/NW-TPHdx	E.37			
EPA Method 8015B/D-GRO/NW-TPHgx	E.38			
EPA Method 1311 TCLP	E.50			
EPA Method 1312 SPLP	E.51			
DHS Method (WET) Waste Extraction Test	E.52			
EPA Method 3545 (ASE) Accelerated Solvent Ext.	E.55			
EPA Method 3510 Separatory Funnel	E.56			
Organic Acids	E.64			
EPA Method 300.0/9056	E.65			
EPA Method 314.0	E.66			
EPA Method 9060A/SM5310C	E.67			
Methane/Ethane	E.68			

Name _____ Signature _____ Date _____

Certification
of
Initial/Continued Proficiency Requirement

Alpha Analytical, Inc.
255 Glendale Ave., Ste 21
Sparks, NV 89431

I the undersigned, **CERTIFY** that:
1) I have read, understood, and agree to perform the most current version of the test method, standard operating procedure and to keep current the initial and continued proficiency requirements for the following:

Method	**SOP**			**Initial**
	Doc No	**Revision**	**Date Issued**	
EPA Method 200.8/6020 (Metals)	E.60			
EPA Method 3015 Microwave Digestion	E.70			
EPA Method 3051 Microwave Digestion	E.71			
EPA Method 200.2/3010 Block Digestion	E.72			
EPA Method 120.1/9050A/SM2510B (Conductivity)	E.75			
EPA Method 150.2/9040C/9045D (pH)	E.76			
Standard Method SM4500NH3 D (Ammonia/TKN)	E.77			
EPA Method 180.1 (Turbidity)	E.78			
Standard Method SM2540C (TDS)	E.80			
Standard Method SM2540D (TSS)	E.80			
Standard Method SM2540B (TS)	E.80			
ASTM 2216 (Percent Dry Weight and Percent Moisture)	E.81			
EPA Method 1664A (Oil and Grease)	E.82			
Standard Method SM2310B (Acidity)	E.85			
Standard Method SM2320B (Alkalinity)	E.86			
EPA Method 7196A/SM 3500-Cr D	E.90			
Standard Method SM4500-S D (Sulfide)	E.92			
Standard Method SM4500-Cl G (Residual Chlorine)	E.93			
EPA Method 410.4/SM 5520-D (COD)	E.94			
EPA Method 365.3/SM4500P E (Total Phosphorus)	E.95			
Standard Method SM3500-Fe D	E.96			

Name _____ Signature _____ Date _____

Certification
of
Education/Technical Background

Alpha Analytical, Inc.
255 Glendale Ave., Ste 21
Sparks, NV 89431

I the undersigned, **CERTIFY** that:

1) The educational and/or training requirements as specified in Alpha's QAM have been meet.

2) The representation of my college degree and/or additional training is correct.

Degree	School of Degree	Date

Name	Signature	Date

PERFORMANCE EVALUATION
(PE)

DATA

Study Number/Date	Analyte/Method	Acceptance (Yes/No)

INITIAL DEMONSTRATION OF CAPABILITIES
(IDC)

SUMMARY
DATA

Method	SOP	IDC Date

METHOD DETECTION LIMIT
(MDL)

SUMMARY
DATA

Method	SOP	MDL Date

Appendix D

Standard Operating Procedure

SOP D.6
Signature Log

1.0 EMPLOYEE SIGNATURE/INITIAL LOG

1.1 An employee signature and initial log is recorded and maintained by Alpha in order to identify personnel from their initials or signatures on laboratory documents. The list contains the analyst's typed names, initials, written signatures, and written initials.

TABLE D.6 - 1

LABORATORY SIGNATURE LIST

Name	Initials	Signature	Initials
Ami Awano	AA		
Barbara Steele	BS		
Behrooz Aryainejad	BA		
Corinne Miner	CM		
Darin Hussey	DH		
David Maestas	DM		
Emily Steele	ES		
Elizabeth Adcox	EA		
Guanzhen Ji	GJ		
Jennifer Webster	JW		
Jeff Yoshimoto	JY		
John Vasquez	JV		
Joseph T Simonsen	JT		
Joseph Mauro	JM		
Jason Herrmann	JH		
Kathryn Murray	KM		
Latricia Edrosa	LE		

Name	Initials	Signature	Initials
Michael Aseltine	MA		
Melanie Wickham	MW		
Rickey Overton	RO		
Randy Gardner	RG		
Roger Scholl	RS		
Reyna Vallejo	RV		
Tammy Brace	TB		
Tara Dickinson	TD		
Tasha Pascal	TP		
Tom Wickham	TW		
Walter Hinchman	WH		
Wei Wu	WW		
Zhen Jin	ZJ		

Appendix D

Standard Operating Procedure

SOP D.7
Instrument Sequence Log

1.0 INSTRUMENT SEQUENCE LOGBOOK RECORD KEEPING PROCEDURE

1.1 Quality control can only be proven by the documentation that it exists. QC data, therefore, is fundamental in the operation, implementation and maintenance of a QA plan. The need for a simple yet efficient procedure for this activity is paramount in reconstructing historical analytical records.

2.0 STANDARD OPERATING PROCEDURE

2.1 For each instrument there is an associated analytical data control record keeping file system. This record keeping file system is uniquely associated with a particular instrument for the sole purpose of reconstructing historical analytical records.

2.2 Each analytical run made on an instrument is partially or completely documented in the Instrument Sequence Logbook. The following is a description of how to maintain and document these analytical runs.

2.3 At the end of the analytical sequence a photocopy of the instrument sequence logbook is placed at the beginning of the analytical quantitation reports. This serves as an index to the data which follows.

2.4 Analytical runs are placed in chronological order as they were analyzed on the analytical sequence log.

2.5 Final data, which is placed in the client file, need not be photocopied. However, data such as CV's, tunes, blanks and other QC data should be included in the logbook with the analytical sequence data.

2.6 The only exception to this policy is the final data which is placed into the client file.

2.7 The reconstruction of an analytical sequence(s) is easily accomplished by the use of this record keeping system and the associated client files.

2.8 This record keeping system also serves as a secondary backup to the original instrument logbook.

Appendix D

Standard Operating Procedure

SOP D.8
Maintenance Log

1.0 INSTRUMENT SEQUENCE AND MAINTENANCE LOGBOOK

1.1 All analytical instruments have two separate log books: 1) the Instrument Sequence Logbook; 2) and the Maintenance Logbook. The log books are annotated by the analyst to track and monitor all activities associated with that particular instrument. Complete documentation is a mandatory criteria that all personnel abide by

2.0 STANDARD OPERATING PROCEDURE

2.1 Instrument Sequence Logbook

This is not a complete list of all the types of activities which can be documented in the log book. However, the following is a list of the minimum information which should be annotated on a daily basis.

- Date;
- Instrument conditions, if they have been changed from the previous days conditions;
- Minor instrument adjustments such as changing the multiplier etc.;
- Full descriptions of each analytical run including: sample/client identification, amount injected or purged, analytical run# or file ID;
- Initials on each page; and
- If the instrument is operating other than normal, state conditions.

2.2 Instrument Maintenance Logbook

Any type and description of the maintenance performed on an instrument should be annotated in this book. There are no required information; however, common sense should indicate the types of entries that should be placed into this logbook.

2.3 All log book entries are documented with the date and the initials of the person making the entry.

Appendix D

Standard Operating Procedure

SOP D.9
Analytical Balance Logbook

1.0 ANALYTICAL BALANCE LOGBOOK

1.1 Balances are the primary analytical test instrument for several gravimetric methods of analysis and are crucial instruments in support of various other analytical methods. In either case, final quantitative results are dependent on their accuracy and the need to track, monitor, and document their status is important to maintaining data integrity.

2.0 STANDARD OPERATING PROCEDURE

The following is a description of practices and procedures used to monitor analytical balance accuracy and how this information is documented.

2.1 Daily Monitoring and Accuracy Checks

2.1.1 Purpose - to ensure quantitative results produced by the analytical balances are accurate.

2.1.2 Frequency - Daily or before use with S - class weights.

2.1.3 Procedure - Daily balance checks, using two S class weights chosen to bracket the anticipated target weight, are recorded in the balance logbook.

2.1.4 Acceptance Criteria - The results of the daily accuracy check must be within the general performance criteria of ±0.1% of the targeted weight value or ±0.5mg, which ever is larger, unless method-specified guidance exists.

2.1.5 Corrective Action - If the results are not within the specified guidelines:

i. the balance is removed from service until repaired; or

ii. the balance can be used if a correction factor can be reliably established and maintained.

2.2 Semi-annual Scheduled Maintenance and Traceability Check

2.2.1 Purpose - required to ensure quantitative results are accurate using second source balance weights to verify accuracy.

2.2.2 Frequency - twice a year (semi-annually).

Note: NELAC requires an annual servicing by a certified technician.

2.2.3 Procedure

2.2.3.1 A analytical balance service company is contracted to provide semi-annual preventative and scheduled maintenance. This service call includes cleaning, lubricating, and adjusting all balances to the original manufactures specifications and testing for errors. In addition, built in weights are cleaned and tested for errors.

2.2.3.2 After balances have been serviced, they are calibrated and checked against NIST traceable weights to verify accuracy. The calibration also includes a linearity and cornerload check.

2.2.3.3 Balances are then certified for use with letters certifying accuracy.

2.2.3.4 All records of repair and maintenance activities, including the documentation of certificates of accuracy, are kept by a lab technician responsible for these duties.

2.2.4 Acceptance Criteria - Manufacturers specification.

2.2.5 Corrective Action - If the results are not within the specified guidelines:

i. the balance is removed from service until repaired; or

ii. the balance can be used if a correction factor can be reliably established and maintained.

2.3 S Class Weights.

2.3.1 S class weights used for daily balance accuracy check are certified at a minimum every 5 years for accuracy.

2.3.2 These weights are sent to a company certified under ISO/IEC 17025-1999 ANSI/NCSL Z540-1-1994 program to perform this procedure.

2.3.2 They use reference standards traceable to NIST using NIST IR 6969 SOP 4 Double Substitution Weighing Design Protocol.

TABLE D.9-1
GENERAL GUIDELINES FOR BALANCE WEIGHT ACCEPTABILITY

Balance Model	Location	Alpha ID	Sensitivity	True Weight	Range of Acceptability	Criteria
Mettler AB-204S	organic ext lab	1A	0.0001g (± 0.1mg)	0.0050 g 5.00 g	0.0052 - 0.0048 g 5.005 - 4.995 g	4 % * 0.1 %
Mettler PM-300	organic ext lab	2A	0.01 g (± 10mg)	0.500 g 200.0 g	0.49 - 0.51 g 199.8 - 200.2 g	2 % * 0.1%
Mettler PB602S	volatile prep lab	3A	0.01g (± 0.1mg)	5.00 g 50.0 g	5.01 - 4.99 g 50.05 - 49.95 g	0.2 % * 0.1 %
Mettler AJ-100	volatile prep lab	4A	0.0001g (± 0.1mg)	0.0050 g 5.00 g	0.0052 - 0.0048 g 5.005 - 4.995 g	4 % * 0.1 %
Mettler AB-204S	inorganic wet chem	5A	0.0001g (± 0.1mg)	5.00 g 50.0 g	5.005 - 4.995 g 50.05 - 49.95 g	0.1 % 0.1 %
Mettler AB-204S	inorganic Metals	6A	0.0001g (± 0.1mg)	5.00 g 50.0 g	5.005 - 4.995 g 50.05 - 49.95 g	0.1 % 0.1 %
Mettler AB-204S	inorganic gravimetric	7A	0.0001g (± 0.1mg)	5.00 g 50.0 g	5.005 - 4.995 g 50.05 - 49.95 g	0.1 % 0.1 %
Sartorius BP-310S	TPH-D ext lab	8A	0.001g (± 1mg)	0.500 g 50.0 g	0.501 - 0.499 g 50.05 - 49.95 g	0.2 %* 0.1 %
Mettler AB-204S	TPH-D ext lab	9A	0.0001g (± 0.1mg)	0.500 g 50.0 g	0.5005 - 0.4995 g 50.05 - 49.95 g	0.1 % 0.1 %

Note: Criteria is established as 0.1% or 0.5mg, whichever is larger.
Note: * Criteria check is at its limit of sensitivity.

Appendix D

Standard Operating Procedure

SOP D.10
Extraction/Digestion Logbook

1.0 SAMPLE EXTRACTION/DIGESTION LOG

1.1 All sample preparations are documented in the Sample Extraction Logbook. Any changes in the protocol during preparation must be authorized by the Laboratory Director.

2.0 STANDARD OPERATING PROCEDURE

2.1 The following information is recorded by the LIM System:

- Batch No.;
- Matrix;
- Analysis;
- Date;
- Page;
- Extraction method;
- Cleanup procedure;
- Solvent;
- Initials of extraction chemist;
- Crucible number if applicable;
- AAI Lab ID No.;
- Client ID;
- Sample weight information;
- Remarks on odor or color, etc.;
- Information on surrogates or spike solution added; and
- Information on any specific difficulties (i.e. emulsions) with sample.
-

2.2 The extraction or digestion procedure used is referenced with adequate information to repeat the procedure at a later date.

- 3510 - Separatory funnel extraction;
- 3545 - Accelerated solvent extraction;
- 3550 - Sonication extraction;
- 3511 - Aqueous micro-extraction;
- 3570 - Soil micro-extraction;
- 5035 - Closed system purge-and-trap of soils;
- 200.2 - SDWA metals block digestion;
- 3015 - Microwave assisted digestion of waters; and
- 3051 - Microwave assisted digestion of soils.

2.3 The sample cleanup procedure used is referenced such as:

- (AW) Sulfuric acid cleanup (SW 3665A);
- (SG) Silica gel cleanup (SW 3630C);
- (SGM) Modified silica gel cleanup (NWTPH-dx);

- (Al) Alumina cleanup (SW3610B);
- (Al-TPH) Alumin cleanup for TPH) (SW3611B); and,
- (Ba/Ag/H) Perchlorate pre-treatment cleanup (314.0 x-up).

2.4 At the end of an extraction, the extracted material is labeled with the AAI sample number, solvent, date, initial and analytical method.

2.5 If an error is made, a single line is drawn through the information, dated and initialed.

2.6 LIMS Procedure for starting a Preparation Batch

2.6.1 Single click left button of mouse on "sample prep";

2.6.2 Click left button of mouse on "Add" in the upper right corner of the screen;

2.6.3 Type in the method number followed by an underline and P or B (no spaces) in the space provided, designated "Prep Code" i.e., 515_P or use select key;

2.6.4 Choose the name of the technician, who will be extracting these samples, by clicking on the downward pointing arrow adjacent "technician";

2.6.5 If all samples available are to be extracted click on "User Select". If samples are not to be extracted deleted them from the user select screen.

2.6.6 Type in the necessary number of matrix spike samples in this column by typing the client ID followed by the client number and MS, i.e., 09101540-01 AMS;

2.6.7 Click on "Reagents/Spikes" positioned left of center at the top of the screen;

2.7 After all spikes and surrogates are recorded click "main" at the top left of the screen to return to the main page of this prep Batch.

2.8 Choose an "end date" for when this batch will be ready for analysis and enter "end date".

2.9 Exit the file by using the icon in the upper left hand corner. Upon exiting this file the computer will ask to "complete the status of this Prep Batch report," yes or no. Once this has been completed, the Prep Batch and all associated samples are annotated in the LIMS system.

Appendix D

Standard Operating Procedure

SOP D.11
Annual Thermometer Calibration Procedure

1.0 ANNUAL THERMOMETER CALIBRATION PROCEDURE

1.1 Method SM250B: Determination of Temperature Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998.

2.0 Standard Operating Procedure:

2.1 Temperature readings are used to monitor the thermal preservation of all samples received at the laboratory and for environmental samples stored in the laboratory. In addition, thermometers are used in a variety of other analytical techniques in the laboratory such as in the calculation of alkalinity, in studies of saturation and stability with respect to calcium carbonate, etc.

2.2 For laboratory operations which report temperature, and for reference thermometers, temperature measurements should be made preferably with a spirit-filled or digital thermometer. The spirit-filled thermometer should have a scale marked for every 0.1 to 0.2°C, with markings etched for glass capillary thermometers.

2.3 Glass thermometers should be used according to the type of thermometer.

2.3.1 Partial immersion thermometers - are immersed in the fluid to the level (mm) marked on the stem or to the inscribed ring.

2.3.2 Total immersion thermometers - are immersed in the fluid to the level of the temperature being measured. For example, if you are checking a temperature of 35° C, the 35° C increment of the thermometer stem and mercury level will be just below or above the top of the fluid.

2.3.3 A complete immersion thermometer - would be completely immersed in the fluid.

2.4 Laboratory thermometers are calibrated annually against a National Institute of Standards and Technology (NIST) reference thermometer or NIST traceable thermometer.

2.5 Thermometers are assigned a unique identifier when calibrated and placed into service. This identifier is an internal sequential number assigned by QA and is used to identify the thermometers for calibration and temperature monitoring logs.

2.6 Quality Control

2.6.1 Liquid filled thermometers are calibrated annually as a minimum frequency and quarterly for electronic thermometers as a minimum frequency. A calibration factor is assigned with each calibration event.

2.6.2 In order for the NIST reference thermometer to be used for the internal calibration of thermometers it should meet the following criteria:

- the reference thermometer should have divisions of 0.1 to 0.2° C and
- have listed NIST calibration points at 0°C, 100°C and 180°C.

2.7 Calibration Procedure

2.7.1 Hot Water Bath Thermometers

2.7.1.1 Partial emersion reference thermometer

When calibrating thermometers for general use above room temperature, a standard water bath is heated to approximately 100°C or at the normal operational temperature of the batch. Place the (partial emersion) reference thermometer and the thermometers to be calibrated in the water batch and adjust them to their appropriate level in the fluid. Compare the values of the working thermometers against that of the reference thermometer at the temperature of interest.

2.7.2 Oven Thermometers

2.7.2.1 Total emersion reference thermometer

When calibrating thermometers for use in ovens, heat an oven to approximately 104°C or 180°C. Place the (total emersion) reference thermometer and the thermometers to be calibrated in the oven thus the reference thermometer is totally emersed. Compare the values of the working thermometers against that of the reference thermometer at the temperature of interest.

2.7.3 Refrigerator Thermometers

2.7.3.1 Partial emersion reference thermometer

When calibrating thermometers for general use in a refrigerator, a standard water bath is chilled with ice to approximately 4°C. Place the (partial emersion) reference thermometer and the thermometers to be calibrated in the water bath and adjust them to their appropriate level in the fluid. A second method of calibrating this type of thermometer, would be to place them in a refrigerator at approximately 4°C and calibrate the thermometers as a group. Compare the values of the working thermometers against that of the reference thermometer at the temperature of interest.

2.7.4 Freezer Thermometers

2.7.4.1 Total emersion reference thermometer

Thermometers are calibrated at approximately -15°C when calibrating thermometers for use in sample freezer. Place the (total emersion) reference thermometer and the thermometers to be calibrated in the freezer thus the reference thermometer is totally emersed. Compare the values of the working thermometers against that of the reference thermometer at the temperature of interest.

2.7.4 Complete the information on the calibration form.

2.7.5 Identify each thermometer with the assigned unique identification number. Indicate the date of calibration, temperature of normal use, calibration factor, serial numbers of the reference thermometer and working thermometer, and analyst performing the calibration. The calibration factor is the difference between the working thermometer and the reference thermometer at the point of interest. It is the number of degrees that have to be added or subtracted from the measured temperature to get the true temperature.

2.8 Calibration

2.8.1 Calibrations factor, CF
CF = RT - WT
RT = Temperature of the reference thermometer
WT = Temperature of the working thermometer

2.8.2 If the calibration factor is positive, that amount is added to the measured temperature to get the true temperature.

2.8.3 If the calibration factor is negative, that amount is subtracted from the measured temperature to get the true temperature.

2.8.4 If the calibration factor is greater than ±2°C that particular thermometer should be discarded and taken out of service and replaced with a newly calibrated thermometer.

2.9 Documentation

2.9.1 Calibrations Form - This form, Figure D.11-1, is used to document the calibration of laboratory thermometers. A copy of this form is maintained by the QA department.

Thermometer Calibration Form

	Ref Thermometer	Ref Thermometer SN	Ref Thermometer Type	
	XYZ Instrument Co	xxxxxxx	Partial Immersion	
Therm Style	Thermometer ID	Serial Number (SN)	Thermometer Type	Date in Service
Electronic	SAR-1B	xxxxxxx	Stem	1/1/2009

Note: Electronic - calibrate quarterly at two temperatures that bracket the temperature against NIST- traceable thermometer. If only a single temp is used, calibrate at the temperature of use. Liquid in glass-annually.

	1st Quarter Cal		2nd Quarter Cal		3rd Quarter Cal		4th Quarter Cal	
Calibration Date	Date:		Date:		Date:		Date:	
	Ref Therm	Cal Therm	Ref Therm	Cal Therm	Ref Therm	Cal Therm	Ref Therm	Cal Therm
Temp #1 °C								
Temp #2 °C								
Temp #3 °C								
Average Temp								
CF=ref-therm								

Initials							
Acc of Ref Therm at temp of interest							

Comments _____

Figure D.11-1

Appendix D

Standard Operating Procedure

SOP D.12
IR Thermometer Procedure

1.0 IR Thermometer Standard Operating Procedure

1.1 Reference - Users manual for the Linear C-1000 IR thermometer

2.0 Applicable Matrix or Matrices

This method is applicable to the determination of temperature, using an IR gun, on essentially any type of material container.

3.0 Method Detection Limit

The IR gun has a temperature sensitivity of ± 1°C or F.

4.0 Scope and Application

Thermal energy is radiated by all objects and a portion of this thermal energy is radiated as infrared energy. An IR gun is a temperature measuring device which consists of a hand-held probe with a lens to focus the infrared energy onto a detector. Once the infrared energy is detected it is converted by a microprocessor to temperature and is displayed. The unique benefits of measuring temperature with this type of IR probe are as follows:

a) measurements are made without physical contact,
b) measurements are made rapidly,
c) heat is not removed from the measured object so the accuracy of the readings are ossured,
d) Objects that are contaminated can be easily measured.

5.0 Summary of Method

An Infrared (IR) thermometer is used to determine and record sample temperature.

6.0 Definitions

6.1 Emissivity - The ratio of energy emission of an object being measured to that of a black object at the same temperature.

6.2 IR Gun Functions

6.2.1 ARROWS - used in Sample or Emissivity mode to increase or decrease the emissivity. Depressing either key will adjust emissivity in steps of 0.01 for six steps then switch to an accelerated mode for rapid adjustment.

6.2.2 AVERAGE - used to display the average temperature of readings taken in the Sample mode.

6.2.3 °C and °F - used to change the display units

6.2.4 CONTINUAL - used to enter Continual mode for constant monitoring of the target.

6.2.5 EMMISSIVITY - used to enter Emissivity mode.

6.2.6 MAXIMUM - used to display the maximum temperature reading obtained in either the Sample or Continual mode.

6.2.7 MINIMUM - used to display the minimum temperature obtained in either the Sample or Continual mode.

6.2.8 SAMPLE - used to enter sample mode and to take an individual reading of the target.

7.0 Interferences

7.1 Temperature measurements made at a distance greater than 3 times the sample size may affect the temperature reading. Measurements can be made at virtually any distance from the bottle. However, as the distance from the bottle is increased, the diameter of the measured area increases proportionally. When the 3:1 distance to size ratio is breached and the distance is greater than 3 times the sample size, than background temperature will start interfering with the determination of the sample temperature.

7.2 Measurements must be made perpendicular to the object being measured, as non-perpendicular measurements will slightly increase the measured area and the 3:1 distance to size ratio may not be maintained and could affect the displayed temperature.

7.3 Avoid contact of the IR gun cone with warm objects for more than a few seconds, as this could cause the signal to drift several degrees.

7.4 Prolonged readings of large, hot sources are also to be avoided.

8.0 Safety

The IR gun is used to measure sample containers which may be contaminated. Sample and sample containers need to be treated with caution. See appropriate SOPs for details. Also, see Alpha's Laboratory Safety/Hazardous Communications Manual and Chemical Hygiene Plan for additional information and details.

9.0 Equipment and Supplies

9.1 Linear C-1000 Infrared Thermometer

9.2 9 volt alkaline battery

10.0 Reagents and Standards

Not applicable.

11.0 Sample Collection, Preservation, and Storage

Not applicable. See the individual methods of analysis.

12.0 Quality Control

See D.11, Standard Operating Procedure for Annual Thermometer Calibration

13.0 Calibration and Standardization

See D.11, Standard Operating Procedure for Annual Thermometer Calibration and see section 14.5 below.

14.0 Procedure

14.1 Maintenance

A 9 volt alkaline battery is used to power the IR gun. When the battery needs replacing, a "Lo" appears on the LCD display. The battery is located in the probe. To gain access to the battery, first slide the probe off of the display unit. Lightly press down on the arrow on the battery cover while sliding the battery cover in the direction of the arrow. Replace the battery. To replace the cover, simply slide it back into the probe.

14.2 Modes of operation:

a) Sample, and

b) Continual.

For our purpose the IR gun should be placed in the Sample Mode. In this mode, a sample measurement is taken each time the SAMPLE key is pressed. The measurement remains on the LED display until another sample measurement is made or another mode is selected.

A running average is calculated of all the samples taken. The average temperature can be displayed by pressing the AVERAGE key. Pressing either the MAXIMUM or MINIMUM key will display the maximum or minimum temperature measured in any mode since the unit was turned on.

DO NOT RECORD THIS AS THE SAMPLE TEMPERATURE!

14.3 Measuring Temperature

14.3.1 To measure temperature, simply hold the probe perpendicular to the object being measured at a distance not greater than three times the size of the object and press "SAMPLE." It is important that this 3:1 ratio is maintained for accurate temperature measurements.

14.4 Calculating Distance

14.4.1 To measure an 8 inch sample bottle, hold the probe perpendicular to the bottle within 24 inches of the bottle.

14.5 Emissivity Adjustment

14.5.1 An IR gun temperature measuring instrument reports temperature by adjusting the measured temperature against the emissivity of the object being measured.

Emissivity is the ratio of energy emission of an object being measured to that of a black object at the same temperature which produces an emissivity constant. This ratio is unique to the surface material being measured. Therefore, IR guns measurements are adjusted by multiplying the measured IR temperature by this emissivity ratio to correct for differences in energy emissions.

Once the emissivity function on the IR gun is adjusted, the temperature reading on the IR gun display has then been corrected for errors associated with surface emission.

14.5.2 Adjusting emissivity

14.5.2.1 If the emissivity is known, enter the EMISSIVITY mode button and adjust the emissivity ratio using the ARROW key.

14.5.2.2 If the emissivity is unknown, it can be determined as follows:

14.5.2.2.1 Place a black sticker on the object to be measured.

14.5.2.2.2 Enter the Emissivity mode and adjust the emissivity to 1.0.

14.5.2.2.3 Save the new emissivity by exiting the Emissivity mode by pressing the EMISSIVITY key.

14.5.2.2.4 Measure the temperature on the sticker by pressing SAMPLE key and note the temperature.

14.5.2.2.5 Next measure an area next to the sticker by pressing the SAMPLE key.

14.5.2.2.6 If the reading is the same as the previous one, the emissivity is calibrated for the surface.

14.5.2.2.7 If it two temperatures are not the same, keep the probe pointed at the area next to the sticker. Press the down ARROW key. (An emissivity value will briefly appear on the display and then the temperature compensated with the new emissivity will remain. Note the reading.

14.5.2.2.8 If it is not the same temperature as obtained on the sticker, press the down ARROW key until the measurements matches that of the black sticker. At this point the emissivity is calibrated for the surface.

Note: If a black sticker cannot be used, flat black paint can be used. Paint a small area on the object to be measured and follow the procedure just described.

Emissivity Table
Table D.12-1

Material	Emissivity (%)
Glass	92
Glass, frosted	96
Plastic	99
Ice	97
Water	98
Wood	85
Rubber	95
Quartz	93

14.6 Procedure

14.6.1 Turn the IR gun "ON" using the switch located on the left side of the IR gun.

14.6.2 Place the IR gun to the SAMPLE mode.

14.6.3 Enter the emissivity.

14.6.4 Point the IR gun perpendicular to the sample at a distance no greater than 3 times the size of the object being measured.

14.6.5 Press SAMPLE and note the measured temperature for recording. Take the average of three consecutive measurements when recording temperature. DO NOT USE THE AVERAGE function key for this procedure.

Note: The final temperature recorded in not corrected if the IR gun has a correction factor (this is to maintain standardization across all temperature recordings in the laboratory.).

14.6.6 Turn the IR gun "OFF" using the switch located on the left side of the IR gun.

15.0 Calculations

Not applicable.

Note: Temperature is reported in °C for most applications

16.0 Method Performance

Not applicable.

17.0 Pollution Prevention

No solvents, acids or bases are used with this procedure. The sample containers which are being measured by the IR gun may be contaminated and need to be treated with caution. See appropriate SOPs for details. Also, see Alpha's Laboratory Safety/Hazardous Communications Manual and Chemical Hygiene Plan for additional information and details.

18.0 Data Assessment and acceptance criteria for quality control measures

Not applicable.

19.0 Corrective Actions for Out-of-Control Data

Not applicable.

20.0 Contingencies for Handling Out-of-Control or Unacceptable Data

20.1 Failed Instrument

See instrument maintenance and/or use another calibrated thermometer.

21.0 Waste Management

Reference Alpha Analytical's Sample Waste SOP.

Appendix D

Standard Operating Procedure

SOP D.13
Temperature Log

1.0 TEMPERATURE LOG

1.1 Thermometers are of primary importance for several analytical test procedures and are crucial instruments in support of various other analytical methods. In either case, final quantitative results are dependent on their accuracy and the need to track, monitor, and document their status is important to maintaining data integrity.

2.0 STANDARD OPERATING PROCEDURE (Thermometers)

2.1 All thermometers or thermisters used to monitor temperatures are calibrated against an NBS/NIST calibrated or traceable thermometer on an annual basis for liquid filled glass thermometers and quarterly for electronic thermometers.

2.2 Ovens (Spirit Filled Thermometers)

2.2.1 Each oven is assigned a calibrated thermometer and is identified using the same identification scheme as the oven. If possible, this identification number is written on the thermometer to avoid the switching of thermometers. If not the thermometer is identified by its serial number.

2.2.2 Oven thermometers are generally full immersion, spirit filled thermometers placed in a sand filled beaker to buffer oven temperature variations.

2.2.3 Placing these thermometers in a sand bath helps monitor actual temperature variations which may occur in environmental samples. Secondly this practice facilitates the reading of the thermometer and eliminates the temperature probe from coming into direct contact with a non-temperature equilibrated surface.

2.2.4 The sample custodian or other delegated person is responsible for monitoring and recording oven temperatures. This information is recorded on the Temperature Log.

2.3 Refrigerators (Steel Stemmed Thermometers)

2.3.1 Steel stemmed digital display refrigerator thermometers are particularly useful for easy reading. Each refrigerator thermometer is assigned a calibrated thermometer and is identified using the same identification scheme as the associated refrigerator. If possible, this identification number is written on the thermometer to avoid the switching of thermometers. If not the thermometer is identified by its serial number.

2.3.2 The refrigerator thermometer stems are placed through the septum of a 40 ml VOA vial or a 1 liter amber container filled with water in order to buffer

refrigerator temperature variations.

2.3.3 This practice helps monitor actual temperature variations which may occur in environmental samples. Secondly this practice facilitates the reading of the thermometer and eliminates the temperature probe from coming into contact with a non-temperature equilibrated surface.

2.3.4 The sample custodian or other delegated person is responsible for monitoring and recording refrigerator temperatures. This information is recorded on the Temperature Log.

2.4 Refrigerators (Wireless Thermometers)

2.4.1 Electronic thermometers or thermisters configured with a wireless data logger are particularly useful for the continuous monitoring of refrigerators. Each refrigerator with a wireless data recorder is assigned a calibrated thermister and is identified using the same identification scheme as the associated refrigerator. This identification number is written on the data logger for positive identification.

2.4.2 The refrigerator thermisters are placed through the septum of a 40 ml VOA vial or a 1 liter amber container filled with water in order to buffer refrigerator temperature variations.

2.4.3 This practice helps monitor actual temperature variations which may occur in environmental samples. Secondly this eliminates the thermister from coming into contact with a non-temperature equilibrated surface.

2.4.4 The sample custodian or other delegated person is responsible for monitoring and recording refrigerator and oven temperatures. This information is recorded daily 7 days a week in the Temperature Log book.

2.5 Temperature readings are recorded directly from the spirit filled or steel stemmed thermometers without making any thermometer corrections. However, thermometer calibration correction factors are written on the Temperature Log and maintained by the responsible person.

2.6 Alpha has established temperature range criteria for all ovens, refrigerators and freezers containing samples, sample extracts and standards.

2.7 The person taking temperature recordings will make all refrigerator, or oven recordings at approximately the same time each day to avoid additional variability in temperature recordings.

2.8 This person can make minor refrigerator/oven adjustments to the temperature control in order to compensate seasonal fluctuations, sample mass to be cooled or heated, or any other contributing factor. All adjustments are recorded in the comments section of the Temperature Log.

2.9 The Laboratory Director or Laboratory Manager must be informed of refrigerators or ovens with temperatures out side of their designated range, wildly fluctuating temperatures or abnormalities which might affect the sample integrity. All corrective actions and maintenance will be recorded on its log record.

2.10 The SCO is responsible for maintaining historical records.

Temperature Log

Oven/Refrigerator No:_____
NBS Certified Thermometer No:_____
Thermometer Serial No:_____
Correction Factor:_____

TDS Oven Temperature 180 ±2°C
TSS Oven Temperature 104 ±1°C
TS Oven Temperature 104 ±1°C

Refrigerator Temperature 0.1 - 6°C
Freezer Temperature -15 ± 5°C

	Monday			Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday		
Week	Date	Temp	Init	Date	Temp	Init	Date	Temp	Init	Date	Temp	Init	Date	Temp	Init	Date	Temp	Init	Date	Temp	Init
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					
16																					
17																					
18																					
19																					
20																					
21																					
22																					
23																					
24																					
25																					
26																					

Comments:_____

Appendix D

Standard Operating Procedure

SOP D.14
Procedure of Cold Storage Temperature Excursions

1.0 PROCEDURE FOR COLD STORAGE TEMPERATURE EXCURSIONS

1.1 Cold storage units require daily temperature monitoring to ensure samples and extracts are kept cool. Samples and extracts are refrigerated to minimize sample degradation and as a good laboratory procedure.

2.0 STANDARD OPERATING PROCEDURE

2.1 These guidelines describe the necessary steps to follow in the event of a temperature excursion or other abnormality associated with a cold storage unit.

2.2 Refrigerator temperatures should be kept within an ideal temperature range of >0°C to 6°C. A refrigerator's cold setting is adjusted in order to maintain its temperature in an acceptable range. Freezer temperatures should be kept within an ideal temperature range of -20°C to -10°C and ovens should be maintained according to their particular use.

2.3 If the refrigerator/freezer temperature continuously drifts outside the prescribed range of acceptability the following steps should be taken:

2.3.1 Notify the Laboratory Director and/or the QA Officer immediately;

2.3.2 Monitor the refrigerator or oven for a minimum of three consecutive days with a thermograph or wireless thermister to establish a real-time temperature baseline;

Note: A temperature excursion may be an isolated occurrence, therefore constant monitoring is required to document a more precise determination of a problem.

2.3.3 If the temperature excursions persist for three consecutive days then the samples or extracts located in that refrigerator or oven should be moved to a back-up and the out-of-control unit repaired or replaced; and,

2.3.4 If the Laboratory Director or QA Officer deems it necessary to circumvent the three day period at any time, they may do so.

Appendix D

Standard Operating Procedure

SOP D.15
Refrigerator Document Control

1.0 REFRIGERATOR DOCUMENT CONTROL

1.1 Refrigerator logs and the maintenance of these historical records is an important part in the overall continuity of sample integrity. Records are kept and maintained to ensure there is no breach in sample integrity or the process of documenting this.

2.0 STANDARD OPERATING PROCEDURE

2.1 Each refrigerator is assigned a one-time unique identification number to distinguish it from any other refrigerator in use by the laboratory. This identification number has the added feature in identifying refrigerators temporally.

2.2 Refrigerators/freezers are labeled with an identification number in the following format:

XXXNNZ

where;

XXX represents a 3-letter prefix unique to each type of refrigerator/freezer

such as;

SAR refers to sample refrigerator
SAF refers to sample freezer
STR refers to a standards refrigerator
STF refers to a standards freezer
EXT refers to an extraction refrigerator/freezer

and;

NN represents a two digit number identifying it from another refrigerator/freezer with the same prefix. Alpha uses the following sets of numbers (NN):

1-19	refers to sample refrigerators/freezers
20-40	refers to standard refrigerators/freezers
31-50	refers to extract refrigerators/freezers

and:

Z represents the refrigerator or freezer itself during a particular period of time.

For example:

If the VOC refrigerator, ID SAR-1A, happened to be replaced for whatever reason

the ID for the new refrigerator would be SAR-1B. By using this scheme, refrigerators which are replaced can be temporarily tracked. This is particularly useful when tracking samples throughout the lab. Samples go in a particular refrigerator and therefore the confusion of which refrigerator and how it was operating during a particular time period can easily be traced.

2.3 Refrigerator adjustments and replacements are all annotated on the specific temperature log and are kept as historical record. Tables D.15-1-through 3 lists all of our refrigerators, their particular identification and the types of samples or standards which are stored in them.

Refrigerator Identification Table
Table D.15-1A

Refrigerator Name	Use
SAR-1B	VOC water samples post analysis
SAR-2C	Contaminated VOC/TPH samples (in paint cans)
SAR-3A	8270/8081/8082 and general SV samples prior to extraction
SAR-4B	TPH/TOC water samples post analysis and non-extracted waters
SAR-5D	Laboratory prepared VOC trip and field blanks
SAF-6B	Air samples and methanolic air extracats
SAR-7A	TPH-E/TOC samples prior to analysis
SAR-8A	VOC water samples prior to screening and prepared sequences awaiting analysis
SAR-9B	Inorganic samples post analysis
SAR-10A	524.2 sample prior to analysis and storage after analysis
SAR-11A	TPH/VOC soil samples prior to analysis and storage after analysis
SAR-12A	VOC water samples after screening and prior to analysis and Alcohol waters
SAR-13A	Inorganic samples
SAR-14A	Department of Defense (DOD) samples
SAR-15B	Incoming sample (Sample Receipt)
SAR-16A	Dissolved Gases
SAR-17A	Alcohols not completed
SAR-18A	Incoming Sample Overflow
SAR-31B	Organic Acids

Refrigerator Identification Table
Table D.15-2

Refrigerator Name	Use
STR-20A	TPH exractable standards
STF-21B	VOC methanolic standards
STR-22A	TOC/Anions standards
STR-23B	Metals/Inorganic standards
STR-24C	VOC standards
STR-25B	8270 standards
STF-26C	VOC methanolic standards
STR-27C	Alcohols standards
STR-28A	ECD standards
STF-29C	524.2 standards
STR-30A	TPH/TOC standards
STR-32A	PEST standards
STR-33A	PCB standards
STR-34A	Metals standards

Refrigerator Identification Table
Table D15-3

Refrigerator Name	Use
EXT-31B	SV extracts
EXT-32B	
EXT-33C	ECD extracts
EXT-34B	SV extracts (autovials)
EXT-35B	SV extracts
EXT-36B	MeOH VOC soil extracts
EXT-37A	TPH extracts
EXT-38A	SV extracts requiring internal C-O-C procedures (DoD extracts)
EXT-39A	

Appendix D

Standard Operating Procedure

SOP D.16
Manual Automatic Dispensing Device (MVDD) Procedure

1.0 MECHANICAL VOLUMETRIC DISPENSING DEVICE (MVDD) PROCEDURE

1.1 ASTM E542 Standard Practice for Calibration of Volumetric Apparatus, and E969 Standard Specifications for Volumetric Pipettes.

2.0 STANDARD OPERATING PROCEDURE

2.1 Mechanical volumetric dispensing devices are assigned a unique identifier when purchased and placed into service. This identifier is used to identify the dispensing device for monitoring accuracy records. Mechanical volumetric dispensing devices are checked quarterly for accuracy against a Class A volumetric cylinder or a certified syringe.

2.2 Mechanical volumetric dispensing devices are checked quarterly for accuracy at a single volume against a Class A volumetric cylinder or a certified syringe.

2.3 If accuracy measurements are greater than ±3% of the expected value, then the volumetric dispensing device must be taken out of service and either sent back to the manufacturer for recalibration or replaced.

2.4 Dispensing devices are labeled with an identification number and checked for accuracy. This information is documented on the Mechanical Volumetric Dispensing Device (MVDD) Accuracy Form.

MVDD Identification and Acceptance Limits
Table D.16-1

ID	Brand Name	Range (mL)	Check Volume (mL)	Accuracy (mL)
MVDD-1	VWR	0-10	4.00	3.88 - 4.12
MVDD-2	Optifix	10-100	100	97 - 103
MVDD-3	Optifix	10-50	30.0	29.1 - 30.9
MVDD-4				
MVDD-5	LabMax	0-2.5	1.00	0.97 - 1.03
MVDD-6				
MVDD-7	Brinkman	0-2.5	1.00	0.97 - 1.03
MVDD-8	LabMax	0-2.5	0.090	0.087 - 0.0927
MVDD-9	LabMax	0-50	20.0	19.4 - 20.6
MVDD-10	VWR	0-10	10.0	9.7 - 10.3
MVDD-11	Brinkman	0-10	1.00	0.97 - 1.03
MVDD-12				
MVDD-13	LabMax	0-50	20.0	19.4 - 20.6
MVDD-14	Brinkman	0.2.5	1.00	0.97 - 1.03
MVDD-15	Brinkman	0-2.5	1.00	0.97 - 1.03
MVDD-16	VWR	0-10	8.00	7.76 - 8.24

MVDD
Quarterly Accuracy Check
Table D.16-2

MVDD # Quarterly Accuracy Check

Brand:
Placed in service:
Monitoring Year:

			Volumetric Verification				Expected Vol __mL	
Month	Initials	Date	Measurement 1	Measurement 2	Measurement 3	Average	Range of Acceptance ( )	Acceptable (Y/N)
Jan								
April								
July								
Oct								

Appendix E

Analytical and Extraction Support Procedures

Appendix E

Standard Operating Procedure

SOP E.1
Analytical and Extraction Support Procedures

1.0 ANALYTICAL AND EXTRACTION SUPPORT PROCEDURES

1.1 The QA manual and associated SOPs have been written to provide the basis for QA and QC in both field sampling and laboratory analysis. Data generated by Alpha could potentially be used to support litigation; therefore, documentation of laboratory procedures is essential to maintain a defensible audit trail for the generation of sample results. One part of this trail of documentation is the need and a compilation of Standard Operating Procedures to assure the various activities were performed and documented with uniformity and consistency.

Not all activities have written SOPs, however, procedures which are performed on a routine basis that may have a significant impact regarding the Data Quality Objectives have SOPs.

Appendix E

Standard Operating Procedure

SOP E.2
Dishwasher Steam Scrubber Operation

1.0 DISHWASHER AND STEAM SCRUBBER OPERATION

1.1 To prevent cross-contamination or carry-over, all organic extraction glassware is thoroughly washed in a Labconco Dishwasher steam scrubber.

2.0 Standard Operating Procedure:

2.1 As soon as possible, glassware that has come in contact with samples or standards should be rinsed with methylene chloride or the solvent last used in the glassware.

2.2 Soak the glassware in hot water with a non phosphate detergent such as Extran-300, to loosen and float particles.

2.3 Manually scrub the glassware with a pad or brush.

2.4 Hot water rinse the glassware to flush away any particles.

2.5 Recommended dishwasher settings:

2.5.1 Steam action on;

2.5.2 Power dry heat;

2.5.3 Fill detergent container with appropriate amount of detergent,

2.5.4 Close the detergent container and fill the extra containers as needed,

2.5.5 Set to appropriate cycle: i.e. plastic, glass 1, glass 2, rinse, etc.,

2.5.6 Push start switch to begin cycle; and,

2.5.7 After the dishwasher stops, inspect and separate glassware which visibly does not look clean and repeat the procedure again.

2.6 Once the glassware has been cleaned and visually inspected it is oven dried at 104 °C for a minium of 4 hours.

Appendix E

Standard Operating Procedure

SOP E.3
Manual Glassware Cleaning Procedure

1.0 MANUAL GLASSWARE CLEANING PROCEDURE

1.1 Certain glassware is incompatible with cleaning in the dishwasher steam scrubber; therefore, the following procedure will be followed.

2.0 Standard Operating Procedure

2.1 Remove surface residuals immediately after use. As soon as possible, glassware that has come in contact with sample and standards should be rinsed with methylene chloride or the same solvent used prior to washing; for inorganic analysis, soak in deionized water.

2.2 Soak the glassware in hot water with a non phosphate detergent such as Extran-300, to loosen and float particles.

2.3 Manually scrub the glassware with a pad or brush.

2.4 Hot water rinse the glassware to flush away any particles.

2.5 After washing, inspect and separate glassware which visibly does not look clean and repeat the procedure again.

2.6 Once the glassware has been cleaned and visually inspected, glassware for organic analysis is oven dried at 104 °C for a minium of 4 hours. Glassware for inorganic analysis does not need to be oven dried with the exception of TKN and ammonia glassware.

Appendix E

Standard Operating Procedure

SOP E.4
Sample Container Cleaning Procedures

1.0 SAMPLE CONTAINER CLEANING PROCEDURES

1.1 Cleaning procedures are practiced to minimize contamination from the containers in which they are stored.

2.0 Standard Operating Procedure

2.1 Policy

It is Alpha's policy not to reuse any sampling bottles or containers used in the collection of environmental field samples. All containers purchased by Alpha are purchased from manufacturers which follow the minimum EPA Level I Protocol prescribed cleaning protocols as outlined below.

2.2 Sample Bottle Material

2.2.1 If the analysis to be determined are organic in nature, the container should be made of borosilicate glass.

2.2.2 If the analytes are inorganic, the container should be polyethylene.

2.2.3 When both organic and inorganic substances are expected to be present, separate sample aliquots should be taken.

2.3 Cleaning Protocols

Commercially cleaned containers are used if cleaning procedures comply with EPA procedures as outlined below.

2.3.1 The procedures for cleaning glass and polyethylene containers and their caps for EPA level I protocol are as follows:

2.3.1.1 Cleaning procedure A for extractable organics:

a) Scrub and wash bottles, teflon liner, and caps in laboratory grade, non-phosphate detergent;

b) Rinse three times with tap water;

c) Rinse with 1:1 nitric acid;

d) Rinse three times with ASTM type 1 organic free water;

e) Rinse with pesticide grade methylene chloride; and

f) Oven dry at 125° C, allow to cool to room temperature in an enclosed contaminant-free environment.

Note: Procedure A used glass, wide mouth jars and amber Boston rounds.

2.3.1.2 Procedure B for purgeable volatile organics:

a) Wash glass vial in hot tap water using laboratory grade non-phosphate detergent;

b) Rinse three times with distilled water;

c) Rinse three times with ASTM type 1 deionized water;

d) Oven dry vials at 104°C for one hour;

e) Allow vials to cool to room temperature in an enclosed contaminant-free environment; and

f) Seal 40 ml vials with septa and cap.

Note: Procedure B used for 40 ml glass vials.

2.3.1.3 Procedure C for inorganic metals:

a) Wash polyethylene bottles in hot tap water with laboratory grade non-phosphate detergent;

b) Rinse with 1:1 nitric acid;

c) Invert and air dry in contaminant-free environment; and

d) Cap bottle.

Note: Procedure C used for High Density Polyethylene (HDPE) bottles.

2.3.1.4 Teflon liners

a) Wash with laboratory grade non-phosphate detergent;

b) Rinse with distilled water;

c) Rinse with acetone;

d) Rinse with Hexane;

e) Air dry;

f) Place liners in cleaned caps;

g) Heat to 104°C for two hours;

h) Allow to cool in contaminant-free environment; and

i) Cap cleaned bottles.

Appendix E

Standard Operating Procedure

SOP E.5
Prevention of Sample Contamination

1.0 PREVENTION OF SAMPLE CONTAMINATION

1.1 The prevention of sample contamination or cross-contamination is an important element in maintaining sample integrity. Contamination can occur virtually anywhere, and therefore, strict adherence to standard operating procedures must be followed.

2.0 Standard Operating Procedure

2.1 Prevention of sample contamination begins in the field when samples are collected. Samples must be collected according to the procedures described in the FSP or a project specific plan.

2.2 Alpha maintains a sequestered supply of sample containers. These containers are factory cleaned according to the procedures described by the USEPA. Alpha only buys, uses and distributes QC'd containers. Each case of sample jars contain a lot number which can be traced back to an analytical report certifying its cleanliness.

2.3 Samples are segregated from one another depending upon factors such as matrix or the types of analysis requested. Extracts are segregated from samples and standards in the hope of preventing cross-contamination or laboratory contamination. Additionally standards are segregated between types of analysis (e.g. volatile, semi-volatiles and metals) and maintained under refrigerated conditions.

2.4 Extraction technicians adhere to SOP's regarding cleaning of glassware, operations of the dishwasher, and other practices used in the laboratory. All glassware which is used during sample preparation, extraction or dilution, is rinsed three times with the solvent or acid used in the procedure prior to its use.

2.5 Once the glassware is used, it is scrubbed and washed according to the written SOP's, and oven dried at 104°C.

2.6 Syringes or other equipment which may come in contact with the sample or its extract are thoroughly rinsed before and after use.

2.7 Analytical instruments are oven-cycled baked or cleaned after highly contaminated samples have been analyzed. Prior to the analysis of additional samples, a method blank or instrument blank is analyzed for proof that a clean analytical instrument was used and did not contribute to environmental sample contamination caused by potential analytical "carry-over".

2.8 Alpha buys the best solvents and acids available for low-level environmental analysis. Solvents and acids are maintained in an environment free of potential cross-contamination from air-borne analytes.

2.9 Alpha has modified its HVAC system, such that, analytical instrument rooms are

operating on separate systems than the extraction labs. In addition, the analytical rooms are under positive pressure in relation to the extraction labs; thereby pulling makeup air from the outside. Make up air vents are upwind from the extraction exhaust hoods.

2.10 Extraction personnel or staff members which have come from the extraction lab and need to enter the VOC analytical room, first must aerate themselves by walking outside prior to entering.

2.11 Water which is used in washing or the rinsing of VOC syringes or associated equipment is organic free produced from our water system.

2.12 HCl which is used in the preservation of many samples is analyzed prior to its use to prevent possible VOC contamination.

2.13 Glassware and syringes used in the preparation of standards are segregated for VOC, semi-volatile and metals use only, and may be method specific.

2.14 Alpha uses several types of blanks to monitor possible contamination either from the lab or sources other than environmental contamination. These blanks are analyzed on an as-need basis for many of them and on a regular frequency for the remainder. For a better understanding of the types of blanks analyzed, and how they are used to monitor contamination see the main body of the QA plan.

Appendix E

Standard Operating Procedure

SOP E.6
Standards Preparation Procedure

STANDARD PREPARATION PROCEDURE

1.0 Identification of Test Method

1.1 The preparation of standards and reagents are in support of the various analytical methods described in the Procedure Manual containing the analytical SOPs,

2.0 Applicable Matrix or Matrices -

Not applicable

3.0 Method Detection Limit

Not applicable

4.0 Scope and Application

4.1 The preparation and maintenance of standards are essential elements for the determination of chemical analytes. The procedures for the preparation of all standards and subsequent dilutions must be consistent and standardized to minimize possible analytical errors.

4.2 This procedure includes all reportable target analytes for all methods. Many EPA standardized methods do not describe in full detail, the preparation of standards, compound stability, expiration dates, etc for the listed method analytes; however, each individual in-house analytical method SOP describes these procedures in detail.

4.3 This procedure is intended as a general guideline for the preparation and the documentation of standards and reagents and should be used in conjunction with the individual in-house method SOPs.

5.0 Summary of Method

5.1 Pure product "Neat" standards are prepared by measuring an appropriate mass or weight of the target analyte into Class A glassware and diluting to volume with the appropriate solvent. The net weight gain is calculated, and the concentration is determined.

5.2 Commercial and/or primary dilution standards may be further diluted (secondary dilutions) to a pre-determined concentration, by measuring an appropriate volume of the concentrated standard and diluting with solvent to the appropriate final volume.

5.3 All measuring and weighing devices including balances, syringes, auto-pipettors, volumetric glassware and/or manual volumetric dispensing devices are certified to accuracy and precision as described by NELAP.

6.0 Definitions

6.1 America Chemical Society (ACS) Grade Chemicals - Chemicals of the highest quality; which often exceeds the latest purity standards set by the American Chemical Society. ACS grade chemicals does not imply a standardized percent purity for all chemicals, but rather is a purity threshold established for individual compounds. ACS grade is the only universally accepted standard grade when evaluating chemicals.

6.2 Primary Dilution Standard - A solution prepared from the stock standard solution and diluted as needed to prepare a more dilute solution.

6.3 Reagent Grade Chemicals - Chemicals with purity that are typically equal to ACS grade. The grading of these types of chemicals are similar to that of ACS grade in that reagent grade does not imply a standardized percent purity for all chemicals; rather it is a purity threshold established for individual compounds and is typically less pure than ACS grade. This grade is suitable for analytical work and is more than adequate for general lab use.

6.4 Stock Standard Solution (SSS) - A concentrated solution containing method anaytes prepared using reference material or purchased from a commercial source.

7.0 Interference

7.1 It is beyond the scope of this SOP to describe all potential sources of interference, but is a reminder to verify glassware, plasticware etc. are free from interferences when preparing standards and reagents.

7.2 Sources of Potential Contamination During Standard Preparation

There are several potential sources of contamination when preparing standards with this procedure.

7.2.1 Contaminated neat material is particularly a potential problem if the neat material is < 98% pure product. Since it is not "pure" product, the remaining non-target material, may be a source of contamination and must be evaluated carefully.

7.2.2 Contaminated dilution solvent.

7.2.3 Contaminated standard preparation glassware to include, syringes, volumetric flasks, weigh boats, etc.

7.2.4 Contamination by carryover can occur whenever high-concentration and low-concentration standards are prepared in sequence. To reduce the potential for

carryover, the standard preparation syringe and/or volumetric measuring containers should be rinsed between standard preparation with an appropriate solvent, typically the dilution solvent.

7.2.4.1 Syringe Rinsing

Clean syringes by flushing the syringe barrel approximately 7-10 times using the standard dilution solvent before and/or after the preparation of individual standards.

7.2.4.2 Volumetric-ware Rinsing

All volumetric glass and plastic ware must be scrupulously cleaned. Clean as soon as possible after use by rinsing with the last solvent used. This should be followed by detergent washing with hot water, and rinse with tap water and reagent-free water. Drain the glassware and dry in an oven at 104°C for several hours or rinse with methanol for organics and/or 1:1 nitric acid for inorganics and drain. Store dry volumetric-ware in a clean environment.

Note: It is extremely important not to dry Class A glassware or plastic ware in ovens above this temperature, due to the potential change in internal volume from the heating and cooling cycles. Most Class A volumetric ware is certified to 1-2%, but is not warranted if heated above 104°C.

7.3 Sources of Potential Organic Contamination from Phthalate Esters

7.2.1 Common plastics contain varying amounts of phthalate esters and are easily extracted from these material during laboratory operations.

7.2.2 Interference from phthalate esters are best minimized by eliminating contact with any plastic material by using only borosilicate glassware and checking all solvents and reagents for phthalate contamination.

7.4 Sources of Potential Inorganic Contamination

7.4.1 Zinc, and other metals may leach from the walls of plastic volumetric glassware.

7.4.2 Boron may leach from the walls of borosilicate glassware.

8.0 Safety

8.1 The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. However, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals should be reduced to the lowest possible extent. A reference file of material safety data sheets is available. See Alpha's Laboratory Safety/Hazardous Communications Manual and Chemical Hygiene Plan for additional information and details.

9.0 Equipment and Supplies

9.1 Equipment

- Analytical and top loading balances, see balance SOP for details
- Manual Volumetric Dispensing Devices, see MVDD SOP for details

9.2 Supplies

- Syringes of various sizes
- Pipettes of various sizes
- Volumetric flasks of various sizes
- ACS grade solvents and acids

10.0 Reagents and Standards

10.1 Reagents

10.1.1 Acids - Ultra high-purity grade acids used in the preparation of standards must be used to avoid any potential contamination. Concentrated nitric and hydrochloric acids should be analyzed to determine the levels of impurity.

10.1.2 Reagent Water - Distilled or deionized water 17.8 Mohm or better, free of the analytes of interest. Water should contain particles no larger than 0.20 µm. This is commonly referred to as ASTM type I water (ASTM D1193).

10.1.3 Solvents - Organic solvents used in the preparation of standards must be of pesticide grade or better.

10.2 Standards

10.2.1 See the following tables for details.

11.0 Sample Collection, Preservation and Storage

11.1 See the following tables for standard storage and expiration.

Stability of Standards
Organic Methods of Analysis
Table E.6-1

Method	Expiration Stock Standard Solutions	Expiration Primary/Secondary Dilutions	Expiration Working Standards	Dilution Solvent
Chlorinated Pesticides 608/SM6630C/8081	Replace after 1 year, or manufacturer's expiration date, or sooner if QC indicates a problem. Store at ≤6°C in the dark	Replace after 6 months or manufacturer's expiration date, or sooner if QC indicates a problem. Store at ≤6°C in the dark	Replace after 6 months or manufacturer's expiration date, or sooner if QC indicates a problem. Store at ≤6°C in the dark	Hexane, iso-octane, acetone, methanol
PCB / Aroclor 608/SM6630C/8082	Replace after 1 year, or manufacturer's expiration date, or sooner if QC indicates a problem. Store at ≤6°C in the dark	Replace after 6 months or manufacturer's expiration date, or sooner if QC indicates a problem. Store at ≤6°C in the dark	Replace after 6 months or manufacturer's expiration date, or sooner if QC indicates a problem. Store at ≤6°C in the dark	Hexane, iso-octane, acetone, methanol
PCBs/Aroclors in Oil EPA-600/4-81/045	Method states: "...standards are non-labile and if maintained, can be stored indefinitely..." Clarification: will use expiration dates as described in 608/SM6630C/8082 above.			Hexane, iso-octane, acetone, methanol
TPH-Extractable 8015B/D-DRO	Replace after 1 year, or manufacturer's expiration date, or sooner if QC indicates a problem. Store at ≤6°C in the dark	Same as SSS	Same as SSS	Hexane
TPH-Purgeable 8015B/D-GRO	Replace after 6 months or manufacturer's expiration date, or sooner if QC indicates a problem. Store at -10 to -20°C with minimal head space.	Same as SSS	Prepare aqueous working standards daily with zero head space.	Methanol for SSS and dilutions. Organic free water for daily working standards.
Volatile Organics 624/8260B	Gases- stable for at least 1 week. Longer if drift is less than 20%. Liquids - stable for at least 6 months or manufacturer's expiration date or sooner if QC indicates a problem. Store at -10 to -20°C with minimal head space.	Same as SSS	Prepare aqueous working standards daily with zero head space.	Methanol for SSS and dilutions. Organic free water for daily working standards.
Semivolatile Organics 625/8270C	Replace after 1 year, or manufacturer's expiration date, or sooner if QC indicates a problem. Store at ≤6°C in the dark	Replace after 6 months or manufacturer's expiration date, or sooner if QC indicates a problem. Store at ≤6°C in the dark	Replace after 6 months or manufacturer's expiration date, or sooner if QC indicates a problem. Store at ≤6°C in the dark	Methylene chloride or other appropriate solvent.
SDWA Volatile Organics 524.2	Gases - stable for at least 1 week Liquids - stable for at least 4 weeks Should replace after 6 months or manufacturer's expiration date or sooner for all standards if comparison with check standards indicates a problem. Store at <0°C with minimal head space	Same as SSS	Prepare aqueous working standards daily with zero head space.	Methanol for SSS and dilutions. Organic free water for daily working standards.
Organic Acids	Replace after 6 months or sooner if QC indicates a problem. Store at ≤6°C in the dark	Replace after 6 months or sooner if QC indicates a problem. Store at ≤6°C in the dark	Replace after 1 week or sooner if QC indicates a problem. Store at ≤6°C in the dark	Reagent-free water

Stability of Standards
Inorganic and Wet-chemistry Methods of Analysis
Table E.6-2

Method	Expiration Stock Standard Solutions	Expiration Primary/Secondary Dilutions	Expiration Working Standards	Dilution Solvent
Conductivity 120.1/SM2510B	No method specified criteria. In-house criteria - if stored in sealed containers, replace after 1 year, or manufacturer's expiration date, or sooner if QC indicates a problem. Note: SSS are purchased as satchets. These satchets contain a small volume of standard sealed in an aluminum bag. Once a satchet is opened and used, it is discarded and not re-used due to potential degradation from atmospheric CO2.	Same as SSS	Same as SSS	Reagent grade water.
pH 150.2/SM4500H B/ 9040C/9045D	No method specified criteria. In-house criteria - replace after 6 months, or manufacturer's expiration date, or sooner if QC indicates a problem.	NA Same as SSS	No method specified criteria. In-house criteria - pour fresh working standards from SSS daily. Do not re-use due to potential degradation from atmospheric CO2.	NA
TS - SM2540B TDS - SM2540C TSS - SM2540D	No method specified criteria. In-house criteria - replace after 1 year, or sooner if QC indicates a problem.	No method specified criteria. In-house criteria - replace after 1 year, or sooner if QC indicates a problem.	No method specified criteria. In-house criteria - replace after 1 year, or sooner if QC indicates a problem.	Reagent grade water.
Turbidity 180.1/SM2130B	Method specifies 1 month if preparing in the lab. Does not specify commercial standards. In-house commercial standards - AMCO-AEPA manufacturer specifies 1 year or sooner if comparison to QC indicates a problem	NA Same as SSS	Method specifies 1 week if preparing in the lab. Does not specify commercial standards. In-house commercial standards - AMCO-AEPA manufacturer specifies 1 year or sooner if comparison to QC indicates a problem	NA
Acidity SM2310B	Method states a minim of 1 week for sodium carbonate used to normalize hydrochloric or sulfuric acid. Method has no other expiration date for standards or reagents. In-house criteria - replace after 6 months, or manufacturer's expiration date, or sooner if QC indicates a problem.	Same as SSS	Same as SSS	Reagent grade water.
Alkalinity SM2320B	Method states a minim of 1 week for sodium carbonate used to normalize hydrochloric or sulfuric acid. Method has no other expiration date for standards or reagents. In-house criteria - replace after 6 months, or manufacturer's expiration date, or sooner if QC indicates a problem.	Same as SSS	Same as SSS	Reagent grade water.
Oil and Grease 1664A	Replace after 6 months, or manufacturer's expiration date or sooner if QC indicates a problem. Store at room temperature in the dark.	Same as SSS	Same as SSS	Acetone

Stability of Standards
Inorganic and Wet-chemistry Methods of Analysis
Continued
Table E.6-2

Method	Expiration Stock Standard Solutions	Expiration Primary/Secondary Dilutions	Expiration Working Standards	Dilution Solvent
Ammonia SM4500NH3 B SM4500NH3 D	No method specified criteria. In-house criteria - replace after 6 months or manufacturer's expiration date or sooner if QC indicates a problem.	Same as SSS	No method specified criteria. In-house criteria - working standards should be prepared fresh daily or manufacturer's expiration date or sooner if QC indicates a problem.	Reagent grade water.
TKN SM4500Norg C SM4500NH3 D	No method specified criteria. In-house criteria -replace after 6 months or manufacturer's expiration date or sooner if QC indicates a problem.	Same as SSS	No method specified criteria. In-house criteria - working standards should be prepared fresh daily or manufacturer's expiration date or sooner if QC indicates a problem.	Reagent grade water.
Iron SM3500Fe D	One year or manufacturer expiration date prior to color development.	Same as SSS	Non-colored working standards are prepared fresh daily. Method specifies a 6 month criteria for color developed standards provided they are sealed and protected from light. In-house criteria - working color developed standards should be replaced after 1 month or sooner id QC indicates a problem.	Reagent grade water.
Hexavalent Chrome 7196A/SM3500Cr D	No method specified criteria. In-house criteria - replace after 1 year or manufacturer's expiration date or sooner if QC indicates a problem.	Same as SSS	No method specified criteria. In-house criteria - working standards should be prepared fresh daily.	Reagent grade water.
Chlorine SM4500Cl G	No method specified criteria. In-house criteria - replace after 1 year, or manufacturer's expiration date or sooner if QC indicates a problem.	Same as SSS	No method specified criteria. In-house criteria - working standards should be prepared fresh daily or manufacturer's expiration date or sooner if QC indicates a problem.	Reagent grade water.
Total Phosphorus 365.3//SM4500P E	No method specified criteria. In-house criteria - replace after 1 year or manufacturer's expiration date or sooner if QC indicates a problem.	Same as SSS	No method specified criteria. In-house criteria - working standards should be prepared fresh daily, but may be used up to 48 hours.	Reagent grade water.
Sulfide SM4500S D	No method specified criteria. In-house criteria - replace after 1 month or manufacturer's expiration date or sooner if QC indicates a problem.	Same as SSS	No method specified criteria. In-house criteria - working standards should be prepared fresh daily or manufacturer's expiration date or sooner if QC indicates a problem.	Reagent grade water.
COD 410.4/SM5220D	Replace after 3 months if no visible microbial growth, or manufacturer's expiration date or sooner if QC indicates a problem, refrigerate	Same as SSS	Same as SSS	Reagent grade water

Stability of Standards
Inorganic and Wet-Chemistry Methods of Analysis
Continued
Table E.6-2

Method	Expiration Stock Standard Solutions	Expiration Primary/Secondary Dilutions	Expiration Working Standards	Dilution Solvent
TOC SM5310C	No method specified criteria. In-house criteria - replace after 1 year or manufacturer's expiration date or sooner if QC indicates a problem. Store at ≤6°C.	Same as SSS	Same as SSS	Reagent grade water.
Metals 200.8/6020	No method specified criteria. In-house criteria - replace after 1 year or manufacturer's expiration date or sooner if QC indicates a problem.	Same as SSS	Method 200.2 - working CAL standards 2 weeks. Not specified for non-CAL standards. In-house criteria - replace after 1 year or manufacturer's expiration date or sooner if QC indicates a problem.	1-2% nitric acid and reagent grade water.
Anions 300.0/9056	Method states a minimum of 1 month when stored at 4°C. In-house criteria - replace after 1 year or manufacturer's expiration date or sooner if QC indicates a problem. Store at ≤6°C.	Same as SSS	Working standards 1 week. Working standards containing Nitrate, Nitrite and/or O-phosphate should be prepared fresh daily, but may be used up to 48 hours.	Reagent grade water.
Perchlorate 314.0	Replace after 1 year or manufacturer's expiration date or sooner if QC indicates a problem. Store at room temperature.	Same as SSS	Same as SSS	Reagent grade water.

12.0 Quality Control

12.1 Isolation of Standards

12.1.1 Potential contamination and/or cross-contamination is a concern for all samples, sample extracts and standards. In order to minimize the potential damage from this type of problem, standards are stored and isolated in their own refrigerators independent from samples and sample extracts.

12.1.2 Standards are also isolated according to method of analysis. Typically, methods are designed to analyze a specific class of compounds or to analyze analytes of a common volatility range or other chemical characteristic. This provides a common separation of standards, samples and sample extracts by method of analysis.

12.1.3 Neat standards are additionally isolated from their common diluted standards of the same method. Neat standards, are stored and sealed in paint cans to further help minimize any potential problems due to cross-contamination of high concentration pure product standards.

13.0 Calibration and Standardization

13.1 Standardization

Standards made from neat material are a source of reference standard material used in the determination of various methods of analysis. If available, neat material is purchased as ACS grade and no purity correction is required. However, occasionally, ACS grade is <98 % pure or ACS grade is unavailable and the next best grade of neat material, Reagent Grade, is purchased. In these cases all standard material should be corrected for purity, when the purity is <98%.

14.0 Procedure

The standard preparation logbook is designed to maintain records on standards, reagents and reference material preparation. These records document the traceability of purchased stock and neat standards to the method of preparation, lot number, expiration date and the preparer's initials.

In addition, all containers of prepared standards and reference material are labeled with a unique identification and expiration date that unequivocally links that container with its associated standard and reference material documentation.

14.1 Identification of Standards, Solvents and Reagents

14.1.1 All reference and non-reference chemicals used in any of the methods of analysis and/or extraction procedures are given an in-house identification number for traceability.

14.1.2 Reagent identifications are segregated by type of method followed by a date, followed by a numerical identification for that day. For example:

FID090503-06 would indicate:

FID - identifies the section of the laboratory which uses GC/FID instruments and where the standard was made or reference material will be used,

090503 - indicates the date in which the standard was logged into the system or prepared, and

-06 - indicates the sixth standard or other reference material identified during that day.

14.2 Documentation of Reagents

14.2.1 After the reagents, such non-standard reference chemicals, have been given an identification they are further documented by entering their relevant information such as lot number, manufacturer, expiration date etc. into to our Solvent and Chemical Log.

14.3 Documentation of Reference Material

14.3.1 Reference material such as commercially prepared standard mixes and neat material of individual compounds mut also be documented into Alpha's tracking system to insure proper identification and traceability of these materials.

14.3.2 Certificates of Analysis (C of A)

14.3.2.1 These types of reference material are typically accompanied with a C of A, which describes the compound or mix of compounds, a lot number, and purity or absolute concentrations of the analytes from the manufacturer.

14.3.2.2 Upon receipt of the standards and C of As, the chemist or technician responsible for the preparation and traceability of that standard must date and initial all certificates. The standard is also given a standard identification, which follows that standard throughout its life in the laboratory.

14.3.2.3 If the reference material is received without the C of A, it is the responsibility of that analyst, or technician, to call the manufacturer and request this information. Often times this information can be downloaded from the manufacturer's web site.

14.3.2.4 Once the standard is logged in to the tracking system the C of A for that standard is then placed into the Reference Material Logbook, a 3-ring binder, and stored for historical reference.

14.4 Documentation of the Original Container

14.4.1 If standards, reagents or reference material are kept in the original containers (as provided by the manufacturer or vendor) the must be labeled with the expiration date in addition to the laboratory identification.

14.5 Preparation of Standards from Neat Material

14.5.1 Determine the concentration and volume of the secondary or working standard required. Typically, stock standards are prepared at a concentration of ten to a hundred times the concentration required for the final working standard to allow for additional dilutions.

14.5.2 Prepare stock standards in the diluting solvent, or acid.

14.5.3 If a 10 mL volumetric flask is used, place approximately 9.8 mL of solvent in the tared volumetric flask.

14.5.4 Allow the flask to stand, un-stoppered, for approximately 5-10 minutes or until all wetted surfaces have dried.

14.5.5 Weigh the flask to the nearest 0.1mg and record and/or re-tare the balance.

14.5.6 Liquid Neat Material

Using a dedicated syringe, disposable pipette, immediately add two or more drops of reference material to the flask, then re-weigh. The liquid must fall directly onto the solvent without contacting the neck of the flask.

14.5.7 Solid Neat Material

Using a disposable weigh boat or weigh paper, measure an approximate weight of the neat material and add directly into the tared flask.

14.5.8 Re-weigh the volumetric flask and record the net gain in weight.

14.5.9 Dilute to volume with the diluting solvent, then mix by inverting the flask several times.

14.5.10 Record all data in the Analytical Standard Log book.

14.5.11 Transfer the stock standard solution into a teflon-lined screw cap vial or other appropriate long-term storage container.

15.0 Calculations

15.1 Calculation of Concentration

When secondary or working standards are prepared, final standard concentrations are determined as follow:

15.1.1 Determine the concentration and volume of the diluted standard required.

15.1.2 Calculate the amount of stock standard needed using the following equation:

$$(V_f)(C_f) = (V_i)(C_i)$$

Where:

V_f = Volume of final secondary/working standard,
C_f = Concentration of final secondary/working standard,
V_i = Volume of initial primary/stock standard, and
C_i = Concentration of initial primary/stock standard.

15.1.3 Add the appropriate solvent and dilute to volume, stopper, then mix by inverting the flask several times, and

15.1.4 Record all required information in the Analytical Standard Log book.

15.2 Calculation of Concentration Corrected for Purity

15.2.1 When standards are less than 98% pure, concentrations should be adjusted by calculating the correct concentration. For example if a neat standard were prepared at a target concentration of 1000 ug/mL and the standard was 96% pure the actual standard concentration would be:

1000 ug/mL x (0.96) or 960 ug/mL.

16.0 Method Performance

Not applicable.

17.0 Pollution Prevention

Minor amounts of solvents and/or acids are used with this procedure as the diluting reagent. The only other chemicals used in this procedure are the occasional use of neat materials and/or commercially prepared standard mixes used in the preparation of standard dilutions. All are used in extremely small amounts and pose no threat to the environment.

18.0 Data Assessment and Acceptance Criteria for Quality Control Measures

Not applicable.

19.0 Corrective Actions for Out-of-Control Data

Not applicable.

20.0 Contingencies for Out-of-Control Situations

Not Applicable.

21.0 Waste Management

21.1 All expired standards and/or reagents must be disposed of properly as described in our Waste Disposal SOP. Reference Alpha Analytical's Sample Waste SOP.

Appendix E

Standard Operating Procedure

SOP E.7
Storage Blank Procedures

1.0 STORAGE BLANK PROCEDURES

1.1 VOC samples may be contaminated in a number of different ways. Several types of blanks are used to monitor various sources of potential contamination. Storage blanks are used to monitor possible VOC contamination contributed by the refrigerator or by cross-contamination from samples stored in the same refrigerator.

2.0 Standard Operating Procedure

2.1 Storage blanks are used to monitor possible VOC contamination. This potential for cross-contamination may occur by the out-gassing of highly contaminated samples through the container septum or sample containers that are contaminated on the outside of the container walls and subsequently contaminate the storage space.

VOC samples may also be contaminated by the refrigerant (Freon) used in refrigerators or air conditioning units or by a number of other means.

2.2 Storage blanks are prepared and placed in sample containers and treated as a sample. Storage blanks are not, however, transported to the sample site or exposed to any sampling activities.

2.3 It is the responsibility of the assigned person to prepare, store, and monitor storage blanks for potential contamination.

2.4 Refrigerator Storage Blank Preparation (Aqueous Refrigerators)

2.4.1 The refrigerator monitor prepares refrigerator storage blanks, by filling 40mL VOA vials with organic free water.

2.4.2 When making refrigerator storage blanks an additional blank is prepared as a QC check blank. This blank is prepared and analyzed to assure the original storage blanks are free from VOC contamination. The results of this analysis is documented in the Refrigerator Storage Blank Log Book.

2.5 Refrigerator Storage Blank Preparation (Soil Refrigerators)

2.5.1 The refrigerator monitor prepares refrigerator storage blanks, by filling 40mL VOA vials with 8 mLs of methanol, mimicking the volume of methanol used in the soil extraction procedure.

2.5.2 When making refrigerator storage blanks an additional blank is prepared as a QC check blank. This blank is prepared and analyzed to assure the original storage blanks are free from VOC contamination. The results of this analysis is documented in the Refrigerator Storage Blank Log Book.

2.6 Quarterly Storage Blanks

2.6.1 Twelve refrigerator storage blanks are prepared at the beginning of the calendar year and placed in the designated refrigerators.

2.6.2 During the first week of each new quarter one of the three vials designated for that quarter is analyzed for VOCs.

2.7 Semi-monthly Water Storage Blanks

2.7.1 In addition to the quarterly storage blanks, three storage blanks are prepared at the beginning of each 2-week interval and placed in the designated VOC sample refrigerators. At the end of that two week period, one of the three storage blanks is analyzed for VOCs.

2.8 Analytical Procedure

VOC storage blank results must be less than one half of the reporting limit for non lab solvents and below the reporting limit for common lab solvents to be acceptable. Analytical results are documented in the Refrigerator Storage Blank Log Book.

2.9 Procedure for non-contaminated Storage Blanks

2.9.1 If VOCs are not found in a storage blank, then it can be determined the refrigerator has been clean of potential air-borne contaminants and no cross-contamination could have occurred for that time period.

2.9.2 If the semi-monthly storage blank indicates no contamination after the two week storage period, another set of three storage blanks is prepared and placed in the designated refrigerator.

The two remaining original vials are also kept as a backup and purged from the refrigerator on the subsequent 2-week interval.

2.9.3 If the semi-monthly storage blank and quarterly blanks indicates no contamination at the end of the year, another set of 12 quarterly storage blanks is prepared and placed in the designated refrigerator. The remaining original quarterly blanks are purged from the refrigerator.

2.10 Procedure for Contaminated Storage Blanks

2.10.1 If the semi-monthly storage blank indicates possible contamination, the second of the three semi-monthly storage blank vials is analyzed to confirm the presence of the contaminant.

2.10.2 If the second semi-monthly storage blank is confirmed positive, then a third stage of confirmation is performed.

2.10.3 This third stage consists of analyzing one of the quarterly storage blanks and potentially the activated carbon.

2.10.4 If the quarterly storage blank analysis is confirmed positive, then it should be considered that all samples within that 2 week period may be suspect for that analyte and appropriate actions should be taken.

2.10.5 Corrective Actions

2.10.5.1 Appropriate actions would be decontamination of the refrigerator or decommissioning of the refrigerator.

2.10.5.2 If the refrigerator contained activated charcoal, it should be removed as a protection against additional cross-contamination while cleaning the refrigerator. A tray of new activated carbon is then placed back into the refrigerator.

2.10.5.3 All samples stored in the refrigerator which has been confirmed positive must be isolated to prevent any additional cross-contamination.

2.10.5.4 All reported sample data, who's sample was stored in the contaminated refrigerator during the associated time period, must be re-evaluated for the identified contaminant.

These samples require a case-by-case decision whether to submit an amended report to the client.

2.11 Housekeeping Procedures for VOC Refrigerators

2.11.1 A tray of activated carbon is placed in all VOC refrigerators to absorb any potential VOC contaminants within the refrigerator.

2.11.2 This carbon is replaced on an as-needed basis and the date of replacement noted on the refrigerator temperature log.

2.11.3 If it was determined, by the analysis of the storage blanks, cross-contamination may have occurred, then the activated charcoal may be analyzed as another confirmation.

TABLE E.7-1
TABLE OF STORAGE BLANKS AND FREQUENCY

VOC Refrigerator	Bimonthly Analysis	Quarterly Analysis
SAR-1B	Every other Friday	Every 3 Months
SAR-5D	Every other Friday	Every 3 Months
SAR-8A	Every other Friday	Every 3 Months
SAR-10A	Every other Friday	Every 3 Months
SAR-11A	Every other Friday	Every 3 Months
SAR-12A	Every other Friday	Every 3 Months
SAR-14A	Every other Friday	Every 3 Months
SAR-15B	Every other Friday	Every 3 Months

Appendix E

Standard Operating Procedure

SOP E.8
A Practical Application Guide for Performing a Determination of Capabilities (DOC), Method Detection Limit(MDL)/Limit of Detection (LOD) and Limit of Quantitation (LOQ) Studies

1.0 A Practical Application Guide for Performing a Determination of Capabilities (DOC), Method Detection Limit (MDL)/Limit of Detection (LOD) and Limit of Quantitation (LOQ) Studies

2.0 Additional References

2.1 Definition and Procedure for the Determination of the Method Detection Limit, 40 CFR, Part 136, Appendix B, Revision 1.11.

3.0 Demonstration of Capability

3.1 Initial Demonstration of Capability Study

3.1.1 An Initial Demonstration of Capability (IDC) is performed prior to using test methods or when a significant change in instrument, test methods or personnel have been made. Demonstration of Capability (DOC) does not test the performance in real world samples, but in available clean matrix (a sample matrix in which no target analytes or interferences are present at concentrations that would impact the results of a specific test method). In addition, for analytes which do not lend themselves to spiking, e.g, TDS, the DOC may be performed using quality control samples.

1) Clarification: "Significant change" refers to any change in personnel, instrument, test method, or sample matrix that potentially impacts the precision, accuracy, sensitivity and selectivity of the data (for example, a change in detector, column type, sample matrix, or a significant method revision). All new analysts, regardless of experience on that instrument in another laboratory, shall complete a demonstration of capability.

3.1.2 When an analyte is added to an existing accredited test method (i.e. a new target analyte) an initial evaluation is performed for that analyte.

3.2 Continuing Demonstration of Capability

Once the IDC has been performed a continuing demonstration of capability is performed annually and the documentation of continued proficiency by at least one of the following once per year:

i. acceptable performance of a blind sample (single blind to the anayst);

Note: successful analysis of a blind performance sample on a similar test method using the same technology, e.g., GC/MS volatiles by purge and trap for Methods 524.2, 624 or 8260, would require documentation for one of the test methods.

ii. a new IDC study, or a study from a similar test method,

iii. at least four consecutive laboratory control samples with acceptable levels of precision and accuracy, or

iv. if i-iii cannot be performed, analysis of authentic samples with results statistically indistinguishable from those obtained by another trained analyst.

Note: Continuing demonstration of capabilities is continuously monitored during the normal course of sample analysis through the use of LCS data evaluation. Laboratory control samples are typically spiked and monitored at the same spike concentration and windows of acceptability as used for the IDC study. Therefore, analytical batch LCS data may also be used to satisfy this requirement.

3.3 Work Cells

A work cell is considered to be all individuals who see a sample through the complete process of preparation, extraction/digestion and analysis.

3.3.1 Individual Demonstration of Capability within the Work Cell

This work cell or "group" as a unit must meet the DOC criteria and the study must be documented for all individuals within that work cell. Even though the work cell operates as a "team," the demonstration of capability at each individual step in the sequence, as performed by each individual team member, remains of utmost importance, e.g., each team member must demonstrate capability in his/her area of responsibility in the sequence.

2) Clarification: It is not the intent to require each combination/permutation of work cell members to demonstrate group capability since DOC is for the individual only. Even though the work cell operates as a "team," the demonstration of capability at each individual step in the sequence, as performed by each individual analyst/team member, remains of utmost importance. For example, if multiple individuals contribute to a single analytical result (e.g., perform preparation, extraction, and analysis) and that result meets appropriate acceptance criteria, than all individuals have demonstrated capability.

Work cells can not be defined as a group within that team who perform the same step in the same process (for example, extractions for Method 8270), represented by one extraction chemist who has demonstrated capability for that step.

3.3.2 New Members within a Work Cell

3.3.2.1 When a work cell is used, and a member of a work cell

changes, the new employee must work with experienced personnel in that area of the work cell where they are employed, e.g., a new analyst should work with an experienced analysts for initial training.

3.3.2.2 This new work cell must demonstrate acceptable performance through acceptable continuing performance checks such as laboratory control samples. This performance is documented and the preparation batch following the change in personnel must not result in the failure of any batch acceptance criteria, e.g., method blank and laboratory control sample, or the demonstration of capability must be repeated. In addition, if the entire work cell is changed or replaced, the work cell must perform a new complete DOC study.

3.4 DOC Study Training Documentation

The DOC performance of individual analysts as well as all members of the work cell are documented through the use of the DOC Summary Data Form and individual training records.

3.4.1 Certification Statement

The DOC certification statement, Figure E.8-1, is used to document the completion of each demonstration of capability. A copy of the certification statement is retained in the personal training files of each affected employee.

3.4.2 Supporting Data

Data applicable to the study does not need to be attached to the form, but is retained and available.

3.5 Continuing DOC Training Documentation

Technical training of each member of the technical staff is kept up-to-date (on-going) by requiring each member to have on record, found in the training file, a certificate that they have read, understood, and are using the latest version of the QA Manual and SOPs which relate to his/her job responsibilities.

3.5.1 The Certification of Initial/Continued Proficiency Requirements are used to document the completion of each demonstration of capability. A copy of the certification statement is retained in the personnel training records of each affected employee.

3.5.2 Supporting Data

All associated supporting data, such as quantitation reports etc., necessary to reproduce the analytical results summarized in the Certification Statement is also retained.

3.6 DOC and Continuing DOC Study Organization

3.6.1 Data is peer reviewed, to verify the analytical method requirements associated with the study have been achieved.

3.6.2 Data packets should be prepared with the analytical sequence log, followed by the sample data in chronological order. Batch QC summary sheets and extraction logs should also accompany this data packet. This helps organize the data for peer review.

3.6.3 A copy of the standards preparation logbook clearly documenting the source of the standards, and/or a brief summary of the stock standard solution, secondary solution, working standards, etc. should also be placed in a separate document packet.

Note: A typical level IV data package is more than adequate for complete study documentation.

3.7 DOC Study Procedure

The following guidelines are used when completing a initial demonstration of capability or continuing demonstration of capability study.

3.7.1 A Quality Control (QC) sample is obtained from an outside source or the QC sample may be prepared using stock standards that are independently prepared from those used in the instrument calibration.

3.7.2 The analytes are spiked into a volume of clean matrix sufficient to prepare four aliquots at the method specified concentration or at a concentration of 1-4 times the limit of quantitation.

3) Clarification: The limit of quantitation is synonymous with the reporting limit. This would suggest that the DOC study should be analyzed at a concentration of 1-4 times the reporting limit; while the NELAC standards also allow the use of LCS samples which are typically spiked at 5-10 times the reporting limit to be used. Therefore, a concentration of 1-10 times the reporting limit is acceptable.

3.7.3 At least four aliquots are prepared and analyzed according to the test method either concurrently or over a period of days.

3.7.4 Using all the results, calculate the mean recovery and the standard deviations of the population sample (n-1) for each parameter of interest.

4) Clarification: The average recovery (not individual recoveries) is compared to the accuracy limits that are either method specified or determined by the laboratory. For most cases this will be the laboratory established LCS window of acceptability.

3.7.5 Compare the information from above to the corresponding acceptance criteria for precision and accuracy in the applicable test method or in laboratory-generated acceptance criteria (if there are not established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of samples may begin. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter and the test needs to be repeated.

3.7.6 When one or more of the target compounds fail the acceptance criteria then the analyst should proceed according to the following:

3.7.6.1 Beginning with (3.7.3) above, repeat the test for all parameters that failed to meet the acceptance criteria.

3.7.6.2 Repeated failure, however, generally confirms a problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with (3.7.3) above.

4.0 Test Method Evaluation

4.1 Evaluation for Standardized Methods

For all environmental organic and inorganic analytical methods of analysis, the method must be evaluated for those parameters that adversely affect data quality. These parameters are things such as method detection limit, reporting limit, accuracy and precision.

4.2 Evaluation for Non-standardized Methods

As part of method development, and to ensure continuous quality of data, QC criteria must be proposed and established that is consistent with similar methods or technology. At a minimum these QC requirements must address the following:

- Calibration,
- Contamination,

- Precision and accuracy,
- Interference, and
- Analyte identification.

4.3 Limit of Detection (LOD)

4.3.1 The LOD is defined as an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte and matrix specific and may be laboratory dependent.

Note: The limit of detection was formerly know as the Method Detection Limit (MDL).

4.3.2 One way to establish a LOD, is to perform a MDL study defined as, the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

A properly conducted LOD study requires that all sample processing steps be included in the determination of the limit of detection.

A LOD study is not required for any component for which spiking solutions or quality control samples are not available such as temperature, *or when test results are not reported to the LOD but reported above the LOQ and within the working range of instrument calibration.*

Note: When a LOD study is not performed, data cannot be reported below the LOQ.

4.3.3 LOD Study Frequency

4.3.3.1 Appendix D.1.2.1 of the System 5 NELAC standards states the following:

An LOD study is NOT REQUIRED for a test method when the test results are not reported outside of the calibration range.

5) Clarification: DOD requires a LOD study be conducted and determined regardless of the NELAC standards.

4.3.3.2 NELAC also requires the LOD study be conducted by the protocol in the mandated test method or applicable regulation, e.g., 40 CFR, Part B, Appendix B.

6) Clarification: Alpha follows the procedures as described in 40 CFR, Part 136, Appendix B, Definition and Procedure for the Determination of the Method Detection Limit.

4.3.4 LOD Study Procedure

4.3.4.1 The LOD study is not conducted using real world samples, but using an available clean matrix (a sample matrix in which no target analytes or interferences are present at concentrations that would impact the results of a specific test method). This is the same matrix as used for the preparation of the method blank or laboratory control sample, e.g., reagent grade water for water matrices, or ottowa sand, sodium sulfate or teflon chips for soil matrices.

4.3.4.2 Cleanup Procedures

LOD studies are generated using the preparatory and cleanup procedures routinely used on sample.

4.3.4.3 LOD Study Frequency

An LOD study is performed initially for all compounds of interest in each test method. An LOD study is determined each time there is a change in the test method that affects how the test is performed or when a significant change in instrumentation occurs that affects the sensitivity of the analysis.

Note: See the clarification box for "significant change" as it applies to both the DOC and LOD studies.

4.3.4.4 Number of Replicates

It is recommended to analyze a minimum of ten replicates containing the analytes of interest at the selected concentrations over the course of several days.

7) Clarification: As stated in 40 CFR 136B, the MDL study shall be determined using a minimum of seven replicates. In addition, several regulatory agencies require that if more than seven replicates are processed, data cannot be excluded, unless exclusion is supported with sound, documented technically based justification (e.g., outlier test). The state of California does not agree with this and will not allow exclusion of any data regardless of reason, (e.g., outlier tests are not allowed) and/or number of replicates.

4.3.4.5 Spike Source

A Quality Control (QC) standard is obtained from a source independent from the source used in the instrument calibration. If a completely independent source cannot be obtained, then as a last resort, the QC sample may be prepared using stock standards that are independently prepared from those used in the instrument calibration.

8) Clarification: Since the LOD study samples must be prepared from a source independent from the calibration source; it may be wise to use the same independent second source for the Initial Calibration Verification (ICV), DOC study and LOD study.

4.3.4.6 Spike Concentration

Determine the LOD spike concentration that corresponds to the following criteria:

- an instrument signal/noise ratio within the range of 2.5 to 5.0;
- the region of the standard curve where there is a significant change in sensitivity, i.e., a break in the slope of the curve.

4.3.4.7 Calculate the Standard Deviation (SD) of each of the analytes.

4.3.4.8 Using the Student t-Test, determine the LOD for each analyte as follows:

$$LOD = (t_{n-1})\ (SD),$$

where (t_{n-1}) is the student's t value for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom, Table E.8-2.

4.3.4.9 Calculate the LOD for each analyte and matrix.

4.3.4.10 LOD Verification Check

Analyze an LOD Verification Check standard immediately following the LOD study. If an annual LOD study is not performed, LOD verification checks should be performed quarterly. The LOD should be evaluated as follows:

- The LOD Verification Check standard should be analyzed at approximately 2 times the current LOD.

- The LOD Verification Check standard is acceptable if the analyte is detected using method specified criteria. If the method has no established LOD criteria, the check standard must produce a signal that is at least 3 times the background noise.

- If the LOD Verification Check standard fails, additional LOD verification checks may be performed at a higher level to set the LOD higher, or the LOD study must be reconducted.

4.3.5 LOD Evaluation

4.3.5.1 If the calculated LOD is higher than the spike concentration, then the study should be repeated at a higher concentration.

4.3.5.2 Compare calculated LOD results to ensure they are at or below the Limit of Quantitation (LOQ).

9) Clarification: Method 8000B requires the LOQ be established at or above the lowest calibration point established during the initial calibration curve. This should be further refined and supported by establishing LOQs that have calculated LODs at or below this limit.

4.3.5.3 Compare the ratio between the mean recovered concentration and the calculated LOD. This ratio should be between 1 to 5 for reagent water matrices and 1 to 10 for other matrices. If the calculated LOD is less than 1/10 of the spike concentration, then the study should be repeated at a lower concentration.

4.3.5.4 LOD From Multiple Instrument

4.3.5.4.1 If multiple LOD results are generated from multiple instruments with identical configurations, then the highest LOD among those should be used in reporting data from all of those instruments. If a lower LOD is reported for specific samples, then the samples must have been run on that specific instrument on which the lower LOD was generated.

4.3.5.4.2 If multiple instruments with identical configurations are used, then conduct a LOD study on at least one of the instruments and confirm the attainability of that LOD on all instruments by using an LOD verification check sample. The LOD verification check standard must be performed quarterly on every instrument.

Note: When confirming LOD using only a LOD verification standard, the concentration of the verification standard should be no greater than 3 times the LOD for single analyte tests and 1-4 times the LOD for multiple analyte tests. This is a different concentration than when confirming the LOD on the instrument performing the base LOD study.

4.3.6 LOD Study Documentation

4.3.6.1 All associated supporting data, such as quantitation reports etc., necessary to reproduce the analytical results summarized in the DOC Certification Statement is also retained.

4.4 Limit of Quantitation (LOQ)

4.4.1 The LOQ is defined as the minimum level, concentration or quantity of a target analyte that can be reported with a specified degree of confidence.

Note: The limit of quantitation was formerly know as the Practical Quantitation Limit (PQL), Minimum Reporting Limit (MRL) or simply the Reporting Limit (RL).

4.4.2 The lowest calibration point must be at or below the established LOQ, but may be the same.

4.4.3 The LOQ is determined for each analyte at a concentration no less than 3 times the LOD.

4.4.3.1 If a client requires a reporting limit below the established LOQ, method modification is required or the client will be required to accept the established LOQ as the lowest technically valid value that can be proveded.

4.4.3.2 If analytes are reported below the established LOQ, they should be flagged as follows:

- If the analyte is reported (detect or non-detect) down to one-half of the LOD, the data is flagged with a J.
- If the analyte is reported as a non-detect down to the LOD, the data is flagged with a U.

- If the analyte is detected between the LOD and LOQ, the data is flagged with a J.

4.4.4 LOQ Verification Check

Analyze a LOQ check standard for each analyte at a concentration of 1-2 times the LOQ. The LOQ study is not required for components or methods for which spiking solutions are not available or inappropriate, e.g. pH.

4.4.5 LOQ Evaluation

If the recovery of the LOQ verification check standard is within established test method criteria, or client data quality objectives for accuracy, than the LOQ is acceptable.

4.4.6 LOQ Frequency - The LOQ is verified annually.

Note: The LOQ does not have to be verified annually, if the LOQ is reported at or above the lowest calibration point.

5.0 Outlier Test

Even though CA NELAP does not allow the use of the Dixon Outlier test it is included for reference for use in other programs.

5.1 Often in a series of measurements, one or more of the results will differ greatly from the other values. Theoretically, no data results should be rejected, because it may indicate either a faulty technique that casts doubt on all results or the presence of a true variant in the distribution. In practice, reject the result of any analysis in which a known error has occurred (data rejection must be supported with proof of the error). In environmental analysis, extremely high and low concentrations of contaminants may indicate the existence of areas with problems or areas with no contamination, so they should not be rejected arbitrarily.

5.2 If a set of data is ordered from low to high, and the average and standard deviation are calculated, then suspected high or low outliers can be tested by the following procedure. First calculate the statistic T:

$T = (X_H - X_{AV})/S$ for a high value, or

$T = (X_{AV} - X_L)/S$ for a low value.

5.3 Compare the value of T to the Outlier Statistics TableE.8-2 at the 1% level of significance. If the calculated T is larger than the table value for the number of measurements, n, then the X_H or X_L is an outlier at that level of significance.

Demonstration of Capability
Certification Statement

Date:_____
Alpha Analytical, Inc.
255 Glendale Ave Ste21
Sparks, NV 89431-5778

Analyst Name:_____
Matrix:_____
Method #:_____
SOP #/Rev #:_____

Parameters: MDL/IDC

We, the undersigned, CERTIFY that:

1) The analyst identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

2) The test method(s) was performed by the analyst identified on this certification.

3) A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.

4) The data associated with the demonstration capability are true, accurate, complete and self-explanatory (1).

5) All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

Analyst	Signature	Date
Quality Assurance Officer	Signature	Date

This certification form must be completed each time a demonstration of capability study is completed.

(1) True: Consistent with supporting data.
Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.
Complete: Includes the results of all supporting performance testing.
Self-explanatory: Data properly labeled and stored so that the results are clear and require no addition explanation.

Figure E.8-1

TABLE OF STUDENT'S t VALUES AT THE 99 PERCENT CONFIDENCE LEVEL

NUMBER OF REPLICATES	DEGREES OF FREEDOM (n-1)	$t_{n-1, .99}$
4	3	4.541
5	4	3.747
6	5	3.365
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764
12	11	2.718
13	12	2.681
14	13	2.650
15	14	2.624
16	15	2.602
17	16	2.583
18	17	2.567
19	18	2.552
20	19	2.539

Table E.8-1

Outlier Statistics Table	
Number of Measurements n	**Critical Value 1%**
3	1.15
4	1.49
5	1.75
6	1.94
7	2.10
8	2.22
9	2.32
10	2.41
12	2.55
14	2.66
15	2.71
16	2.75
18	2.82
20	2.88
30	3.10

Table E.8-2

STATISTICAL CALCULATIONS

STATISTIC	SYMBOL	FORMULA	DEFINITION	USES
Mean	$\bar{x}$	$\frac{\sum_{i=1}^{n} X_i}{n}$	Measure of central tendency	Determine average value of measurements
Standard Deviation	SD	$\left(\frac{\sum (x_i - \bar{X})^2}{(n-1)}\right)^{\frac{1}{2}}$	Measure of relative scatter of the data	Calculating variation of measurements
Relative Standard Deviation	RSD	$(\frac{s}{\bar{x}})\ x\ 100$	Relative standard deviation, adjusts for magnitude of observations	Assess precision for replicate results
Percent Difference	% D	$\frac{x_1 - x_2}{x_1}\ x\ 100$	Measure of the difference of 2 observations	Assess accuracy
Relative Percent Difference	RPD	$\left(\frac{(x_1 - x_2)}{(\frac{x_1 + x_2}{2})}\right)$ x 100	Measure of the variability that adjusts for the magnitude of observations	Assess total and analytical precision of duplicate measurements
Percent Recovery	% R	$\left(\frac{x_{measured}}{x_{true}}\right)\ x\ 100$	Recovery of spiked compound in pure matrix	Assess accuracy
Percent Recovery	% R	$\frac{\text{Value of Spiked Sample} - \text{Value of Unspiked Sample}}{\text{Value of Added Spike}}$ x 100	Recovery of spiked compound in sample matrix	Assess matrix effects and total precision

x = Observation (concentration)n = Number of observations

Table E.8-3

Appendix E

Standard Operating Procedure

SOP E.9
A Practical Application Guide for Performing Manual and Automated Integration Routines

1.0 A PRACTICAL APPLICATION GUIDE FOR PERFORMING MANUAL AND AUTOMATED INTEGRATION ROUTINES

2.0 General Chromatographic Principals and Goals when Performing Manual Integrations

2.1 The goal of analytical chromatography is to separate sample constituents within a reasonable time. Baseline resolution of each target analyte from co-extracted materials provides the best quantitative results but is not always possible to achieve.

2.2 Some analytical procedures list analytes that may not all be resolved from one another. Therefore, while each of these methods is suitable for the listed compounds, they may not be suitable to measure the entire list in a single analysis. In addition, some methods include compounds that are isomers or closely related compounds which are well-known as co-eluting or are not completely separable. In these instances, the results should be reported as the sum of the two (or more) compounds.

2.3 This application procedure is written as a guide to help aid analysts in determining if there is acceptable baseline resolution and peak shape and that appropriate integration routines are being used. It is also the purpose of this policy to give analysts guidance in how to consistently integrate; how to produce accurate quantification, and how to handle data in situations where accurate quantification is difficult, such as coeluting isomeric pairs. The importance of the analysts' experience in performing these types of anlayses to the ultimate success of the methods can not be overemphasized.

2.4 It is not the intent of this application procedure to provide guidelines for all possible case scenarios when less than perfect integration is achievable. However, this application procedure is written such that, when doubt exists regarding integration, then the analyst must use the philosophy of consistent integration techniques that are also compatible with the guidelines of Alpha's Ethics Policy.

2.5 This application procedure is written as a philosophical approach to help aid analysts' decision making procedures in the integration of chromatograms.

3.0 Manual Integration Policy

3.1 There are no mandated rules that can be applied to the practice of integration. However, it is Alpha's policy to produce analytical data using the automated and manual integration practices, in a manner that is:

- Non-arbitrary integration - standards, control samples, and client samples are all integrated using consistent integration practices.
- Rational integration - data can be backed up with the reason for a particular integration practice.

3.2 This policy is applicable to all data produced from environmental analyses performed by GC, GC/MS, HPLC, IC or any other instrument capable of producing a chromatogram used to report quantitative data.

3.3 This policy is not intended to teach chromatography, but rather provides guidance when chromatographic difficulties present itself.

3.4 This policy is independent of any software.

3.5 This policy is consistent with the EPA's procedures and methods for environmental analyses, good laboratory practice and Alpha's ethics policy conducive to producing consistent, scientifically valid and defensible data for use by any end user.

4.0 Manual Integration Guidelines and Procedures

4.1 Consistent Verses Inconsistent Integration

4.1.1 Individual analytes in the initial calibration standards should be integrated consistently, (i.e. the same integration technique), with calibration points within the initial calibration curve regardless of concentration.

4.1.2 Individual analytes in the calibration verification standards should be integrated using the same integration technique, for that analyte, as used with that initial calibration.

4.1.3 Individual analytes in samples should be integrated using the same integration technique, for that analyte, as used with that initial calibration.

Generally, samples should be integrated in a manner consistent with the calibration standards. However, because of matrix effects, interferences, and compounds at varying concentrations, it is not always possible nor appropriate to integrate samples exactly the way the calibration standards were integrated. In calibration standards, each compound is usually at the same concentration as every other compound in the standard. In a sample, each compound will probably have a different concentration. Therefore, an integration technique that was accurate for a calibration standard may not be accurate for a sample. The analysts' experience, detailed examination, and good judgement is required in these cases.

4.2 Poor Instrument Chromatography Verses Nasty Samples

4.2.1 When establishing and evaluating a set of instrument parameters and conditions for an analytical system the analyst has a primary responsibility to ensure adequate analyte sensitivity, resolution, lineartiy, and quantitation. The analyst should ask themselves these fundamental questions:

- Is the low standard response so small that it does not produce a three to one signal to noise ratio?
- Does the separation between compounds become worse as the concentration increases?
- Is there column overloading at the higher concentrations?
- Is the instrument linear throughout the whole curve?
- Is the column capacity sufficient for the amount of material being analyzed?

If this is not the case, the analyst must find and resolve the problem before proceeding with sample analysis.

4.3 Documentation of Manual Integrations

4.3.1 Data Files

4.3.1.1 Computer generated automatic integrations must be supported by sound integration routines and parameters. These integration routines are documented and supported by the method file saved in support of the final analytical data. When these computer generated integration routines need to be adjusted; then the manual integrations must be based upon industry accepted chromatographic integration practices.

4.3.1.2 This procedure does not imply that an additional electronic data file needs to be kept; however, it does imply the final data file must be fully supported electronically.

4.3.2 Chromatograms

4.3.2.1 Manual integrations performed on initial calibrations should be documented. Documentation should include a before and after chromatogram or reconstructed ion chromatogram. In addition, the analyst must document these IC manual integrations with a chromatographically valid reason to support the manual integration.

4.3.2.2 The "before" data file chromatogram needs to be printed in such a manner to visually verify the manual manipulation of peaks and/or a notation of rationale. This does not imply each and every peak be printed out on individual pages, but it is a strong suggestion that a "clear picture speaks a thousand words." The principal purpose of

printing a "before" and "after" chromatogram is to develop and track a complete audit trail of all manual integrations.

4.4 Manual Integration of Multi-response Analytes

4.4.1 Several analytes such as diesel, gasoline, toxaphene, technical chlordane and PCBs are considered multi-response analytes. Such analytes and their associated methods require an integration routine encompassing an extremely wide retention time window. For these types of compounds manual integration is often required with each chromatographic run as the software may be incapable of making these types of integration decisions. Therefore, the documentation of manual integrations with before and after chromatograms and the justification of those manul integrations are not required; rather good chromatographic judgment is required by the analyst.

4.5 The Number of Times an Analyte may be Integrated and the Associated Documentation

4.5.1 Manual integrations should only be integrated one time. However, occasionally a second manual integration is required. These types of integrations are documented with the normal description justifying the reason for the manual integration.

4.5.2 When more than two manual integrations are used on any one analyte it must be supported with a description of why three integrations were required in addition to the primary reason for the manual integration to begin with.

4.5.3 If more than three manual integrations are warranted, the integration must be initialed by the analysts direct supervisor.

4.6 State and Project Specific Manual Integration Documentation Requirements

4.6.1 Manual integrations of all data in support of the DOD IR Program and the State of Arizona must be performed in such a manner as to produce a complete audit trail. Audit trails are most easily produced by printing a "before" and "after" chromatogram and initialing and dating the printouts.

4.7 In summary, there are two situations which may trigger the printing of a before and after chromatogram when manual integrations have been performed and they are:

- initial calibrations, and
- sample and batch QC data associated with DOD and Arizona samples.

In addition, there may be three situations which trigger the documentation of these chromatograms to produce a complete audit trail and they are:

- initial calibrations.
- sample and batch QC data associated with DOD and Arizona samples, and
- when more than one manual integration has been performed on a single analyte.

4.8 Documenting Manual Integrations using Standardized Peak Nomenclature

Reasons to perform manual integrations are documented using the mnemonic scheme described as follows:

Mce	**M**anual integration due to **c**o-**e**lution (target and/or non-target analyte)
Mpnfi	**M**anual integration **p**eak **n**ot **f**ully **i**ntegrated (typically due to peak tailing, small peaks near the baseline, etc.).
Mpoi	**M**anual integration **p**eak **o**ver **i**ntegrated (typically due to negative peak, or a dip in the baseline, etc.)
Mmp	**M**anual integration **m**issed **p**eak or peak simply not integrated.
Mipi	**M**anual integration **i**ncorrect **p**eak **i**ntegration.
Mrts	**M**anual integration **r**etention **t**ime **s**hift
Mcsm	**M**anual integration **c**omplex **s**ample **m**atrix
Mcd	**M**anual integration **c**hromatographic **d**egradation (creates a situation where the software routine, instrument needs to undergo maintenance).
Mad	**M**anual integration **a**nalyst **d**iscrection

5.0 Chromatography Guidelines and Evaluation Procedures

5.1 Peak Definition

A peak is defined as a pictorial representation of the response of the compound where the response of the compound is at least three times the background noise. Background noise can be from the instrument electronics, solvent, sample matrix, mobile phase, gases, column bleed, etc.

5.2 Peak Shape

5.2.1 Ideal peak shape is a bell curve or Gaussian. The perfect peak should be symmetrical with a round top. The compound signal should take a few seconds to rise and fall. The rise and fall of a signal too quickly would generally be indicative of a noise spike.

5.2.2 Due to detectors, matrix and compound polarity, peaks may become

broadened, have shoulders or tailing. These are all acceptable as long as it is not indicative of co-elution. Some methods have specific criteria as to how much of these imperfections are allowable. Judgement is necessary as to what is excessive. An analyst should base the judgement of current chromatography on historical instrument performance.

5.3 Baseline Resolution

5.3.1 The best case chromatography is an ideally shaped peak residing on a flat baseline completely resolved from any other peak or interference. Baseline integration is a line drawn from each endpoint of the peak, baseline to baseline, including the entire area under the curve of the peak (Figure E.9-1). This is appropriate when the quantification will be based on peak area.

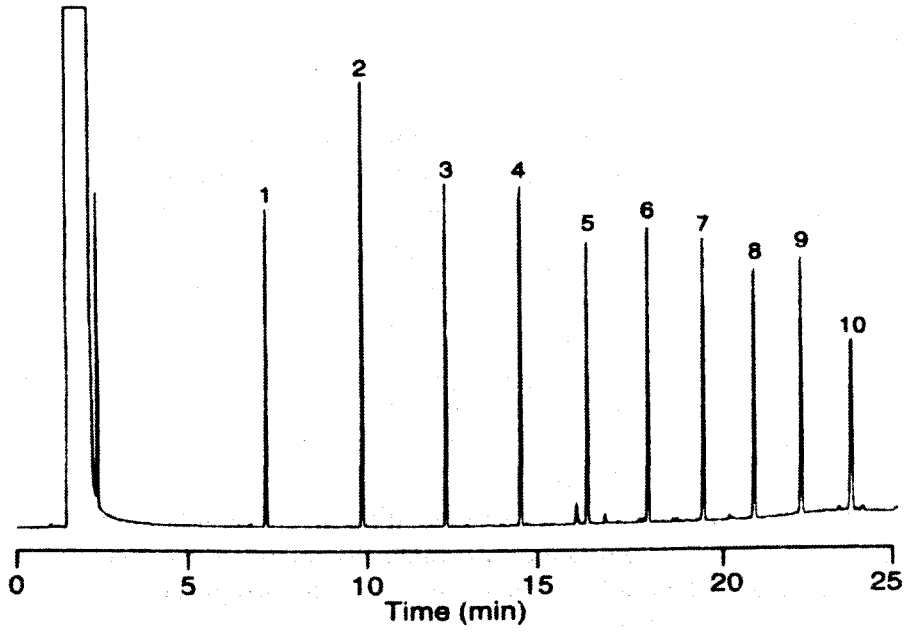


Figure E.9-1

6.0 Integration Techniques

6.1 Irregular Peak Shape

When there is an irregular peak shape first ensure that it is not excessive and indicative of instrument problems or column overload. Then ensure this is not due to any co-elution problems from either target compounds or the matrix. If neither of the above is the reason for the irregular peak shape, then the general guideline is to integrate the entire peak (Figure E.9-2).

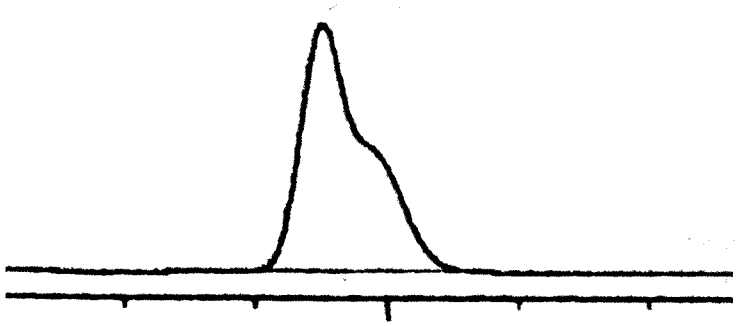


Figure E.9-2

6.2 Less than 100% Baseline Resolution

6.2.1 Dropping a Perpendicular

This integration technique is used when two compounds partially co-elute and there is a discernable valley between the two peaks. A perpendicular line is drawn from the valley between the two peaks to the baseline.

This technique assumes that both compounds have symmetrical peak shape and equal detector response, such as in the case of isomeric pairs. If this assumption is correct, then the area contributed from one compound as compared to the other compound will be the same and the quantification will be equivalent to 100% baseline resolved. Usually this is not the case, which means the detector has different sensitivity, peak shape and amount of resolution or co-elution must be carefully evaluated before using this technique.

Several methods state that acceptable resolution is achieved for structural isomers if the height of the valley between the two isomeric peaks is less than 25% of the sum of the two peak heights. Otherwise, structural isomers are identified as an isomeric pair. The method formula for acceptable resolution is $V < 0.25(P1 + P2)$. Where V is the height of the valley between the peaks; P1 is the left peak and P2 is the right Peak (Figure E.9-3).

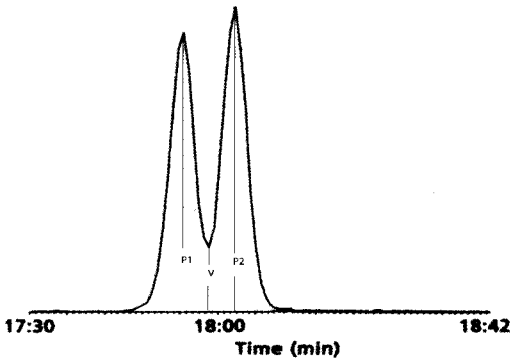


Figure E.9-3.

A second approach used by many methods in determining adequate resolution between two peaks is defined by the equation:

$$R = \frac{t}{w}$$

where t is the difference in elution times between the two peaks and w is the average peak width, at the baseline of the two peaks. Resolution is adequately resolved when R> 1.0 using this formula (Figure E.9-4).

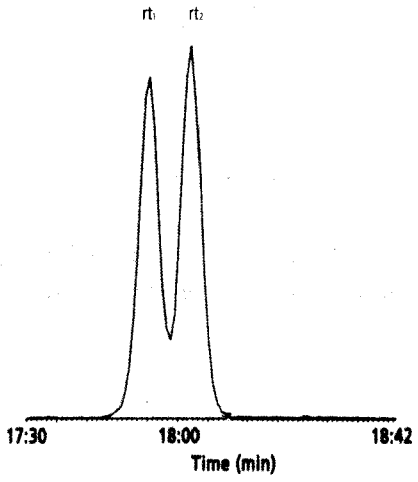


Figure E.9-4

6.2.2 Structural Isomers

While structural isomers represent the best conditions under which to integrate peaks by dropping a perpendicular, this criteria can be applied to all co-eluting peaks. If in the analyst's judgement adequate resolution cannot be achieved than this technique should not be used. As an alternative, either integrate the two peaks together and report them with a footnote as co-eluting peaks or do further method development to achieve better separation.

6.3 In GC/MS methods where chromatograms of a single quantitation ion are used, more unique ions that have adequate intensity should be considered for cases of close compound elution.

6.4 Valley to Valley and Baseline to Valley Integration

6.4.1 The valley to valley technique involves drawing the integration line from the valley between two peaks to another valley between two peaks.

6.4.2 Baseline to valley integration is drawing the line from the baseline at one end of the peak to the valley between two peaks at the other end of the peak being integrated.

6.4.3 The weakness of these two techniques occurs with the quantitation of samples that have a calibration produced where peak integration was produced on a flat baseline as compared to samples which do not exhibit the same flat baseline attribute, and thus may under quantitate or over quantitate actual sample concentration.

The following examples attempt to explain the weakness of this integration technique.

6.4.3.1 Two Peaks with similar and non-similar response in the initial calibration

6.4.3.1.1 Two peaks have similar detector response such that standards would be integrated by dropping a perpendicular where less than 100% baseline resolution occurs (Figure E.9-5).

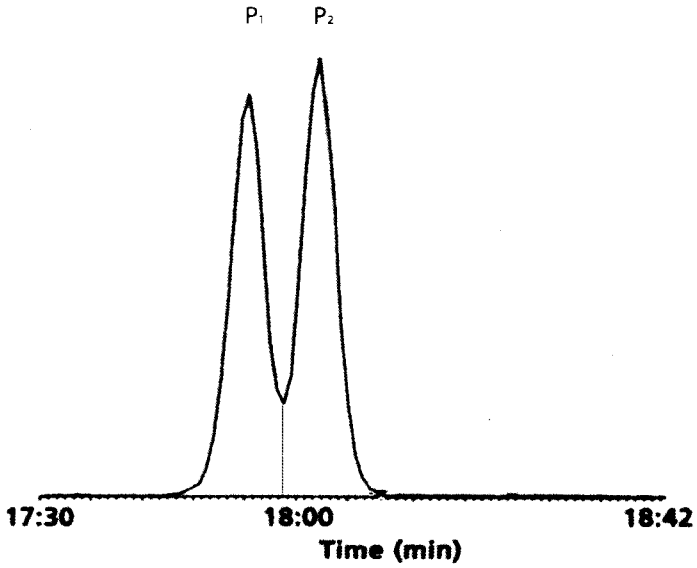


Figure E.9-5.

6.4.3.1.2 In this situation peak #1 (P1) has a greater signal intensity or response than peak #2 (P2) (Figure E.9-6.).

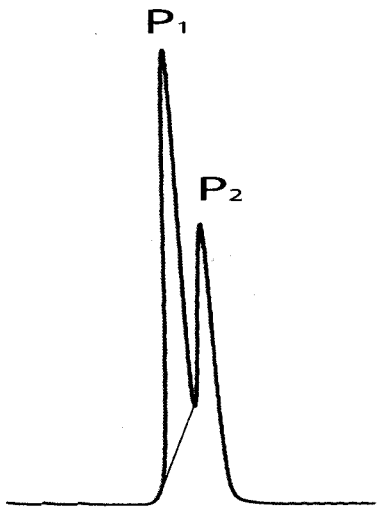


Figure E.9-6.

6.4.3.1.3 If P1 is integrated baseline to valley, then P1 will be under quantitated and P2 will be over quantitated. The percentage error associated with P1 is less than the error associated with P2. This may be significant if P2

is at or slightly above the reporting limit where the error could be as much as or greater than 100% or a factor of 2 of the actual concentration. It may be appropriate to drop a vertical (Figure E.9-7) or to integrate valley to baseline (Figure E.9-8).

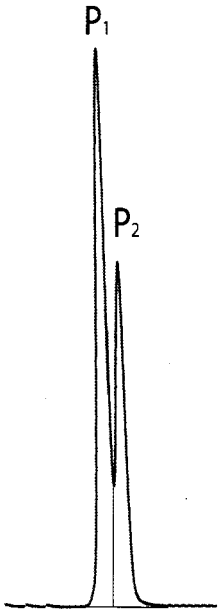


Figure E.9-7.

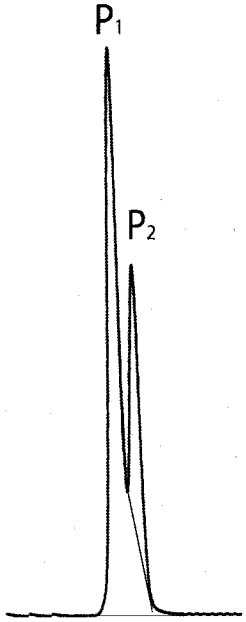


Figure E.9-8

6.4.3.1.4 The weakness of integrating valley to baseline (Figure E.9-8) are the same problems as discussed in the following section, peak skimming; namely, excluding area from P2 thought to be contributed by the larger peak. Normally peak skimming is not a recommended practice since peak tailing is very inconsistent. Therefore, it may be most appropriate to drop a vertical and integrate.

6.4.3.1.5 Two peaks have similar detector responses such that standards would be integrated by dropping a perpendicular where less than 100% resolution occurs. The same situation as indicated in Figure E.9-5.

6.4.3.1.6 In this situation P2 has a greater signal response than P1 (Figure E.9-9).

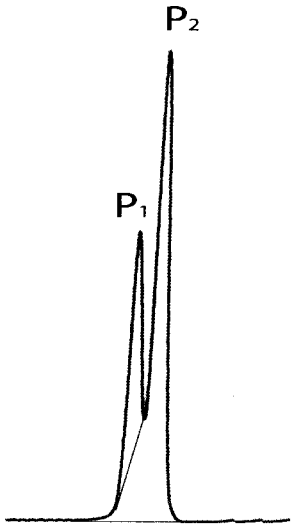


Figure E.9-9

6.4.3.1.7 If P1 is integrated baseline to valley (Figure E.9-9), then the same problems associated with Figure E.9-8 exists. Area is being excluded from P1 thought to be contributed by P2. Secondly the error associated with P1 will be significant if it is at or slightly above the reporting limit.

6.4.3.1.8 If P1 is integrated valley to baseline (Figure E.9-10) then P1 will be over quanitated and P2 will be under quantitated and it may be more appropriate to drop a vertical.

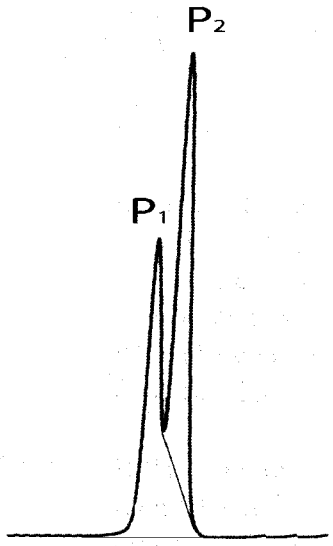


Figure E.9-10.

6.4.3.2 Two Peaks with dissimilar response in the initial calibration

6.4.3.2.1 The two peaks have widely differing detector responses such that the standards would be integrated by dropping a perpendicular where less than 100% baseline resolution occurs (Figure E.9-11.).

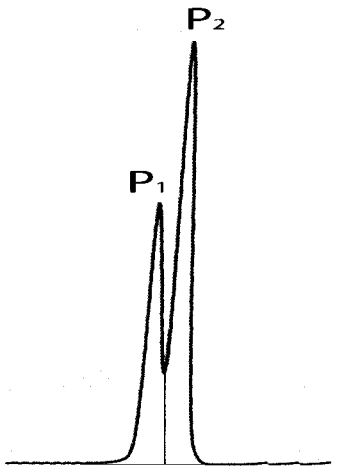


Figure E.9-11.

6.4.3.2.2 The integration scenarios detailed in example #1 and example #2 also apply to this situation. It is up to the analysts best judgment in determining the best integration techniques in order to minimize the potential quantitation errors.

6.4.3.3 The two peaks have similar or widely varying detector responses such that the standard would be integrated by dropping a perpendicular where less than 100% baseline resolution occurs.

In this situation either P1 or P2 as integrated in the standard is not found in the sample. Regardless of integration techniques used the target analyte will be under quantitated due to the area in the standard that was less than 100% baseline resolved. In this situation it is important to understand the significance of the error associated with the situation and overall impact of the data.

6.4.4 Because of these limitations, valley to valley and baseline to valley integration techniques are recommended only for instances where the baseline is shifting or matrix interferences are inherent in the analysis.

6.4.5 To help determine where the baseline is in a calibration standard, analyze a method blank. This should give a good indication of how the baseline is shifting throughout the run due to inherent system characteristics. When the calibration standards are analyzed, draw the baseline in the same general shape and slope as it appears on the method blank. Do not forget to take into account the additional baseline rise or shifting that the compound is causing.

6.5 Peak Skimming

Peak skimming is used when one peak elutes on the tail of another, larger peak (Figure E.9-12). Generally, the analyst would draw the integration line that defines where and how long the tail of the larger peak is. This excludes area from the smaller peak thought to be contributed by the larger peak. Normally peak skimming is not a recommended practice since peak tailing is very inconsistent. The analyst should try to achieve better resolution; however, this is not always practical.

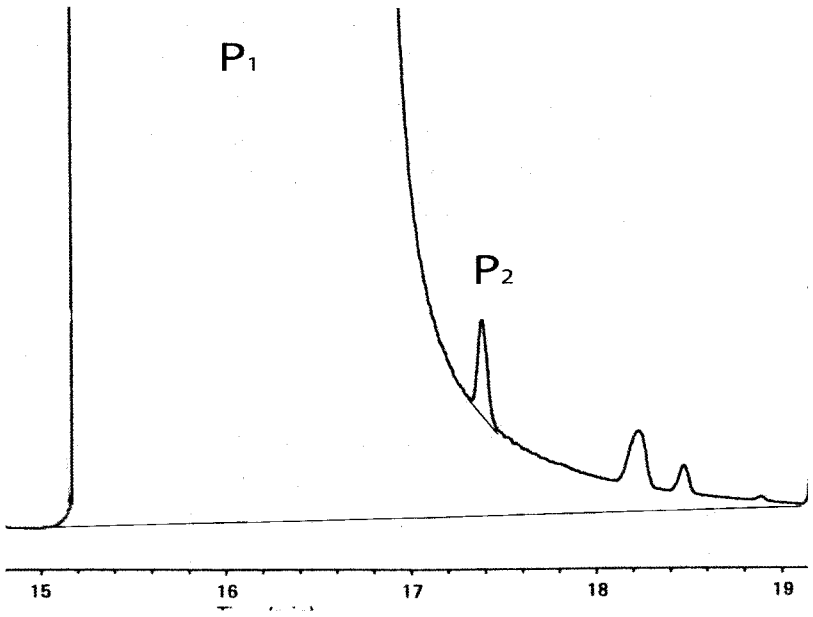


Figure E.9-12.

7.0 Inappropriate and Unacceptable Integration Practices and Techniques

7.1 The following scenarios constitute an ethics and fraud violation when integrating analytical data:

a) No manual integration will be performed exclusively on QC samples in order to meet QC acceptance criteria. Manual integration is acceptable as long as consistency rules are applied to all standards and samples, and there is a reason why it is necessary.

b) Under no circumstances is peak shaving allowed for the sole purpose for obtaining QC acceptance.

7.2 Peak Shaving

Peak shaving is integrating in such a manner that part of the peak response is excluded. Omitting portions of peaks or drawing the integration further into the peak is an unacceptable practice.

7.3 Adding Area Under the Baseline

This involves creating a peak from area under the baseline or adding to the response of a peak by taking additional area from under the baseline. In analysis where system behavior or matrix effects make it difficult to determine where the baseline is, some discretion is to be used to avoid adding or subtracting area which is not due to the compound's response.

7.4 Inadequate Resolution

7.4.1 Adding area from another peak often occurs with partial co-eluting compounds which exhibit poor resolution. Even if the analyst knows a compound is present, as in the case of standards, and the irregular peak shape is due to this compound, the analyst should not artificially create a separation between two peaks which do not have adequate resolution.

7.4.2 As mentioned earlier, either integrate the two peaks together and report them as co-eluting peaks or perform additional method development to achieve better baseline resolution.

7.4.3 Samples which exhibit matrix interference may produce target analytes with irregular peak shapes produced by the presence of non-target analytes. In this case, either integrate the compound and its' interferent together, or if a discernable valley exists or shoulder exists, drop a perpendicular.

7.5 Negative Spikes or Peaks

7.5.1 A negative spike or peak occurs when matrix interferences cause a sudden drop then increases in the baseline. In general the analyst should improve chromatography so that all target compounds are resolved from the negative spike. For some analyses this is very difficult. This problem should be corrected by getting the analyte to move away from this region then integrate the peak normally. If this occurs in a sample but not in the standards, integrate as best as possible.

Laboratory Ethics/Fraud Prevention Program for Manual Integration

The following scenarios constitute an ethics and fraud violation when integrating analytical data:

a) No manual integration will be performed exclusively on QC samples in order to meet QC acceptance criteria. Manual integration is acceptable as long as consistency rules are applied to all standards and samples, and there is a reason why the manual integration is necessary.

b) Under no circumstance is peak shaving allowed for the sole purpose for obtaining QC acceptance.

c) Under no circumstance may an analyst add area under the baseline of a peak, in an effort to create additional peak area.

These are specific examples of fraudulent and unethical manual integration practices, and are not intended to be a comprehensive list; rather this list is intended to give the analyst an idea of the types of unethical behavior that will not be tolerated.

I the undersigned, CERTIFY, that:

I have read, acknowledged and understand the personal ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions regarding manual integrations.

Employee Name (Print)	Signature	Date

Appendix E

Standard Operating Procedure

SOP E.10
Preparation of Reagent Grade Water

1.0 Preparation of Reagent Grade Water

1.1 The preparation of reagent grade water is an essential element in the success of our laboratory. Reagent grade water is used in many critical and non-critical areas of the laboratory during the production and analysis of environmental samples. The use of reagent grade water in the critical areas of the laboratories requires this water to be of such quality as to not interfere with the analysis of target analytes at the method reporting limits.

1.2 References

1.2.1 Method 1080 (Reagent Water): Standard Methods for the Examination of Water and Wastewater, 20th edition, 1998.

1.2.2 American Society for Testing and Material, ASTM, Volume 11.01, Section DH93-91, 1992.

2.0 Standard Operating Procedure

2.1 Introduction

2.1.1 One of the most important aspects of chemical and biological analysis is the preparation of reagent grade water. The quality of water required is related directly to the analysis being made. Reagent grade water is used for several critical areas in the final production of analytical data. Some of these critical areas include such things as:

a) dilution of chemical reagents;

b) dilution of samples requiring direct analysis;

c) analytical instrument rinse water; and

d) preparation of Quality Control samples such as:

- method blanks,
- laboratory control samples,
- trip blanks,
- field blanks,
- equipment/rinsate blanks, etc.

2.1.2 ASTM Type I ultra-pure water is produced by purifying tap water using a series of water clean-up procedures. Tap water is first treated through a reverse osmosis system; the water is subsequently stored in a 100 L reservoir and finished by treating this water with a deionization unit.

2.1.3 The ROpure Infinity reverse osmosis system is a fully automated system providing up to 600 liters per day of ASTM Type I water when used in combination with the NANOpure Infinity deionization unit.

2.2 Definition

2.2.1 Adsorption - a process used to remove chlorine and organic impurities. It is accomplished typically with granular activated carbon. In general, organic adsorption efficiency is inversely proportional to solubility and may be inadequate for the removal of low-molecular-weight, polar compounds.

2.2.2 ASTM Type Water - water that has the following water quality characteristics:

	Type I	**Type II**	**Type III**	**Type IV**
Electrical conductivity, Max *u*s/cm at 25°C	0.056	1.0	0.25	5.0
Electrical resistivity, Min MΩ at 25°C	18.0	1.0	4.0	0.2
pH at 25°C	*	*	*	5.8-8.0
Total Organic Carbon (TOC) Max, ug/L	100	50	200	no limit
Sodium, Max, ug/L	1	5	10	50
Chlorides, Max, ug/L	1	5	10	50
Total silica, Max, ug/L	3	3	500	no limit

Note: * The measurement of pH in Type I, II and III reagent water has been eliminated from this specification because these grades of water do not contain constituents in sufficient quantity to significantly alter the pH.

2.2.3 Ion exchange - a process in which water is prepared by passing feed-water through a mixed-bed ion exchanger, consisting of a strong anion and strong cation resins mixed together.

2.2.4 Reagent water - water with no detectable concentrations of the compounds or elements to be analyzed at the detection limit (typically established at one-half of the reporting limit) of the method of analysis and free of substances that may interfere with those analytical methods.

2.2.5 Reverse osmosis - a process in which water is forced under pressure through a semipermeable membrane removing a portion of dissolved constituents and suspended impurities.

2.3 System Description

2.3.1 Reverse Osmosis

2.3.1.1 The ROpure Infinity reverse osmosis system uses a thin micro-porous surface that rejects impurities, but allows water to pass through. The membrane rejects the following:

Constituent	Rejection Rate
• Monovalent ions	90-95%
• Polyvalent Ions	95-99%
• Inorganic solids	85-95%
• Organic solids	>99% (with a mol. weight > 300)
• Dissolved gasses	0%
• Microorganisms	>99% (bacteria and viruses)

This system is capable of producing up to 30 liters per hour of reagent grade water. This system is also microprocessor controlled which can allow automatic operation up to 24 hours a day. The RO membranes are automatically flushed for 10 minutes every 4 hours, eliminating contaminant buildup on the membranes.

2.3.1.2 Reject Water

A large percentage (50-98%) of the feed water does not pass through the membrane but flows across the membrane surface, constantly cleaning the membrane and carrying the inorganic and organic solids to drain.

2.3.1.3 Feed Water Pressure

The purity of the product water depends on the purity of the feed water. During the reverse osmosis process feed water pressure affects both the quantity and purity of reverse osmosis product water. Lower feed water pressure causes lower product flow rate and lower product purity. Feed water pressure should operate in the range of 30 - 100 psi.

2.3.1.4 RO Pretreatment System

The ROPure Infinity uses a thin film composite membrane to produce reagent grade water. The thin film membrane may be damaged by free chlorine; therefore, a pretreatment system using activated carbon is used to remove the free chlorine.

2.3.1.5 Feed Water Temperature

RO membrane performance is based on feed water temperature of 25°C (77°F). For every 1°C below 25°C product water quantity is reduced 3%. Therefore, a mixing valve (hot and cold) is used to maximize water production at a feed water temperature of 25°C/77°F.

2.3.2 Storage Reservoir

2.3.1 The reverse osmosis system requires storage to maintain back pressure on the RO membrane and also provides a large quantity of water on demand. This system uses a 100 L reservoir with an automatic shut-off float valve designed for automatic hands free water production.

2.3.3 Deionization

2.3.3.1 The NANOpure Infinity system is designed to deliver up to 1.5 L/min of deionized water with resistivities of up to 18.3 MΩ/cm and less then 1ppb organics. This system uses 4 distinct steps to produce final product water. They are:

a) a pretreatment adsorption cartridge,
b) a mixed bed deionization cartridge,
c) a finish grade organic adsorption cartridge, and
d) a final membrane filtration.

2.3.3.2 Pre-deionization Adsorption Cartridge

An pre-deionization adsorption cartridge made of activated carbon on a unique macroreticular resin is used to remove organics, chlorine, colloids, and some bacteria from the feed-water. This activated carbon cartridge is used to extend the life of the deionization cartridge. The use of two different carbons promotes the removal of both large molecular weight and smaller volatile organics, providing for lower overall TOC values in the final product water.

2.3.3.3 Mixed Bed Deionization Cartridge

Ions are removed from water as the water passes through the ion exchange resin beds. In the generated form, cation resin contains hydrogen ions on its surface which are exchanged for positively charged ions. Anion resin contains hydroxide ions on its surface which are exchanged with negatively charged ions. The final product of these two exchanges form water molecules.

2.3.3.4 Membrane Filtration

Final product water is filtered using an in-line 0.2 micron membrane filter to remove bacteria or particles that may have passed through the other cartridges.

2.4 Cartridge and Membrane Installation

2.4.1 ROpure Infinity Reverse Osmosis System

2.4.1.1 To replace the cartridges or membranes first disconnect the unit from the power supply. Open the front door and disengage the cartridge hold-down bracket by pulling it out and up.

2.4.1.2 Prefilter Installation

The prefilter is installed to remove particulates from the feed-water which could cause damage to the RO membrane. Install the prefilter cartridge as follows:

2.4.1.2.1 Remove a new prefilter (PN D9004) and wet the o-rings on both end caps.

2.4.1.2.2 Insert the upper end cap into the upper farthest left position of the two cartridge end cap sockets until it bottoms out in the connector.

2.4.1.2.3 Lower the prefilter and insert the lower end cap into the lower socket until it is firmly seated.

2.4.1.3 Pretreatment Carbon Cartridge

The pretreatment carbon cartridge is designed to remove chlorine from the feed-water which could cause damage to the RO membrane. Install the pretreatment carbon cartridge as follows:

2.4.1.3.1 Remove a new pretreatment carbon cartridge (PN D9005) and wet the o-rings on both end caps.

2.4.1.3.2 Insert the upper end cap into the upper position immediately right of the prefilter until it bottoms out in the connector.

2.4.1.3.3 Lower the carbon cartridge and insert the lower end cap into the lower socket until it is firmly seated.

2.4.1.3.4 With both the prefilter and pretreatment carbon cartridges installed, reposition the cartridge hold-down bracket.

2.4.1.4 Membrane Protection System (MPS) Installation

The MPS is a clear plastic bag containing organophosphate powder. This powder is combined with water and pumped through the RO system to eliminate scale buildup on the membrane surface. After feed-water flows through the prefilter and pretreatment carbon cartridges, a pump injects 4-8 ppm of the powder-water mix into the water flowing through the unit before it reaches the RO membranes. Install the MPS cartridge as follows:

2.4.1.4.1 Remove the lid on the new MPS cartridge (PN CM900X1) and add approximately 1L of deioninzed water and agitate.

2.4.1.4.2 Close the lid, and locate and reattach the MPS bag using the quick disconnect fitting.

2.4.1.4.3 Carefully place the bag upside down in the MPS holder.

2.4.1.5 Membrane Installation

This is a 2 membrane system used for the production of reverse-osmosis water. The membranes are installed as follows:

2.4.1.5.1 Place the first membrane cartridge in the right rear of the system cabinet. Ensure that the center connector (product water) points to the left and the offset connector (reject water) points to the rear of the unit.

2.4.1.5.2 Locate the tubing labeled Product and attach to the appropriate connector. Locate the Reject tubing and attach this tubing to the Reject connector.

2.4.1.5.3 Place the second membrane in the front of the fist membrane and install as mentioned above.

2.4.2 NANOpure Infinity Deionization System

2.4.2.1 To replace the cartridges first disconnect the unit from the power

supply. Open the front door and disengage the cartridge hold-down bracket by pulling it out and up.

2.4.2.2 Cartridge Installation

2.4.2.2.1 Install the cartridges in the following order from left to right:

Position 1)	Pretreatment	PN D50251
Position 2)	Ultrapure	PN D50253
Position 3)	Ultrapure	PN D50253
Position 4)	Organic Free	PN D50252

A kit consisting of all four cartridges can be purchased using part number PN D50254.

2.4.2.2.2 Wet the o-rings with water on both cartridge nipples.

2.4.2.2.3 Install the appropriate cartridge in the correct position by pressing the top cartridge end cap into the upper socket until it bottoms out.

2.4.2.2.4 Lower the cartridge and insert the lower end cap into the lower socket until it is firmly seated.

2.4.2.2.5 Replace the cartridge hold-down bracket.

2.5 System Operation

For complete system operation see the operating manual.

Appendix E

Standard Operating Procedure

SOP E.11
Sub-sampling and Sample Compositing Procedure

1.0 Sub-sampling and Sample Compositing Procedures

1.1 When samples are received in greater volumes or numbers than are required for final analyses, laboratory sample mass reduction is necessary. There are two primary approaches for preparing samples for analysis: 1) sub-sampling the original discrete sample in order to prepare the sample for final analysis; or 2) compositing multiple discrete samples by sub-sampling each individual sample and physically combing the individual sub-samples into a single final composite sample to be analyzed. This procedure describes the steps necessary to sub-sample or to composite discrete individual samples to ensure a representative sample is obtained for analysis and to ensure the procedure was properly documented.

2.0 Additional References

2.1 Method EPA/600/R-03/027: Guidance for Obtaining Representative Laboratory Analytical Subsamples from Particulate Laboratory Samples, USEPA, Office of Research and Development, November, 2003.

2.2 Method ASTM D 6323- 98: Standard Guide for Laboratory Subsampling of Media Related to Waste Management Activities, ASTM Standards, Vol II.04, 1998.

3.0 Standard Operating Procedure

3.1 Introduction

Most analytical methods require a sample preparation procedure prior to the final analysis. These sample preparation procedures sometimes require the extraction chemist to sub-sample (i.e. take a smaller aliquot) the original grab sample. When sub-sampling is necessary, the goal is to obtain a representative sample as described in the references above.

As these documents note, representativeness is a matter of scale. Fortunately for water and virtually all soil samples received for environmental analysis, the laboratory subsampling devices greatly exceed the minimum interior diameter of 3 times the largest particles, once extraneous material has been removed from the samples.

For soil samples, multiphase samples and samples containing extraneous material, sub-sampling can be the major source of error in the measurement process, so great care must be used in applying these procedures to obtain a representative sample.

3.2 Multiphase Samples

3.2.1 Inspect the sample and determine if the sample consists of a single matrix or if multiple matrices are encapsulated in the single discrete grab sample.

3.2.2 It is Alpha's policy to analyze and report single discrete sample matrix and to not prepare and analyze multphase samples as a single discrete sample. Because each matrix must be analyzed separately, a determination of which matrix or matrices to be analyzed must be made. If multiple matrices are included perform the following procedure:

- Scrutinize the chain-of-custody and determine if the client has provided further guidance.
- If no guidance is given on the COC, the client should be called to clarify exactly which matrix or matrices the client wishes to have analyzed. This information must be documented in the client file.
- If a particular matrix is requested, the sample is decanted into the various matrices and the requested matrix is isolated for final sample preparation.

3.3 Water Subsampling Procedures (excluding VOCs)

3.3.1 Discrete water samples are typically collected in 1-L glass or plastic containers. Samples are visually inspected to determine if there are extraneous materials that should not be included as an integral part of the sample matrix. Extraneous materials may include such things as twigs, leaves, worms, etc which obviously are not an integral part of the matrix to be extracted/digested and analyzed. The extraneous materials are to be removed from samples before subsampling and preparation for analysis.

3.3.2 Inspect the sample and determine if filtering is required. Colloidal suspensions typically associated with high dissolved solids often times interfere with the organic solvent extraction procedures and may need to be filtered prior to the extraction. Refer to the particular analytical and sample preparation procedures for specific filtering requirements. The only universal exception which prohibits the filtering of any sort is oil and grease, sulfides, and ammonia analysis.

3.3.3 Once the sample matrix has been inspected, and prepared, the entire grab sample should be vigorously shaken in an effort to completely homogenize the sample constituents.

3.3.4 The sample is now ready for sub-sampling. This is most easily accomplished by decanting the required volume in a volumetric glass cylinder.

3.3.4.1 Once samples have been sub-sampled into a secondary container, they must never be poured back into the original sampling container, preventing a possibility of contamination.

3.3.4.2 If samples have been decanted back into their original container, they should be considered compromised and not used in any further preparation or analysis.

3.3.4.3 Sample volumes are then recorded and the sample preparation procedure may commence.

3.4 Soil Subsampling Procedures (excluding VOCs)

3.4.1 Discrete soil samples are typically collected in 250 ml wide mouth glass containers or occasionally in brass sleeves. Samples are visually inspected to determine if there are extraneous material that should not be included as an integral part to the sample matrix. Extraneous material may include such things as twigs, leaves, rocks, etc which obviously are not an integral part of the matrix to be extracted/digested and analyzed. The extraneous materials are to be removed from samples before subsampling and preparation for analysis.

3.4.2 Inspect the sample and determine if the sample consists of a single solid matrix or if the matrix is a sludge.

3.4.3 Sludge Subsampling Procedures

3.4.3.1 Inspect the sample and determine if the sample consists of a single matrix or if multiple matrices are encapsulated in the single discrete grab sample.

3.4.3.2 If the sample is defined as a sludge (i.e. solid matrix that has the viscosity properties of a liquid), then the following procedures are followed:

- Scrutinize the chain-of-custody and determine if the client has provided further guidance.
- If no guidance is given on the COC, the client should be called to clarify exactly which matrix or matrices the client wishes to have analyzed. This information must be documented in the client file.

Note: It is Alpha's policy to analyze and report single discrete sample matrix and to not prepare and analyze multphase samples as a single discrete sample.

- If the supernate is requested, the liquid matrix is decanted and isolated for final sample preparation.

- If the sludge is requested, the supernate is decanted from the sludge and the sludge is isolated for final sample preparation.

3.4.4 Sub-sampling Wide Mouth Sample Containers

3.4.4.1 Once the sample matrix has been inspected, and isolated, the entire grab sample should be stirred with a clean, non-reactive spatula, or glass stirring rod, in an effort to completely homogenize the sample constituents. Samples should be homogenized until the texture and color appear to be uniform.

3.4.4.2 Sub-sampling is most easily accomplished by scooping, with a clean spatula, a portion of the well mixed solid matrix into a receiving container.

3.4.4.3 Once samples have been sub-sampled into a secondary container, they must never be placed back into the original sampling container, preventing a possibility of contamination.

3.4.4.4 If samples have been decanted back into their original container, they should be considered compromised and not used in any further preparation or analysis

3.4.4.5 Sample weights are then recorded and the sample preparation procedure may commence.

3.4.5 Sub-sampling Brass Sleeves

3.4.5.1 Sample collection using brass sleeves involves pounding the brass sleeve into the ground or collecting the sample from a split spoon sample coring device. This collection procedure prohibits the sample preparation person from easily extruding the sample from the brass sleeve without enormous effort or possible contaminating the sample. Therefore, the sample can not be completely homogenized prior to sample preparation. However, the sample is sub-sampled as follows:

- Open the sample container and discard the first 0.25 to 0.5 inch of material. This material should not be used due to possible contamination during the sampling event and contact with the sample lid.

- Proceed with weighing the required sample amount needed to perform the extraction/digestion.
- If a higher degree of homogenization is required then weigh a portion of material approximately 2-3 times the amount required for the sample preparation.
- Perform this same procedure on the opposite side of the brass sleeve and combine the two sub-samples.
- Stir with a clean, non-reactive spatula, or glass stirring rod, in an effort to completely homogenize the sample constituents. Samples should be homogenized until the texture and color appear to be uniform.
- Proceed with weighing the required sample amount needed to perform the extraction/digestion.

3.5 Sample Compositing Procedures

3.5.1 Compositing is a method of combining several samples of a specific sample matrix for a single chemical analysis. The single chemical analysis of a composite sample results in an averaging of the concentrations of its individual component samples.

3.5.2 Composite sampling and analysis can substantially reduce analytical costs by reducing the number of required analysis. A composite sample is typically produced by the physical mixing of individual samples and subsequently analyzing this as a single sample. By selecting the appropriate composite sample size and retesting individual samples, the composite sample may reveal the same information as would otherwise require many more analyses.

3.5.3 Prepare composite samples using equal volumes or weights of each single discrete sample. Sub-sampling of individual discrete samples should be completed as described below.

3.5.4 Mix the composite sample throughly by stirring with a clean, non-reactive spatula, or glass stirring rod, in an effort to completely homogenize the sample constituents. Samples should be homogenized until the texture and color appear to be uniform. For water samples, vigorously shake the final sample composite or stir to homogenize the resultant sample.

3.5.5 Ideally, when preparing a composite sample, each sub-sample comprising the composite sample should be of the same weight or volume. This would limit

the error associated with the compositing procedure to the same final analytical error expressed on the final analytical report as significant figures.

Secondly, analytical methods of analysis vary greatly in significant figures and concentration units. Therefore, to decrease the systemic error produced through sample compositing a higher degree of homogenization is required.

Soil samples inherently have a larger degree of potential sampling error associated with them when compared to liquid samples due in most part to particle size distribution. This is most easily overcome by sub-sampling a larger portion of material, approximately 2-5 times the amount required for the sample preparation, thereby decreasing the overall error. Liquid samples are simply proportioned mathematically to the overall volume required.

There are no universal rules applied to the error margin involved with sample compositing due to the complexity of the overall analytical procedures etc. Therefore, a general guideline to minimize the potential sub-sampling error for soils would be to weigh a sample aliquot to ± 5% of the final target weight. Conversely a general guideline for liquids of ± 2% sub-sampling error should be used when preparing composite samples.

Note: Volumetric cylinders have a volumetric error of ± 2% (Class A) and are acceptable to use when preparing liquids for compositing with the exception of VOCs.

3.5.6 The single most important compositing rule is NEVER mix the entire discrete samples into a single composite sample. Sample weights and volumes will probably not be the same, thereby introducing biased analytical results, and secondly, no additional sample is left to analyze the individuals as discrete samples.

SVOC Soil Compositing Table
Targeting a Overall Weight
Two Times Extraction Requirement
Table E.11-1

Number of composite samples	Sub-sample aliquot (±5% error)	Target weight of individual sub-samples	Final overall Target weight	Weight required for analysis
5	3.8 - 4.2	4.0 g	20 g	10 g
4	4.8 - 5.3	5.0 g	20 g	10 g
3	6.3 - 7.0	6.7 g	20 g	10 g
2	9.5 - 10.5 g	10 g	20 g	10 g

SVOC Soil Compositing Table
Targeting a Overall Weight
Five Times Extraction Requirement
Table E.11-2

Number of composite samples	Sub-sample aliquot (±5% error)	Target weight of individual sub-samples	Final overall Target weight	Weight required for analysis
5	9.5 - 10.1	10.0 g	50 g	10 g
4	11.9 - 13.1	12.5 g	50 g	10 g
3	15.9 - 17.5	16.7 g	50 g	10 g
2	23.8 - 26.3	25 g	50 g	10 g

SVOC Water Compositing Table
Table E.11-3

Number of composite samples	Sub-sample aliquot (±2% error)	Target volume of individual sub-samples	Final overall Target volume	Volume required for analysis
5	98 - 102 ml	100 ml	500 ml	500 ml
4	122 - 128 ml	125 ml	500 ml	500 ml
3	163 - 170 ml	167 ml	500 ml	500 ml
2	245 - 255 ml	250 ml	500 ml	500 ml

3.6 VOC Preparation

The preparation of VOCs are of great concern when sub-sampling or preparing samples for compositing. The compositing of VOCs is not recommended because the compositing process itself provides a mechanism for the contaminants to escape into the atmosphere. Consequently, composite samples may underestimate the amount of VOCs actually present in the sample.

If VOC samples are to be sub-sampled or composited, then the following SOP is appropriate, with the following caveats:

3.6.1 Soil samples must not be mixed or shaken to homogenize the matrix at any point with the exception of shaking or vortexing the sample once it has been extracted with methanol.

3.6.2 VOC sub-sampling or compositing must take precedence over all other analysis, to minimize their potential loss into the atmosphere, as well as minimizing the potential for contamination by lab solvents which are also VOC analytes.

3.6.3 Once the sample container has been opened, speed is of paramount importance, DO NOT DELAY in any aspect of preparing the sample for final analysis. Because of the fragile nature of these compounds, samples should be subsampled mathematically to the overall volume or weight required for the analysis.

3.6.4 As discussed previously, there are no universal rules applied to the error margin involved with sample compositing due to the complexity of the overall analytical procedures etc. Therefore, a general guideline for soils of ± 5% sub-sampling error of the final weight should be used when preparing composite samples. Conversely a general guideline for VOC liquids of ± 2% sub-sampling error should be used when preparing composite samples.

VOC Soil Compositing Table
Table E.11-4

Number of composite samples	Sub-sample aliquot (±5 % error)	Target weight of individual sub-samples	Weight required for analysis
5	3.8 - 4.2	4.0 g	20 g
4	4.8 - 5.3	5.0 g	20 g
3	6.3 - 7.0	6.67g	20 g
2	9.5 - 10.5	10 g	20 g

VOC Water Compositing Table
Table E.11-5

Number of composite samples	Sub-sample aliquot (±2% error)	Target volume of individual sub-samples	Volume required for analysis
5	8.4 - 8.8	8.6 ml	43 ml
4	10.5 - 11.0	10.8 ml	43 ml
3	14.0 - 14.6	14.3 ml	43 ml
2	21.1 - 21.9	21.5 ml	43 ml

Appendix E

Standard Operating Procedure

SOP E.12
A Practical Application Guide for Performing Instrument Calibration, Calibration Model Determination and Calibration Verification

A Practical Application Guide for Performing Instrument Calibration, Calibration Model Determination and Calibration Verification

1.0 Constructing a Calibration Curve

1.1 The most commonly constructed calibration curve used in analytical chemistry is a two variable calibration curve. The two variables are as follows:

a) Independent - the one we set (e.g. concentration - X axis), and
b) Dependent - the one we measure (e.g. response - Y axis).

In reality both variables are somewhat considered independent. In developing a calibration curve for sample quantitation, the primary goal is to develop a quantitation model to relate the two variables.

1.2 The approach used to develop a calibration model is to:

a) prepare a series of known analyte standards,
b) hold all other factors constant (e.g. sample injection volume),
c) measure the response, and
d) develop a calibration model (calibration curve).

1.3 It must be stressed that the analyte response after calibration may actually rely on a number of factors that may affect sample quantitation such as:

a) matrix,
b) interfering analytes,
c) random errors,
d) sample preparation,
e) sample calibration, etc.

Therefore the relationship between the analyte and its response is a function of the entire method.

1.4 Most methods have a range in which the relationship between the response and the analyte concentration may be determined (i.e. range of calibration). There are four primary limiting points in any calibration curve. They are as follows:

a) Limit of Quantitation (LOQ)- concentration point above which an analyte is detected and may be reported with a defined manageable error.

- SW846 requires Reporting Limits (RL) to be established at or above the lowest calibration point in a calibration curve.

- The LOQ and RL are used by our laboratory synonymously.

- NELAP requires the LOQ/RL be established no lower than three times the MDL/LOD.

b) Limit of Detection (LOD) - concentration point above which an analyte is detected with no concern of actual associated error.

- This is typically thought of in most cases as the MDL.

- This is typically a statistically determined concentration below the lowest calibration point which may or may not be included in the calibration curve.

c) Method Detection Limit (MDL) - 40 CFR Part 136 Appendix A states the following: "The Method Detection Limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero."

The MDL is a statistical determination which may or may not be at a concentration that can be measured. This is not factored into the MDL study but is clearly mis-stated in the overall definition.

Some regulatory agencies are beginning to recognize this fact by requiring laboratories to verify the calculated MDL. This is accomplished by analyzing a standard at two to four times the MDL. If the MDL verification standard has a signal to noise ratio greater than three, the MDL is recognized as valid. If not the MDL study needs to be re-conducted at a higher concentration.

d) Limit of Linearity (LOL) - the uppermost concentration point above which an analyte does not exhibit the proven linear relationship developed for lower concentration point standards.

- SW846 would define this as the upper calibration point in the established calibration curve, regardless of calibration model used for calibration.

- Other methods (300.0 and 200.8) would define this as a concentration point above which the linear relationship does not exist at a defined limit of acceptability. For example, if a aluminum standard at a concentration of 1000 mg/L produced a quantitated value of 1256 mg/L it would not be considered linear at that particular concentration. The defined limit of acceptability for these methods are ± 10% and the method would require aluminum to have a quantitated value no larger than 1100 mg/L to be acceptable.

e) Range of Linearity (ROL) - the range of concentration points which define both the upper and lower boundaries which exhibit a proven linear relationship. The ROL is the range in which method analytes may be quantitated. Compounds outside of the ROL can not be quantitated without further concentration or dilution or reporting with footnotes.

In reviewing the four limits of detection it should become obvious that the range of calibration is defined by the LOQ/RL and the LOL. This is stated in our analytical SOPs as follows:

Calibration standards must cover the working range of the instrument with the low level standard at or below the reporting limit. In order to produce acceptable sample results, the response of the instrument must be within the working range established by the initial calibration.

2.0 Calibration Models

2.1 Types of Calibrations

There are four primary models for calibration curves that can be considered for instrument calibration, Linear, Quadratic, Power and Non-Linear. We are interested in only two of the four.

a) Linear $Y = a + bX + \varepsilon$
b) Quadratic $Y = a + bX + c(X^2) + \varepsilon$

Where:

Y	denotes a instrument response
X	denotes the known concentration value of a reference standard
a,b,c	denotes coefficients to be determined, and
ε	denotes a measurement error also known as residual.

Note: For our application, ε will be ignored.

2.2 Special Calibration Cases

There may be a special case in which a multipoint calibration is not required where the calibration is proven to exhibit a linear response. That is: a = 0, and b = 1.

1) Clarification: It is the intent of SW-846 to prioritize the use of IC mathematical models. The first is to begin with the simplest approach, the linear model through zero, and progressing through other options until the calibration acceptance criteria are met. However, it is also acceptable to use *priori knowledge* of the detector response to choose the calibration model.

2.3 Linear Calibration Models

2.3.1 The linear calibration model is widely applied to many instrument calibration procedures because it has several advantages over the more complicated quadratic model. A couple of these advantages are as follows:

- the computation of coefficients and standard deviations are easy;
- the correction for bias is easy;
- there is often a theoretical basis for the model (i.e. a stoichmetric relationship exhists between color intensity and concentration.

2.3.2 Linear Calibrations Forced Through Xero

2.3.2.1 The linear model $Y = a + bX + \varepsilon$ is often written as $Y = mX + b$

where:

Y	denotes the instrument response
X	denotes the known value of a reference standard
m	denotes the slope of the curve, and
b	denotes the y intercept.

Therefore, if $b = 0$, the equation can be rewritten as:

$$Y = mX$$

and the average calibration used to generate a calibration curve.

2.3.2.2 If the RSD calculated from the RF of each analyte is generally ($\leq$ 15% for GC/MS methods and $\leq$ 20% for GC methods), then the response of the instrument is considered linear and the average response factor can be used to determine sample results (e.g., linear forced through zero).

Note: Linearity through zero is a statistical assumption and is not a rationale for reporting results below the calibration range demonstrated by the analysis of standards. It may be tempting to exclude the y intercept, b, from the model because a zero on the x-axis should lead to a zero response on the y-axis. However, the correct procedure is to test the model for the significance of the y intercept term.

That is to say, test the linear calibration model through zero with low level standards quantitated against itself and/or method blanks to understand the significance of the quantitation as it approaches zero.

2.3.3 Linear Calibration not Forced Through Zero

2.3.3.1 The linear model is most commonly written as $Y = mX + b$

where:

Y	denotes the instrument response
X	denotes the known value of a reference standard
m	denotes the slope of the curve, and
b	denotes the y intercept.

In this case b is not equal to 0.

2.3.3.2 If the RSD of the RF is generally greater than 15% for GC/MS methods or 20% for GC methods, then linearity through the origin cannot be assumed. However, a linear calibration not forced through zero can be generated by using a linear regression model. The linear regression calculation will generate a weighted correlation coefficient (r) that is a measure of the "goodness of fit." In order to be used for quantitative purposes, r must be greater than or equal to 0.99.

2.3.4 Quadratic Calibration Models not Forced Through Zero

2.3.4.1 The quadratic calibration model is written as

$$Y = a + bX + c(X^2)$$

2.3.4.2 The statistical considerations in developing a nonlinear calibration model requires more data than the linear model. A minimum of five standards for a linear (first order) calibration model is required, a quadratic (second order) model requires six standards and a third order polynomial requires seven standards. The "goodness of fit" of curve fitting equations is evaluated by calculating the weighted Coefficient of Determination COD. In order to be an acceptable nonlinear calibration, the COD must be ≥ 0.99.

2) Clarification: DoD requires the correlation coefficient to be≥ 0.995. The method and NELAP only require a (r) value of 0.99.

3) Clarification: Alpha's calibration policy restricts the use of polynomials higher than the second order for calibration (e.g. cubic etc.).

2.3.4.3 Some of the disadvantages of the use of quadratic and higher order polynomials are:

- they require more reference standards to capture the region of curvature and define the range of calibration; and
- the correction for bias is more complicated than for the linear model and may not be well understood,

Note: A plot of the data is always recommended, but is not sufficient for identifying the correct model for the calibration curve. Instrument response may not appear to be non-linear over a large calibration range. Calibration models must be justified by the RSD of the RF or the CF.

In addition, test the quadratic calibration model with low level standards quantitated against itself and/or method blanks to understand the significance of the quantitation as it approaches zero and/or the reporting limit.

Non-linear calibrations can not force the line through the origin, i.e., do not set the intercept as 0, and do not include the origin as a calibration point.

3.0 Initial Calibration

3.1 Instrument calibration is intended to eliminate or reduce bias in an instrument's readings over a selected range for all concentration values within that designated calibration range. Reference standards with known values for selected concentration points are measured.

Initial calibration points for the individual target analytes are prepared and analyzed using a minimum of three points for 600 series organic methods and a minimum of five points for 8000 series organic methods to construct a calibration curve. An internal calibration procedure is used for GC/MS methods of analysis and an external calibration procedure is generally used for GC methods of analysis. Calibration standards are prepared at series of concentration points. Some compounds are calibrated at staggered limits and are compound specific (e.g. MTBE, acetone etc.).

3.2 Once the calibration standards have been analyzed, a functional relationship is established between the values of the standards and the corresponding measurements. There are two varying situations that occur with calibrations:

3.2.1 External Calibration

The instrument quantitates sample data in the same units as the reference

standards (e.g. external calibration). For example, GC/FID instruments measure and quantitate sample data for Total Petroleum Hydrocarbon (TPH) in mg/L units. These are the same units used for instrument calibration, mg/L or ug/ml.

3.2.2 Internal Calibraiton

The instrument converts the sample data to response ratios and amount ratios during sample quantitation (e.g. internal calibration). For example, GC/MS instruments measure and quantitate sample data for TPH units in mg/L. However, these instruments use internal standards to ratio the sample response to the response of the associated internal standard to produce a response ratio. These ratios are used to develop the Response Factors (RF) to quantitate data before converting back to concentration units as displayed on a final quantitation report.

The calibration method is the same for both situations and requires following the same basic steps:

- Selecting reference standards with known concentration values to cover the range of interest.
- Measurements of the reference standards with the instrument to be calibrated.
- Determining the functional relationship between the measured and known values of the reference standards (construction of a calibration curve).
- Correction of all sample measurements by the inverse of the calibration curve.

3.3 Response Factors (RF)

Instruments using an internal calibration procedure use response factors to evaluate initial calibrations. If a linear calibration forced through zero model is used, then the average RF can be easily used to quantitate the sample data. Response factors are determined as follows:

$$RF = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

Where:

A_s = Peak area of the analyte
A_{is} = Peak area of the internal standard
C_s = Concentration of the analyte in ug/L
C_{is} = Concentration of the internal standard in ug/L

3.4 Initial Calibration Verification

Immediately after the initial calibration has been established, the calibration must be verified by the analysis of the ICV.

4) Clarification: The ICV using a second source standard is not required by any of the established methods. However, NELAP has established the use of an ICV, but has not established acceptance criteria. Since the ICV is from a second source standard, additional variability is inherent in the quantitation of this standard. Therefore, the ICV should generally meet the CV criteria.

4.0 What can go wrong with the calibration procedure

There are several circumstances where the calibration curve will not reduce or eliminate instrument bias as intended by the analyst. A critical review of the calibration data should expose such problems.

4.1 Poor instrument precision or unsuspected day-to-day effects (e.g. room temperature variances over the course of the day) may result in standard deviations that are large enough to jeopardize the calibration. The best strategy is to estimate the instruments's precision and determine if it is acceptable for the precision required.

4.2 Outliers in the calibration data can seriously distort the calibration curve, particularly if the outliers lie near one of the endpoints of the calibration range.

4.2.1 If the RSD for one or more analytes exceed 15% or 20%, then the following steps are recommended but not required:

1) If the RSD appears to be associated with a single standard, that one standard may be re-analyzed and the RSD recalculated. Replacing the standard may be necessary in some cases.

2) Narrow the calibration range by eliminating one or more of the calibration standards producing a narrower calibration range.

Note: Changes to the upper end of the calibration range will affect the need to dilute samples above the range, while changes to the lower end will affect the overall sensitivity of the method. Hence, narrowing the calibration range by changing the concentration of the lowest standard will, by definition, change the method quantitation limit.

5) Clarification: If a particular calibration model can be achieved by either replacing an aberrant standard, or using a narrow calibration range, then the decision must be clearly documented. If a standard is replaced, then the entire standard and all associated RFs associated with the standard must also be replaced.

4.2.2 It is possible for different analysts to produce instrument measurements with variances that differ between analysts on the same instrument. This is not usually a problem with GC and/or GC/MS instrumentation. Small differences among analysts can be accepted as part of the imprecision of the measurement process, but large systematic differences among analysts require resolution.

These differences of imprecision can usually be traced back to systematic problems such as the preparation of standards etc.

4.3 Once established, the calibration procedure relies on the instrument continuing to respond in the same way over time. If the system drifts or takes unpredictable excursions, the calibrated values may not be properly corrected for bias, and may further degrade the accuracy of the measurements. To assure that future measurements are being produced correctly the calibration curve is verified on a regular frequency with calibration verification standards.

5.0 Calibration Model Validation

5.1 A primary consideration for employing any calibration model is determining a procedure to identify and validate the model used for the calibration curve. The statistical criteria used to validate the calibration model has already been discussed. These criteria are generally established and stated in the individual methods of analysis. The SW846 Method 8000B criteria has been referenced in this SOP because it is the most stringent set of established criteria used by the EPA.

5.2 However what is not discussed in most analytical methods of analysis is the criteria to validate the software used with the calibration model used to quantitate sample data. The in-house established criteria is as follows:

Data acquisition and quantitation software must display sample data in a format that would allow the analyst to verify the sample quantitation (concentration) report against the initial calibration regardless of calibration model.

5.3 Alpha uses two primary software packages for data acquisition:

a) Agilent Technologies, Chemstation, and

b) Dionex, Chromeleon software.

5.4 Chemstation Validation Procedure

5.4.1 SVOC (Internal Calibration Procedure)

The table presented below represents the quadratic equation [a(x*x) + bx + c)] determined by the Agilent Chemstation for the compound 2,4-dinitrophenol. This equation has been used to verify and validate the quantitation determined for this compound as tabulated below.

This compound was quantitated against a quadratic equation displayed at the bottom of the compound's calibration curve. Since this is an internal standard calibration procedure, Response Ratios are used to verify the Amount Ratios.

The response ratios are simply determined by:

$$\frac{\text{Response of the analyte}}{\text{Response of the associated internal standard}}$$

This value can be used to verify the concentration on the quantitation report.

The concentration value displayed on the quantitation report can be converted to a Amount Ratio simply by:

$$\frac{\text{Concentration of the analyte on the quantitation report}}{\text{Concentration of the associated internal standard}}$$

If these two values agree than the calibration model and software quantitation has been verified.

This same decision-tree-procedure is used regardless of calibration model.

2,4-Dinitrophenol	Quadratic equation			R = [.0399 * (a*a)] +(.181*a) - .0449				
Std Conct.	0.5 ng/ul	0.75 ng/ul	1 ng/ul	1.5 ng/ul	2 ng/ul	2.5 ng/ul	3.0 ng/ul	4.0 ng/ul
Injection Vol	20 ul	20 ul	20 ul	20 ul	20 ul	20 ul	20 ul	20 ul
mass on column	10 ng	15 ng	20 ng	30 ng	40 ng	50 ng	60 ng	80 ng
Amt Ratio Cont (mass)/Cont IS	0.250	0.375	0.500	0.750	1.00	1.25	1.50	2.00
Response Std	4353	13038	22055	43054	66929	92647	130286	158290
Response IS (Acenapthene)	452336	425018	418961	411835	406809	380772	381953	338524
Response Ratio Rsp(std)/Rsp(IS)	0.00962	0.0306	0.0526	0.1045	0.1645	0.2431	0.3411	0.4675
R= (manual calculation) (e.g., a = .25, .375 etc) (Theoretical Response Ratio calculated to best fit quadratic curve)	0.00284	0.0285	0.0556	0.1133	0.1760	0.1820	0.2275	0.4767
concentration on quantitation report	11.34 ng	15.39 ng	19.46 ng	28.53 ng	38.21 ng	49.92 ng	63.22 ng	78.89 ng
Amt Ratio calculated from quantitation report (e.g. 11.34/40 = 0.2835)	0.2835	0.38475	0.4865	0.71325	0.95525	1.248	1.5805	1.97225
Response Ratio calculated from Amt Ration from the Qt report inserted into the quadratric equation.	0.00962	0.0306	0.0526	0.1045	0.1645	0.2431	0.3408	0.4673
Verified	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

5.4.2 VOC

5.4.2.1 Software validation of a quadratic calibration model (Internal Calibration Procedure)

The table presented below represents the quadratic equation [a(x*x) + bx + c)] determined by the Agilent Chemstation for the compound Chloroethane. This equation has been used to verify and validate the quantitation determined for this compound as tabulated below.

This same decision-tree-procedure is used regardless of calibration model as described below.

Chloroethane	Quadratic equation			R = [-0.0101 * (a*a)] +0.152*a) - 0.000109				
Std Conct.	0.25 ug/L	0.50 ug/L	1.0 ug/L	2.0 ug/L	4.0 ug/L	8.0 ug/L	16 ug/L	
Amt Ratio "a" Cont (mass)/Cont IS	0.0250	0.05	0.1	0.2	0.4	0.8	1.6	
Response Std	2616	4975	8787	12919	40853	72905	138320	
Response IS	617903	622915	633385	626190	597915	622710	644054	
Response Ratio Rsp(std)/Rsp(IS)	0.004	0.008	0.014	0.021	0.068	0.117	0.215	
"R" determined from quadratic using "a"	0.004	0.007	0.015	0.030	0.059	0.115	0.217	
concentration on quantitation report (ug/L)	0.29	0.53	0.93	1.38	4.65	8.16	15.82	
Amt Ratio calculated from quantitation report (e.g. 0.29/10 = 0.029)	0.029	0.053	0.093	0.138	0.465	0.816	1.582	
Response Ratio "R" calculated from Amt Ration from the Qt report inserted into the quadratric equation.	0.004	0.008	0.014	0.21	0.068	0.117	0.215	
Verified	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

5.4.2.2 Software validation of a linear regression calibration model (Internal Calibration Procedure)

The table presented below represents the linear regression equation (aX + b)] determined by the Agilent Chemstation for the compound 1,1,2,2-Tetrachloroethane. This equation has been used to verify and validate the quantitation determined for this compound as tabulated below.

1,1,2,2-tetrachloroethane	Linear Regression equation			R = [0.492*a) - 0.00356				
Std Conct.	0.25 ug/L	0.50 ug/L	1.0 ug/L	2.0 ug/L	4.0 ug/L	8.0 ug/L	16 ug/L	32 ug/L
Amt Ratio "a" Cont (mass)/Cont IS	0.0250	0.05	0.1	0.2	0.4	0.8	1.6	3.2
Response Std	2477	5280	11718	21909	48065	87603	189127	402829
Response IS	242481	246435	253070	248662	237135	245818	248731	260591
Response Ratio Rsp(std)/Rsp(IS)	0.010	0.021	0.046	0.088	0.203	0.356	0.760	1.55
"R" determined from linear equation using "a"	0.009	0.021	0.046	0.095	0.193	0.390	0.784	1.57
concentration on quantitation report (ug/L)	0.28	0.51	1.01	1.86	4.19	7.31	15.51	31.47
Amt Ratio calculated from quantitation report (e.g. 0.28/10 = 0.028)	0.028	0.051	0.101	0.186	0.419	0.731	1.551	3.147
Response Ratio "R" calculated from Amt Ration from the Qt report inserted into the quadratric equation.	0.010	0.022	0.046	0.088	0.203	0.356	0.760	1.54
Verified	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

5.4.2.3 Software validation of a linear through zero (average RF) calibration model (Internal Calibration Procedure)

The table presented below represents the linear equation (aX) determined by the Agilent Chemstation for the compound Toluene. This equation has been used to verify and validate the quantitation determined for this compound as tabulated below.

Toluene	Linear Average RF equation				R =(3.35*a)			
Std Conct.	0.25 ug/L	0.50 ug/L	1.0 ug/L	2.0 ug/L	4.0 ug/L	8.0 ug/L	16 ug/L	32 ug/L
Amt Ratio "a" Cont (mass)/Cont IS	0.0250	0.05	0.1	0.2	0.4	0.8	1.6	3.2
Response Std	19818	41005	85866	161992	338446	621027	1407233	2869298
Response IS	242481	246435	253070	248662	237135	245818	248731	260591
Response Ratio Rsp(std)/Rsp(IS)	0.082	0.166	0.339	0.651	1.43	2.53	5.66	11.01
"R" determined from linear equation using "a"	0.084	0.168	0.335	0.670	1.34	2.68	5.36	10.72
concentration on quantitation report (ug/L)	0.24	0.50	1.01	1.94	4.26	7.54	16.88	32.86
Amt Ratio calculated from quantitation report (e.g. 0.24/10 = 0.024)	0.024	0.05	0.101	0.194	0.426	0.754	1.688	3.286
Response Ratio "R" calculated from Amt Ration from the Qt report inserted into the quadratric equation.	0.080	0.168	0.338	0.650	1.43	2.53	5.65	11.01
Verified	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

5.5 Dionex Validation Procedure

5.5.1 Software validation of a quadratic calibration model (External Calibration Procedure)

The table presented below represents the quadratic equation [a(x*x) + bx + c)] determined by the Dionex software for the compound alpha-BHC. This equation has been used to verify and validate the quantitation determined for this compound as tabulated below.

This same decision-tree-procedure is used regardless of calibration model as described below.

α-BHC	Quadratic equation	Amount (concentration) = [5.746319xE-15 * (a*a)] +(1.510110 x E-07*a) + (-0.0010)								
Std Conct (ug/ml)	0.0005	0.001	0.03	0.05	0.06	0.09	0.12	0.15	0.18	0.20
α-BHC response	9307	8683	203684	348143	393666	588711	793844	941483	1143017	1280581
Conct. From QT report in ug/L	0.0004	0.0003	0.0300	0.0522	0.0593	0.0899	0.1225	0.1462	0.1791	0.2018
Calluated Conct from equation	0.0004	0.0003	0.0300	0.0522	0.0593	0.0899	0.1225	0.1462	0.1791	0.2018
Verified	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

5.5.2 Software validation of a Linear calibration model (External Calibration Procedure)

The table presented below represents the linear equation [(ax + b)] determined by th Dionex software for the compound alpha-BHC. This equation has been used to verify and validate the quantitation determined for this compound as tabulated below.

α-BHC	Linear equation	Amount (concentration) = (1.557 x E-07*a) + (0)								
Std Conct (ug/ml)	0.0005	0.001	0.03	0.05	0.06	0.09	0.12	0.15	0.18	0.20
α-BHC response	9307	8683	203684	348143	393666	588711	793844	941483	1143017	1280581
Conct. From QT report in ug/L	0.0014	0.0014	0.0317	0.0542	0.0613	0.0917	0.1236	0.1466	0.1780	0.1994
Calluated Conct from equation	0.0014	0.0014	0.0317	0.0542	0.0613	0.0917	0.1236	0.1466	0.1780	0.1994
Verified	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

5.6 Chemstation Metals Validation Procedure

5.6.1 Sample concentrations may be verified by the use of the Counts Per Second (CPS) information displayed on the calibration and final sample data quantitation reports. This data used in conjunction with the initial calibration equation report may be used to verify the calculated concentrations on the final sample quantitation report.

Example:

Scandium initial calibration equation using the weighted linear regression equation is a follows: (This changes for each new initial calibration, ie. daily).

$Y = (1.642E+0 * X) + 4.195E-2$

Therefore:

$$X = \frac{Y-(4.195E-2)}{1.642E+0}$$

The sample concentration may be verified as follows:

Y = Sample counts for Scandium is 84.9575

Therefore:

X = 51.70 ug/L which equals the concentration on the sample quantitation report.

Appendix F

Software Quality Assurance Plan (SQAP)

Appendix F

Standard Operating Procedure

SOP F.1
Software Quality Assurance Plan (SQAP)

1.0 SOFTWARE QUALITY ASSURANCE PLAN (SQAP)

The generation, compilation, and reporting of electronic data is a critical component of Alpha's laboratory operations. In order to generate data of known and acceptable quality, the quality assurance procedures and quality control practices for electronic data systems have been developed to be comparable in sophistication and intent to other elements of Alpha's QA program. Sections 8.1 through 8.11 of EPA Document 2185-Good Automated Laboratory Practices has been used as the foundation for the development and implementation of Alpha's SQAP.

Alpha has developed and implemented a Software Quality Assurance Plan (SQAP) that addresses requirements and responsibilities for QA activities related to the LIMS, local software, instrumentation software, and other systems related to the generation, compilation, reporting of data, or other supporting information. It is the responsibility of the LIMS Administrator to implement the SQAP and to ensure that all software and QA functions are being properly documented. The LIMS Administrator is also a part of the QA Team and reports on a regular basis to the QA Officer. The SQAP describes polices and practices for the development, modification, maintenance, archival, and use of computer software.

Appendix F

Standard Operating Procedure

SOP F.2
Computer Software Operations

1.0 COMPUTER SOFTWARE OPERATIONS

1.1 This standard operating procedure outlines and defines the techniques, operations, maintenance, and security when dealing with any of the various electronic data collection, processing, and archival devices present in Alpha's facilities.

2.0 Standard Operating Procedure

2.1 In general the computer department is responsible for all software loading, upgrades, coding changes, debugging and hardware/software retirements.

The following general policies apply to these functions:

i. Only authorized, trained personnel are allowed to perform these functions;

ii. No unauthorized software is to be loaded on any company computer;

iii. Only authorized, trained personnel are allowed to use company connections to the network or internet; and,

iv. No hardware, software, or raw data is to be removed from the laboratory without written authorization.

2.2 Definitions

Alpha - a specific MSAccess2003 database containing laboratory data.

Khemia - software program utilizing MSAccess2003 security formats for the Omega and Alpha databases.

Laboratory Information Management System (LIMS) - a general term used to describe the entire in-house network.

Network - the interconnection of various PCs and servers.

Omega - a specific MSAccess2003 database containing templates for queries, reports and forms. This term is also used as a general grouping of the interconnected Khemia, Omega, and Alpha database structure.

2.3 Safety

2.3.1 General

When dealing with any of the equipment in this facility, assume that hazardous conditions are present in the form of mechanical, electrical, or chemical

situations. Complete a new assessment of the potential hazards of any equipment prior to undertaking any interactions with this equipment. This assessment should be made each time the equipment has been out of sight. There should also be a continual scanning of the equipment during use to ensure that no new situations have occurred or been overlooked. If any hazardous conditions are present, appropriate precautions should be undertaken to limit the user's interactions with these conditions.

2.3.2 Mechanical Hazards

2.3.2.1 Temperature

Most of the equipment present in this facility contains zones which are used to heat or cool. Either of these conditions can cause severe burns with only momentary contact. If it is necessary to work around these zones without bringing them to room temperature, the use of protective devices should be used to limit the possibility of contacts.

2.3.2.2 Pinching and Crushing

Various portions of the equipment in this facility use automated robotics. Due to automated movements of these devices severe damage can occur. Shielding should be used whenever it is necessary to work around these devices without disabling the automated processes. Extreme caution is to be taken to ensure that the automated processes are not accidently started.

2.3.2.3 Weight

Training has been given to all employees regarding the appropriate techniques to use when moving or lifting heavy equipment. These should be followed without exception.

2.3.2.4 Ergonomics

Much of the equipment is located in areas that are not easily accessible for maintenance. If it is not possible to disconnect and move the equipment to a more accessible area, extreme care should be taken to limit the possibility of injury due to falls, strains, or space constraints. Also, care should be taken to ensure weight limits are not exceeded that may be present when climbing on or around the equipment, especially when dealing with tables and ladders.

2.3.2.5 Dust

Due to the area in which we are located, dust is quickly accumulated in all of the facility's equipment. This dust creates a potential for blinding or ingestion. Before working on any piece of equipment it is recommended that the dust be removed with a vacuum. If a pressurized container is to be used to remove the dust, extreme care should be taken that items are not propelled into the nose, mouth, or eyes.

2.3.3 Electrical Hazards

2.3.3.1 Dangerous currents are present in most of the equipment in this facility. Extreme care should be taken to ensure that the operator does not come into contact with any source of electricity. Whenever dealing with electrical areas, it is strongly recommended that all sources of current be removed. When systems have been unplugged from their current source, care should be taken that they are not accidentally reconnected. Lockout tags or plastic ties can be used to alert the need for the source to remain disconnected.

Current can still exist after the source has been disconnected! Allow ample time for capacitors to discharge prior to maintenance.

2.3.3.2 Static electricity is an ever present consideration. The discharge of static through the equipment components can cause failures. It is strongly recommended that static wrist bands be worn whenever electronic components are being maintained.

2.3.3.3 Liquids of various types are used throughout our facility. Many of these are excellent conductors of electricity. Do not work on electrical equipment that is wet without removing any potential source of current.

2.3.4 Chemical Hazards

2.3.4.1 This facility utilizes many chemicals that are of an extreme hazardous nature. Read the MSDS for each chemical present in the work area prior to starting work. Especially note any potential situations that might affect the work area such as flammability and contact thresholds.

2.3.4.2 When dealing with any cleaning solutions, be aware of their potential effects on the surrounding equipment. Many of the cleaning solutions are potential contaminants in our testing procedures.

2.4 Software Documentation

Software development activities are conducted in a traceable, planned, and orderly manner such that all major activities such as, coding changes and debugging can be documented.

2.4.1 Software Inventory/Coding Modification Logbooks

Three-ring logbooks contain records documenting laboratory controlled software programs and their revisions used by Alpha. These commercially purchased software products have their own logbook.

2.4.1.1 Omega Database

Two logbooks are kept for changes made to the omega database. One of these logbooks is maintained for documenting coding and structure modifications and the other logbook is used for data and data quality objective changes made to the omega database.

2.4.1.2 Chemstation

A single logbook is maintained documenting both common coding changes and individual system (instrument) code changes made to the chemstation software.

Appendix F

Standard Operating Procedure

SOP F.3
Data Collection and Storage

1.0 DATA COLLECTION AND STORAGE

1.1 This procedure is used to standardize the naming of subdirectories used to collect and store computer data for consistency throughout the laboratory.

2.0 Standard Operating Procedure

2.1 Data Collection

All data collection, interpretation, and corrections are made in a manner consistent with the practices and protocols outlined in the various Standard Operating Procedures governing these areas.

2.2 HP Chemstation / Enviroquant

2.2.1 Data File Nomenclature

YYMMDD## where:

YY - the YEAR that the data file was created.
MM - the MONTH that the data file was created.
DD - the DAY that the data file was created.
- a sequential NUMBER indicating the order in which the data file was analyzed and resets with each sequence to 01.

Thus a data file that was created on 01FEB09, and was the third in that sequence would be : 09020103.

2.2.2 Data File Storage

2.2.2.1 Each PC has its own harddrive (C: or D:) location for the storage of the Chemstation/Enviroquant files. Within this harddrive, all of the Chemstation/Enviroquant files are stored under the subdirectory HPCHEM or MSDCHEM.

2.2.2.2 Within this subdirectory, the METHODS, SEQUENCES, and DATA, have their own subdirectories that exist in a subdirectory named after the specific instrument (e.g.,C:\HPCHEM\MS05\DATA\).

2.2.2.3 Sequences should be named the same as the data files, but without the sequential number indicating order (e.g., 09201.S).

2.2.2.4 DATA should be stored in its own data subdirectory that is named the same as the sequence within which it was collected. This additional

subdirectory exists within the DATA subdirectory and helps to create "packets" of related data that are easier to locate, archive, and retrieve (e.g., C:\HPCHEM\MS05\DATA\090201\09020113.D).

2.3 Long Term Data File Storage and Archival

2..31 Each month's data subdirectories are compiled into a single subdirectory named for the month and year (e.g., Feb 09).

2.3.2 Each month, the previous month's data is archived on dual DVDs, one of which is kept offsite.

2.3.3 As space permits, previous data is kept on each PC, with the oldest data being removed first.

2.3.4 Each day, the entire, non-monthly archived , contents of each system's data collection software is copied onto the main server. Each subsequent day's archive is stored separately in folders on the server. Mid-month, the previous month's archives are deleted.

Appendix F

Standard Operating Procedure

SOP F.4
Data File Uploading Procedures

1.0 DATA FILE UPLOADING PROCEDURES

1.1 All data produced by analytical instruments must be formatted in a way the Omega software can parse-out information that is critical to the final compilation, reduction and reporting of data.

2.0 Data File Downloading into Omega Formats (Chemstation Data)

2.1 For correct interfacing between the Chemstation/ Enviroquant text file and the Omega database, the following information must be present in specific areas on the quantitation report. This interface needs to have the specified information in the exact position noted below. Each field must contain the exact number of characters. Use blank spaces for empty characters. If too few or too many spaces are present, the file will not upload. Any information after the sample ID on the sample line is ignored as far as Omega is concerned.

2.2 The positions are those as seen when in the sequence table or when editing the file information from the quantitation screen.

Field	Example	Quant report Line	Start Position	Length
Sample Type	SAMP	Sample	1	5
Sample ID	05021422-23AMSD	Sample	6	16
VOC or BNA Batch ID	MS06W0625A	Misc	1	10
VOC or BNA Test Name	VOC_W	Misc	11	6
VOC or BNA PQL Multiplier	1.000	Misc	17	6
TPH Batch ID	MS06W0625B	Misc	23	10
TPH Test Name	TPH/P_W	Misc	33	8
TPH PQL Multiplier	1.000	Misc	41	5
Alcohol Batch ID	08460	Misc	1	6
Alcohol Test Name	Alcohol_W	Misc	7	10
Alcohol Multiplier	1.000	Misc	17	6

If there are no TPH-Purgeable batches associated with the data file, these fields can be left blank or used for other information.

2.2.1 Field — Explanations

Sample Type — use **SAMP** for all client samples

use **MBLK** for all Method Blanks (not needed for cleanout blanks)
use **DUP** for all sample Duplicates (not fortified/spiked)
use **LCS** for all Laboratory Control Samples and Laboratory Fortified Blanks
use **LCSD** for all LCS Duplicates and LFB Duplicates
use **MS** for all Matrix Spikes
use **MSD** for all MS Duplicates

Sample ID

Client ID & Sample ID & Fraction (must be identical to that listed on our work-order sheet.)
(e.g. GMT09020143-06A)
(e.g. GMT09020143-06ADUP)
(e.g. GMT09020143-06AMS)
(e.g. GMT09020143-06AMSD)

Batch ID

Instrument number and Matrix and Month and Day and Letter of the batch associated with the VOC samples (e.g. MS09W0214B) or prep batch ID associated with SEMIVOA samples. (e.g. 12345). This must be identical to that listed on our work-order sheet.

Test Name

- PNA_SIM_S
- PNA_SIM_W
- TPH/P_W
- TPH/P_S
- TPH/P_A
- VOC_W
- VOC_S
- VOC_A
- BNA_W
- BNA_S
- ALCOHOL_W
- ALCOHOL_S

PQL Multiplier

The amount by which the report's standard reporting limit needs to be raised. Note that this may not necessarily be the instrument multiplier.

2.3 When all of the reportable runs have been reviewed, run a DoList selecting MACRO and then OMEGA. This will dump the selected files onto the floppy in the A: drive, in a text format that is readable by Omega. This floppy should then be included with the hard copies of the QC data.

2.3.1 Include the associated sample with the MS/MSD on the QC floppy (as the LIMS system needs to reference the MS/MSD to its parent sample).

2.3.2 The sample associated with the MS/MSD must be logged-in for the associated analytical test.

3.0 Hard Copy, Non-automated, and Non-excel Data

3.1 This type of data is stored in the work order folders and are manually entered into Omega by the report writing department.

Appendix F

Standard Operating Procedure

SOP F.5
Electron Diskette Deliverables (EDDs)

1.0 ELECTRONIC DISKETTE DELIVERABLES (EDDs)

1.1 Many of our clients have a need to incorporate their data into a variety of databases for a multitude of end uses. In an effort to help our clients decrease the need for manually entering the hard copy results received from our facility, we provide a variety of electronic data formats.

There are generally no industry standard formats that are required by our clients; therefore, Alpha maintains the ability to create and structure a specific format for each client. These formats range from a simple text listing of the analytes and their results, through a typical excel format of the full sample and QC data package, to a six file package of the laboratory EDF (GeoTracker) result tables.

2.0 STANDARD OPERATING PROCEDURE

2.1 EDD Format Specification

Clients who request EDDs should provide a specific format and nomenclature for their data. Specific coding has been added to Omega to insure consistency in the EDD creation.

2.2 Data Inclusions

Some clients require QC in their EDDs, while others do not. If required, QC is entered by the reporting department prior to EDD creation.

2.3 EDD Creation

The following description briefly describes the essential elements for the creation of an electronic data deliverable.

2.3.1 Choose the EDD REPORTS option from the main categories in omega.

2.3.2 Under WORK-ORDER, enter the desired work-order. If QC is required use the bottom of the form to double check for errors or omissions prior to creating the EDD.

2.3.3 Click the OK button.

2.3.4 Use the EDD DATE UPDATE button to update the date that the EDD is emailed.

2.3.4.1 Enter the work-order number and then the ENTER key.

2.3.4.2 Repeat until all work-orders have been entered.

2.3.4.3 Click CLOSE to exit.

2.3.5 The unfinished files are located in the L:\Elec_DD\<ClientID>\ subdirectory (this is subject to change).

2.3.6 Open each Excel file and reformat the column widths, margins, and page settings.

2.3.6.1 Widths = size to fit (autofit).

2.3.6.2 Margins - top (0.5), bottom (0.25), left (0.25) and right (0.25).

2.3.6.3 Page settings (depends on the client format):

- Landscape,
- Fit to 1 page wide.

2.3.7 Check the number of rows against the number of expected line items (analytes x samples).

2.3.8 Spot check results with excel entries.

2.3.9 Save each Excel file in an Excel file format.

2.3.10 Email the files to the address listed in L:\Elec_DD\EDD_LIST.XLS (this is subject to change). Include a copy of the Email in the data folder.

2.3.11 Place the completed work-order folders in the scanning department file bins next to the outside door in the fax room.

Appendix F

Standard Operating Procedure

SOP F.6
MSAcess2003 DATABASES

1.0 MSAccess2003 DATABASES

1.1 The Access databases are used to correlate, format and store the various data from our client's requests. These include (but are not limited to) chain-of-custodies, bottle orders, quotes, test preparation, analytes, sample prep, analysis, reports, QC, and EDDs. The Omega database consists of the templates, formats, and structures, for the various tables, forms, and reports. The Alpha database contains all of the data utilized by the Omega database.

2.0 STANDARD OPERATING PROCEDURE

2.1 Omega Database

2.1.1 The Omega database should be renewed on each working day through the double-clicking of the UPDATE icon located on the desktop of each PC. By updating on a daily basis, all of the various PCs will be utilizing the most recent changes to these tables, forms, and reports.

2.1.2 No one other than those authorized should make any coding changes to the databases. The structural integrity of the Omega database is so interwoven, that seemingly minor changes can have massive effects.

Unless specifically requested, only the LIMS administrator is authorized to make any changes.

2.1.3 Request forms are available if changes are desired to the Omega database. If approved, these changes will be incorporated in the next version of the update (see F.6.2.1.1 above).

2.1.4 Any changes to this database are only saved on the local PC. These changes must then be copied over to the server. Extreme care must be taken to insure that a copy of the most recent version is present locally prior to making any changes, otherwise it is possible to overwrite previous changes with an older version.

2.2 Alpha Database

2.2.1 This database contains the actual laboratory generated data. This data consists of not only analytical data, but also all of the information contained within substructures, such as laboratory personnel, analyte names, tests, client information, etc.. This database exists on the server and is therefore accessible to all areas of the laboratory simultaneously.

2.2.2 Due to the intricate interlacing of the information in this database, changes to any portion affects the entire database. Personnel must only utilize those areas

of this database in which they have been trained, and then assure to the best of their ability that the information they enter is correct. Since this information is utilized by all of the laboratory, any changes made to information already present may adversely affect other areas of the laboratory. Any changes made to information already present in the system should be closely examined for those other laboratory areas affected, and the personnel in those areas notified as to the changes.

2.2.3 Since this is a shared database, only one current copy exists. Any data deleted from this database is not retrievable! Only those personnel trained and authorized should perform any data deletions, and then only after careful scrutiny.

A copy of the Alpha database is made by the LIMS Administrator daily. If major problems occur, the copy can be restored, however this will remove any data added or changed since the copy was created.

2.2.4 Due to the shared status of this database, data corruptions occasionally occur for various reasons. These corruptions can be limited through the simple process of returning to the main menu as soon as possible whenever the current task or set of tasks is completed. If the system is not being used for several minutes, then return to the main menu. This action will release resources that might be needed by another area of the laboratory as well as prevent those resources from being corrupted in case of local PC malfunction. The system should never be allowed to stand idle for extended periods with any screen other than the main page present on the PC monitor.

2.3 Database Corruption

Database repair should only be undertaken by the LIMS Administrator or a designated person.

2.3.1 Repair

2.3.1.1 Copy the Alpha.mdb database from S:\Alpha.mdb to the local drive. (This is done to increase the speed of the repair process).

Caution: Be certain that all of the PCs have closed Omega prior to the copy. If any of the PCs are active in the database then the repair process will truncate the tables that were active, causing ALL of the data in those tables to be lost!

2.3.1.2 Open MSAccess without any open databases.

2.3.1.3 Under TOOLs click UTILITIES, then REPAIR and choose the Alpha.mdb database that was copied to the local drive.

2.3.1.4 After the repair is completed, COMPACT the database.

2.3.1.5 If any ERRORS have occurred, then repeat the process using the daily archived database.

- All data and changes entered into the database that day will have been lost and will need to be redone.
- Sometimes, compacting a corrupted database will allow a repair to proceed without errors.
- Sometimes, decompiling will fix a corruted database.

2.3.1.6 After compacting the repaired database, copy the file back to S:\Alpha.mdb.

2.3.2 Compact

2.3.2.1 Open the MSAccess without any open databases.

2.3.2.2 Copy the database from S:\ to the local drive.

- This will increase the speed of the compaction.

Caution: Be certain that the pathways are correct. Multiple copies of the same database from different time periods are present throughout the network.

2.3.2.3 Under FILE click UTILITIES, then COMPACT and choose the correct database on the local drive.

2.3.2.4 Compact the file into itself (i.e. - save the file under the same name and location).

2.3.2.5 Copy the file back into the S:\ directory, overwriting the original.

Appendix F

Standard Operating Procedure

SOP F.7
Data Archiving

1.0 DATA ARCHIVING

1.1 Laboratory data is stored and archived for possible future use in a traceable, planned and orderly manner to facilitate access, ease of use, and security.

2.0 STANDARD OPERATING PROCEDURE

2.1 Analytical Instruments

On a daily basis, in-house software automatically copies all instrument data to a backup server. These daily backups are kept until after the monthly archiving to DVDs are completed. In case of data loss, (at the PC due to various reasons,) the original data can be restored.

On a monthly basis, the system administrator will archive any data files greater than one month old. These files are transferred to dual DVDs for both local and offsite storage. The archived data also remains on the individual PCs as hard drive room permits. When hard drive room is necessary, the oldest archived files are removed first.

2.1.1 In preparation for archiving, the system administrator compiles the various monthly data, method, and sequence files to create a monthly archival subdirectory on each analytical PC.

2.1.1.1 Within the Archive subdirectory, create a new folder called by the month and year of the data (e.g. FEB09).

2.1.1.2 Move the data and sequences into this new folder.

2.1.1.3 Drag (copy) the methods into this new folder.

2.1.2 This archive subdirectory is then copied across the network to the server via the in-house archiving software.

2.1.3 The monthly archive subdirectories are then copied onto DVDs.

2.1.3.1 Copy the archived data from the backup server to the archive PC.

2.1.3.2 Insert a new DVD into the R-RW device (LIMS Administrator's archive PC).

2.1.3.3 Click on the Creator Classic icon.

2.1.3.4 Enlarge the subdirectories in the upper screen such that the desired monthly folder is present on the right side.

2.1.3.5 Drag (copy) the monthly folder down to the right side of the lower screen. If multiple instruments, drag all of the desired instrument folders, not the monthly. Each DVD holds 6.4 Gb. The amount of the selected files is listed at the bottom of the screen. Do not exceed the 6.4 Gb limit.

2.1.3.6 Double click on the UNTITLED on the left bottom screen, and name the DVD with the month and year.

2.1.3.7 Click on the DISC tab at the bottom left, and then on the red RECORD button.

2.1.3.8 When the DVD is finished, the DVD will eject.

2.1.3.9 Insert a new DVD and restart at for the duplicate DVD.

2.1.4 Each DVD is labeled with the month and year

2.1.4.1 Use only felt pens (Sharpie) to write on the DVDs.

2.1.4.2 Label each DVD and jewel box with "RAW DATA," and the month and year.

2.1.5 Store the in-house copies in the DVD bins, and send the duplicates to offsite storage.

2.1.6 Data retrieval is accomplished by copying the desired files from the DVD back onto the archive PC and changing the properties (removing the read only check mark after double right clicking on the file or files). The files are then moved to the backup server where they can be uploaded onto the instrument PC.

2.1.7 Due to various circumstances, the data on the new DVDs may be corrupt. To ensure that a good copy is present, the data from the DVDs is copied to another PC and random files are checked for data integrity.

2.2 Omega

The Omega databases are backed up daily by the in-house archive software in the same manner as the instrument data.

The Omega databases are backed up monthly by the LIMS Administrator for offsite archiving.

2.3 Administration Files

The financial files (BUSINESSWORKS) are backed up nightly, weekly, and monthly with nightly and monthly archived files stored offsite.

2.4 Server

The entire server contents are backed up nightly, weekly, and monthly with monthly archives stored offsite.

2.5 Accessing Archived Data

2.5.1 Occasionally, there is a need to review data that is no longer on the local instrument PC that has been archived.

2.5.2 The LIMS Administrator maintains the original instrument data archived onto DVDs. In the event access to a DVD containing analytical data is required, that access is controlled by the LIMS Administrator.

2.5.3 Upon request, a copy of the required data is made on a CD from the original DVD. The original DVD never leaves the LIMS Administrator's controlled area.

Appendix F

Standard Operating Procedure

SOP F.8
PC/Server Integrity and Software Validation

1.0 PC/SERVER INTEGRITY AND SOFTWARE VALIDATION

1.1 PC/Server hardware and software must be used in an environment that promotes data integrity. All software used for compilation, reduction and reporting of data is validated and verified prior to use.

2.0 STANDARD OPERATING PROCEDURE

2.1 PC/Server Integrity

2.1.1 Software Dos and Don'ts

- All personnel should only use those programs in which they have been trained or have prior experience.
- No unauthorized or unlicensed software is to be loaded on any company computer.
- Only authorized, trained personnel are allowed to use company connections to the network or internet.
- No hardware, software, or raw data is to be removed from the main offices without written authorization.
- No unauthorized removal or modification of any software programs, functions, or coding.
- Document all error messages or undocumented features (bugs).
- No unauthorized modifications to PC settings.

2.1.2 Hardware Dos and Don'ts

- Only trained, authorized personnel should attempt any hardware installations, repairs, or modifications.
- No unauthorized hardware is to be attached to any PC or to the LIMS network.

2.2 Software Validation

2.2.1 Software validation and verification activities are performed to ensure that the software adequately and correctly performs all intended functions, and that the software does not perform any unintended functions. Software validation and

verification are performed jointly by the computer QA unit and the end PC user.

2.2.2 To evaluate the technical adequacy of software, testing activities are performed to assure that the software produces correct results for the test case. Test case results are then compared to results from alternate methods, such as manual computation of results or use of another program to process the same data file.

2.2.3 Once software has been validated, then continuing maintenance of the baseline software is produced during periods of use. As deemed appropriate, this may require removal of latent errors, or adoptions to changes in the operating environment. On a schedule determined by the LIMS administrator, baseline systems are checked for corruption.

2.3 Security

The following security controls are established to permit authorized access and to prevent unauthorized access to software systems and data files:

2.3.1 All personnel should only use their own individual accounts when logging onto the PCs, server, or Omega.

2.3.2 All personnel should log off of the system whenever they are away from their station for extended periods.

2.3.2.1 In place of logging out, the use of password secured screen savers is adequate for normal working hours.

2.3.2.2 Instruments may have their own log-in identifications with limited server and LIMS access.

2.3.3 No unauthorized personnel are to use an account not their own to access secured portions of the system.

Appendix F

Standard Operating Procedure

SOP F.9
Sample Login

1.0 SAMPLE LOG IN (Computer Entry)

1.1 The following SOP is established to maintain uniformity, clarity and consistency when inputting information into the lab database upon sample receipt. This computerized Sample Log In SOP is implemented with all the provision established in the main Sample Log In SOP.

2.0 STANDARD OPERATING PROCEDURE

2.1 To enter Omega from the main computer menu, double click on the Omega icon. When the log-in prompt appears, type access name and click the "O.K."button. This will take you to the main Omega II menu. From this menu, double click on "Work Orders."

2.2 To add a work order, double click the "Add" key in the lower left-hand corner of the screen. Amend the work order number to correspond with the correct sequence:

SCO: 1-19
Assistant SCO: 20-39
Assistant SCO: 40-59
Assistant SCO: 60-79

2.3 In the "Client ID" box, enter the client's three letter code, then double click the "Client Information" field. The company name, contact person, address, phone and FAX numbers will appear automatically.

Amend the "TAT" (turn-around-time) box as needed for TAT"s shorter than ten days. Add an "Order name" if applicable. Click the box and type the name. Add "Report Attention", COC #, sampled by, cooler temp. and comments.

2.4 Double click the "Received" box. A calendar will appear with today's date selected. Double click the proper date. The computer will automatically enter the correct date. Double click the "Date Due" box. The computer will automatically count ahead the numbers of days selected in the TAT box (excluding weekends).

Add any additional comments in the "Comments" box by clicking once in the box, then start typing. Input information such as:

- Real ice present or not,
- Samples frozen or not,
- Security seals present or not,
- Rush Turn Around Time (TAT) sample,
- California samples, etc.

in the comments section. If the client would like to give a purchase order number,

click the"Invoice Info" button at the top of the screen and enter the Purchase Order number.

2.5 Sample Log-In Procedure

2.5.1 Click once in the "Client Sample ID" box. Type in the ID requested by the client.

2.5.2 TAT will automatically appear.

2.5.3 Enter the sample "Collection Date." This should be written on the sample label - otherwise, ask the client. Double space and enter the time sampled in military time.

2.5.4 Enter the sample " Matrix." This can be typed by hand, or by clicking the down arrow adjacent to the matrix box and then selecting the proper matrix (soil, aqueous, etc.). Enter the bottle (container) type the list provided.

2.5.5 Enter the number of containers which belong to the sample currently being entered.

2.5.6 For drinking water, some clients will give Public Water System numbers. This number can be typed in the "PWS/DWS" box in the field data page. A Sample Site ID and System ID can also be added at the client's request in the proper box.

2.5.7 Add any extra comments.

2.6 Click once in the "Test Group" box. Enter the proper test, then click the down arrow next to the box to view the list of possible choices. Tests are segregated by state and test method.

2.6.1 For each *new* sample, click the "Add Sample" and repeat the sample log-in process, starting with a new client ID. Many samples will have Trip Blanks included. Treat the Trip Blank as a separate sample. For Client Sample ID type "Trip Blank." The TAT will be the same as for the corresponding samples. The collection date is listed as the earliest sample date present in the work order. Trip Blanks are not analyzed unless requested by the client. Therefore, under Test Groups type "Hold ". This will tell the analysts that the sample should not be run.

2.6.2 When all of the relevant tests are entered, click the "out-the-door" button at the lower right-hand corner of the screen (picture of an open door with an arrow pointing into it).

2.7 To print the Chain of Custody, click the WO COC button at the top of the screen.

2.8 To print the analyte lists, click on the PRINT TEST Button at the top of the screen. Enter the sample ID (e.g. 02) of the sample with the test parameters that are to be printed. Use a "*" to print all of the test codes, unless a specific test is desired for printing.

2.8.1 These analyte lists are to be included in each of the appropriate test file folders (e.g. the VOC_W list goes into the VOC file folder).

Appendix F

Standard Operating Procedure

SOP F.10
Sample Preparation Omega SOP

1.0 SAMPLE PREPARATION OMEGA SOP

1.1 The following SOP is established to maintain uniformity, clarity and consistency when inputting sample preparation data. This computerized sample preparation SOP is implemented with all the provisions established in the main Sample Preparation SOP.

2.0 STANDARD OPERATING PROCEDURE

2.1 From the Windows desktop, Click on the OMEGA Icon

2.1.1 Every morning, before opening Omega, the UPGRADE icon should be clicked to ensure that the newest version of the Omega software is being used.

2.1.2 The Alpha screen will appear, press enter.

2.1.3 Click on the SAMPLE PREP button.

2.2 To add samples to a previously existing batch:

2.2.1 Scroll down the left list and double click on the desired prep batch.

2.2.2 Click on the SAMPLE ID column and arrow down to the bottom of the list

2.2.3 Enter the sample ID in the first blank line (Only the numbers followed by the letter A).

Note: This can be accomplished by either typing the sample ID or using the user select option.

2.2.3.1 Make sure that the sample ID matches that on the work-order (e.g. : 09021401-01A).

2.2.3.2 If a Client ID and Client Sample ID do not appear after moving out of that cell, then double check the sample ID. If it still does not appear, hand enter the correct information.

2.2.3.3 For MS, MSD, and DUP samples use the parent sample ID followed by the type of QC (e.g. : 09021401-01AMS or 09021401-01AMSD or 09021401-01ADUP).

2.2.3.4 There should be no more than twenty (20) samples in a batch (not including QC).

2.2.4 Fill in the sample volumes and/or weights used for the extraction.

2.3 To create a new batch

2.3.1 Click on the ADD button,

2.3.2 Choose the correct PREP CODE,

2.3.3 Enter the TECHNICIAN'S name,

2.3.4 Start adding samples (see F.10.2.2 above)

2.3.4.1 The system automatically adds a MBLK and LCS/LCSD set. If the LCSD is not required, Click on the far left of the LCSD row to highlight the entire line. Use the DELETE key to remove the entry.

2.3.4.2 A MS/MSD set will need to be added to each batch.

2.4 Click on the REAGENTS/SPIKES tab to enter the surrogate spike data

2.4.1 Enter the IDs from the spike mix containers. If the ID is not present on the list, also enter the spike name in the next cell.

2.4.2 Enter the correct sample type with which the spike is associated.

2.4.2.1 If the same volume and spike mix is used, then:

2.4.2.2 Use SAMP with those spike mixes which are added to everything (e.g. Internal Standards and Surrogates).

2.4.2.3 Use LCS for the mix associated with all of the LCS, LCSD, MS, and MSD QC.

2.4.2.4 If different volumes or mixes are used, add a separate line for each combination.

2.4.3 Enter the correct volume of spike added to each individual sample.

2.5 Click on the VIEW button, to return to the sample list.

2.6 Click in the first SPK ADDED cell and begin to add the spike information.

2.6.1 Enter the line number(s) from the associated reagent/spike table.

2.6.1.1 For example, if the LCS was spiked with three different spikes (IS, Surrogate, and Spike) that corresponded to the first three lines of the spike table, then the line numbers would be 1,2,3.

2.6.1.2 Either spaces or commas may be used as delineators between the different mixes.

2.6.2 If the same reagent is used throughout the entire batch, no notation is necessary for each sample.

2.6.3 If different reagents are used, notate the reagent line using alpha characters (A,B,C,etc.)

2.7 Any deviations from the normal methodology are to be entered in the comments line of the associated sample.

2.7.1 These deviations include such things as different initial or final volumes, spike problems, filtration problems, emulsions, spilled sample, etc.

2.7.2 If the samples are aqueous, measure the sample pH and add this value to the pH column.

2.8 Check all fields before printing.

2.8.1 Before printing, double click on the 2nd prep date line to complete the status of the preparation batch.

2.8.2 After all of the associated information is entered, click on the PRINT button.

2.8.3 Review all of the information on the print out. If everything is accurate initial and date the batch report.

2.8.4 Include a copy of the hard copy batch report in each of the associated work-order folders.

2.8.5 Place the original preparation batch report in the appropriate extraction batch binder.

Appendix G

Laboratory Ethics/Fraud Prevention and Data Integrity Program

Laboratory Ethics/Fraud Prevention and Data Integrity Program

I the undersigned, CERTIFY, that:

I have read, acknowledged and understand the personal ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions.

This includes, data integrity and/or data authentication issues such that the analytical process can be completely reviewed by recreating the paper trail.

Employee Name	Signature	Date
Senior Management Name	Signature	Date

1.0 Laboratory Ethics, Fraud Prevention and Data Integrity Program

1.1 The QA Program includes the components necessary to achieve acceptable data and assumes that personal behavior is ethical. Analytical methods, procedures and EPA programs do not set standards for ethical behavior in the laboratory and assumes that work being conducted in an analytical chemistry laboratory is of the highest integrity. This program is established to communicate to all employees what constitutes expected conduct, ethical behavior, unethical behavior and fraudulent behavior.

1.2 It is Alpha's policy to establish and maintain a Laboratory Ethics, Fraud Prevention and Data Integrity program. There are four required elements within our data integrity system. These are: 1) data integrity training, 2) signed data integrity documentation for all laboratory employees, 3) in-depth, periodic monitoring of data integrity, and 4) a data integrity SOP.

1.3 Data integrity training is provided as a formal part of new employee orientation and is conducted on an annual basis for all current employees.

2.0 Definitions

2.1 Data integrity - the act of conducting data analysis under a program that documents data analysis without any type of data manipulation, falsification or misrepresentation of the actual data results.

2.2 Ethical Behavior - behavior that conforms to accepted professional standards of conduct. Unethical behavior therefore is behavior not conforming to these standards of conduct.

2.3 Ethics - a set of moral principles or a code of right and wrong.

2.4 Fraud - an intentional act of deceit that may result in termination or legal prosecution.

2.5 Improper Actions - deviations from contract-specified or method-specified analytical practices and may be intentional or unintentional.

2.6 Integrity - moral soundness, or honesty.

2.7 Laboratory Fraud - the deliberate falsification, with intent to conceal analytical or quality assurance results.

2.8 Unethical or Illegal Actions - the deliberate falsification of analytical or quality assurance results, where method or contractual requirements are made to appear acceptable.

3.0 Objectives

3.1 The objective of our Ethics, Fraud Prevention and Data Integrity Program is to prevent fraudulent or unethical employee behavior and to ensure ethics violations do not occur. The impact of unethical behavior and fraud could be devastating to our laboratory, our employees, as well as to the data users.

3.2 An effective and rigorous ethics program has been established in conjunction with our laboratory QA program to better ensure that employees act ethically and within the bounds of these programs.

3.3 The objectives of the Ethics and Fraud Prevention program have been established, and are carried out by the annual discussion and documented training of the following critical elements:

- Ethics education and discussion,
- Awareness and prevention of unethical or fraudulent acts, and
- Establishment of policies to prevent and handle problem situations.

3.4 Data integrity training is focused on the primary objective of creating an environment that fosters professional and scientific honesty.

4.0 Training Topics

4.1 Training topics are documented in the individual personnel training documents. Key topics covered include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting,
- How and when to report data integrity issues,
- Record keeping,
- Discussion of data integrity procedures,
- Data integrity training documentation,
- In-depth data monitoring and data integrity procedure documentation.

4.2 The employees are required to understand that any infractions of the laboratory data integrity procedures will result in a detailed investigation that could lead to very serious consequences including immediate termination, debarment or civil/criminal prosecution.

5.0 Laboratory Ethics/Fraud Prevention and Data Integrity Program

5.1 Examples of Inappropriate Practices

The QAM is written as a set of policies and procedures that defines what laboratory

personnel are required to do; however, the following policies are written to ensure that employees are educated as to what they are not allowed to do. The following table lists specific examples of unacceptable laboratory practices and our policy regarding each issue.

Unacceptable Laboratory Practice	**Laboratory Policy**
1. Dry Labbing Making up data such as creating data for an analysis that was not performed or creating information that is not true.	Analytical results for all sample and Quality Control must be based on actual analysis that were performed. Documented data must match actual data (Data Integrity). Sampling information must be based on actual sampling events.
2. Time Traveling Resetting the internal clock on an instrument to make it appear that a sample was analyzed within a specified holding time when in fact it was not. Alternatively, changing the actual time or recording a false time to make it appear that holding times were met, or changing the time for sample collection, extractions or other steps to make it appear that they were performed at the correct time when in fact they were not.	The recorded date and the time of collection, preparation or analysis must match the actual date and time that the action was performed. Samples exceeding holding times are reported in a footnote or case narrative.
3. Improper Peak Integrations Artificially subtracting (peak shaving) or adding (peak enhancing) peak area to produce an erroneous area that forces data to meet specific QC criteria when in fact the criteria were not met.	Instrument peaks must be consistently integrated and reporting according to proper techniques, generally baseline to baseline, valley to valley or a combination of the two. Peak area cannot be subtracted or added to force the data to meet specified criteria. Preventative or corrective action must be taken on instrument data not meeting required criteria.
4. File Substitutions Substituting previously generated runs from a non-compliant calibration or QC run to make it appear that an acceptable run was performed when in fact it was not.	All data must be generated and reported for actual analysis performed. Reported dates and times for all analysis must match actual dates and times. Substitution of files is not permitted.
5. Alteration of Analytical Conditions Improperly altering analytical conditions, such as changing instrument conditions for sample analysis from that used for standard analyses. Also using different procedures to process standards data or standard concentrations other than those used for samples.	All sample analyses must be performed under the same conditions as those used for standard analyses. All standards data must be processed by the same procedures as those used for processing sample data.

Unacceptable Laboratory Practice	Laboratory Policy
6. Improper Calibration a) Performing more than two calibrations or altering a calibration by eliminating one or more points, until one analysis barely meets criteria, rather than taking needed corrective action after the second failed analysis, and not documenting or retaining data for the other unacceptable data. b) Using the incorrect initial calibration to make calibration verification data appear to be acceptable when in fact it was not acceptable when compared to the correct initial calibration. c) Randomly discarding points in the initial calibration to force the calibration to meet the acceptance criteria.	a) All calibration and QC data associated with sample analysis must be documented. Preventative or corrective action must be taken and documented if calibration and/or other QC criteria were not met. b) Acceptance of calibration verification data must be based in the correct initial calibration c) Calibration points can be rejected for inclusions in the calibration curve if a known or suspected error was made. When multiple target analytes are included in each calibration standard it may become necessary to discard selected upper or lower points for individual target analytes. Points can be discarded at the upper end of the curve if the linear range of the detector has been exceeded. For this case samples must be diluted that exceed the highest point of the calibration curve. Points can be discarded at the lower end of the curve if the detector is not producing a response. For theses cases reporting limit must be adjusted accordingly.
7. Misrepresenting QC Samples and Spikes a) Adding SV surrogates after sample extraction rather than prior to sample extraction. b) Reporting post-extracted spikes or duplicates as re-extracted spikes and duplicates. c) Not preparing or analyzing method blanks and Laboratory Control Samples (LCS's) the same way that samples are prepared and analyzed in order to make it appear that method blank or LCS results are acceptable when in fact they may not be.	QC samples and spikes must be prepared, analyzed and reported according to appropriate procedures. a) Surrogates must be added prior to sample extraction. b)Post extracted spikes and duplicates must be reported as post extracted and must not be misrepresented as pre-extracted spikes and duplicates. c) Method blanks and LCS's must be prepared and analyzed the same way that samples are prepared and analyzed. QC results outside of acceptance criteria are reported with a footnote or a case narrative.
8. Deletions of Non-Compliant Data Intentional deletion or non-recording of non-compliant data to conceal the fact that analyses such as calibration or QC were non-compliant.	All data associated with sample analysis, including any out of control events or non-compliant data must be documented and retained. Preventative or corrective action must be taken and documented for non-compliant data.
9. Manipulation of Computer Software Unwanted manipulation of computer software to force calibration or QC data to meet criteria.	Computer manipulation is allowed only for warranted reasons and any manipulation should be minimal and traceable.

Unacceptable Laboratory Practice	Laboratory Policy
10. Concealment of a Known Problem Concealing a known analytical or sample problem from laboratory management. Concealing a known behavior or action from laboratory management.	Any knowledge of analytical or sample problems must be communicated to laboratory management and the client. Any knowledge of unethical behavior or actions must be fully communicated to laboratory management.

5.2 Most individuals do not personally gain from committing an unethical act except to relieve some pressure they feel, whether it is real or perceived. Therefore, education and communication are key elements for our program.

6.0 Relevant Criminal Laws

6.1 Unethical Behavior

An unethical action becomes a fraudulent act when the law is violated. For example, it is unethical if an analyst changes the instrument clock to make samples appear to be analyzed within holding time, when in fact they were not. It is also unethical to manipulate instrument calibration or QC samples to make the calibration or QC analysis meet an acceptance limit, when in fact the actual data was not acceptable.

6.2 Fraudulent Acts (wire fraud / mail fraud)

It becomes a fraudulent act when the falsified data is faxed, mailed or e-mailed. Faxing or mailing false information is an example of wire fraud or mail fraud, respectively, and the person or organization that does so could be charged with wire fraud or mail fraud, as well as making false statements if the work was done under a government contract.

The following is a list of relevant criminal laws all of which can result in substantial fines and possible imprisonment.

- False Claims - 18 U.S.C § 287
- False Statements - 18 U.S.C § 1001
- Mail Fraud - 18 U.S.C § 1341
- Wire Fraud - 18 U.S.C § 1343
- Conspiracy - 18 U.S.C § 371
- Mis-prison (concealment) of Felony - 18 U.S.C. § 4

7.0 Possible Penalties for Environmental Crimes

7.1 Laboratories can face these types of legal action for breaking the law:

- Administrative action - punishment which can result in debarment or probation;
- Civil Action - punishment which can result in large fines;
- Criminal Action - punishment which can result in prison sentences for company officials.

7.2 Individual who commit an unethical act and/or break the law can face the following types of action:

- Disciplinary actions up to and including termination from the job;
- Civil actions - punishment which can result in large fines;
- Criminal action - punishment which can result in prison sentences and/or probation sentences.

8.0 Zero Tolerance Policy

8.1 Alpha Analytical has a zero tolerance policy on unethical activities or fraudulent behavior. Unethical behavior includes, but is not limited to, the **intentional** falsification of the following:

- Data or records,
- Professional credentials,
- Employment records,
- Sampling or sample handling records,
- Laboratory worksheets,
- Analytical logbooks,
- Instrument settings,
- Sample results, and
- Laboratory analytical reports.

9.0 Data Integrity

9.1 One of our principal managerial guiding philosophies is to create and foster a work place culture that promotes professional and scientific honesty. Management acknowledge its support of these issues by:

a) upholding the spirit and intent of all data integrity procedures, and

b) effectively implementing the specific requirements of the procedures.

9.2 Laboratory analysis is a human endeavor which requires a vast amount of professional decision making. Often times these decisions are not black and white issues. Therefore, the documentation trail created during sample analysis is a critical data integrity element. Data integrity requires this paper trail to be complete in order for the data to be properly reviewed, evaluated and authenticated.

Analysts are encouraged to document non-perfect data results or instrument/sample abnormalities by a written narrative. These narratives, can be described as footnotes or other annotations that are written on data quantitation reports, corrective action reports, calibration summaries etc.

It is a laboratory policy to document clearly how all analytical results were obtained and to supply to the data user all relevant information.

9.3 Data integrity discussion items are the key sections found in the QA Manual, Volume I. Many of these items are expounded upon with additional detailed standard operating procedures typically found in QA Manul, Volume II. Data integrity training covers many topics and is continuously trained upon.

10.0 REPORTING

10.1 It is Alpha's policy to assure personal and scientific confidentiality and to provide a receptive environment in which all employees may privately discuss ethical issues or report items of ethical concern, if unethical activities or fraudulent behavior is suspected by an co-worker,

11.0 INVESTIGATIONS

11.1 If unethical activities or fraudulent behavior is discovered as a result of an internal audit or other discovery mechanism, a complete and comprehensive review is conducted by management.

11.2 The discovery of potential issues are handled in a confidential manner until such time as a follow up evaluation, or other appropriate actions have been completed and the issues clarified.

11.3 All investigations that result in finding of inappropriate activity is documented and will include any disciplinary actions involved, corrective actions taken, and appropriate notifications of clients. All documentation of these investigations and actions taken are maintained for a minimum of five years.

Appendix H

State Certifications and Parameters of Analysis

State Certifications and Parameters of Analysis

H.1 The individual parameters and/or methods certified by each of the various state agencies are kept on file by the QA Officer.

H.2 Home State Certification

State	Certification Category	Status
Nevada Nevada Department of Conservation and Natural Resources Division of Environmental Protection (775)-687-9491/9490 Certification # NV000162008B	Waste Water Hazardous Waste Safe Drinking Water	Certified Certified Certified

H.3 Additional State Certifications

State	Certification Category	Status
Arizona Arizona Department of Health Services Division of Public Health Services (602)-364-0720 Certification # AZ0467	Waste Water Hazardous Waste Safe Drinking Water	Certified Certified Certified
Arkansas Arkansas Department of Environmental Quality Laboratory Certification Program 501-682-0937 Certification # 08-049-0	Waste Water Hazardous Waste Safe Drinking Water	Certified Certified
California ELAP California Department of Public Health Environmental Lab Accreditation Program Branch (510)-620-3159 Certification # 2019	Waste Water Hazardous Waste Safe Drinking Water	Certified Certified Certified
Idaho Idaho Department of Health and Welfare (208)-334-2235 Certification # NA	Waste Water Hazardous Waste Safe Drinking Water	No Program No Program Certified

State Certifications and Parameters of Analysis

Additional State Certifications

State	Certification Category	Status
Kansas Kansas Department of Health and Environment Division of Environment (785)-296-1639/6198 Certification # E-10308	Waste Water Hazardous Waste Safe Drinking Water	Certified Certified Certified
Oregon Oregon Environmental Laboratory Accreditation Program (503)-229-5505 Cert. # NV200001-005 Cert. # NV300001-006 (TPH only)	Waste Water Hazardous Waste Safe Drinking Water	Certified Certified Certified
Washington Washington Department of Ecology (360)-895-6144/6178 Certification #C21	Waste Water Hazardous Waste Safe Drinking Water	Certified Certified

National Primary ACCREDITED IN ACCORDANCE WITH nelac *Certification Accrediting Authority*

H.4 NELAP Certification

Primary Accrediting Authority	Certification Category	Status
California NELAP California Department of Public Health Environmental Lab Accreditation Program Branch (510)-620-3159 Certification # 01154CA	Waste Water Hazardous Waste Safe Drinking Water	Certified Certified Certified

4.5 Department of Defense (DOD) Navy Certification

Accrediting Authority	Certification Category	Status
Navy (NFESC) Department of the Navy Naval Facilities Engineering Services Center (805)-982-1659 Certification # NA	Waste Water Hazardous Waste	Approved Approved

Columbia Analytical Services, Inc.

Houston, TX

Columbia Analytical Services, Inc.

Houston, TX

QC Limits May 2009

1668A - 209 Congeners - Acceptance Criteria

		Laboratory Spike/Laboratory Spike Duplicate Criteria (LCS & LCSD)					
	Congene	Accuracy (% Recovery)			Precision (% Recovery)		
PCB Congeners	Number	Water	Soil	Tissue	Water	Soil	Tissue
2-MoCB	1	15-150	15-150	15-150	≤50	≤50	≤50
3-MoCB	2	15-150	15-150	15-150	≤50	≤50	≤50
4-MoCB	3	15-150	15-150	15-150	≤50	≤50	≤50
2,2'-DiCB	4	50-150	50-150	50-150	≤50	≤50	≤50
2,3-DiCB	5	50-150	50-150	50-150	≤50	≤50	≤50
2,3'-DiCB	6	50-150	50-150	50-150	≤50	≤50	≤50
2,4-DiCB	7	50-150	50-150	50-150	≤50	≤50	≤50
2,4'-DiCB	8	50-150	50-150	50-150	≤50	≤50	≤50
2,5-DiCB	9	50-150	50-150	50-150	≤50	≤50	≤50
2,6-DiCB	10	50-150	50-150	50-150	≤50	≤50	≤50
3,3'-DiCB	11	50-150	50-150	50-150	≤50	≤50	≤50
3,4-DiCB	12	50-150	50-150	50-150	≤50	≤50	≤50
3,4'-DiCB	13	50-150	50-150	50-150	≤50	≤50	≤50
3,5-DiCB	14	50-150	50-150	50-150	≤50	≤50	≤50
4,4'-DiCB	15	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3-TrCB	16	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4-TrCB	17	50-150	50-150	50-150	≤50	≤50	≤50
2,2',5-TrCB	18	50-150	50-150	50-150	≤50	≤50	≤50
2,2',6-TrCB	19	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3'-TrCB	20	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4-TrCB	21	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4'-TrCB	22	50-150	50-150	50-150	≤50	≤50	≤50
2,3,5-TrCB	23	50-150	50-150	50-150	≤50	≤50	≤50
2,3,6-TrCB	24	50-150	50-150	50-150	≤50	≤50	≤50
2,3',4-TrCB	25	50-150	50-150	50-150	≤50	≤50	≤50
2,3',5-TrCB	26	50-150	50-150	50-150	≤50	≤50	≤50
2,3',6-TrCB	27	50-150	50-150	50-150	≤50	≤50	≤50
2,4,4'-TrCB	28	50-150	50-150	50-150	≤50	≤50	≤50
2,4,5-TrCB	29	50-150	50-150	50-150	≤50	≤50	≤50
2,4,6-TrCB	30	50-150	50-150	50-150	≤50	≤50	≤50
2,4',5-TrCB	31	50-150	50-150	50-150	≤50	≤50	≤50
2,4',6-TrCB	32	50-150	50-150	50-150	≤50	≤50	≤50
2',3,4-TrCB	33	50-150	50-150	50-150	≤50	≤50	≤50
2',3,5-TrCB	34	50-150	50-150	50-150	≤50	≤50	≤50
3,3',4-TrCB	35	50-150	50-150	50-150	≤50	≤50	≤50
3,3',5-TrCB	36	50-150	50-150	50-150	≤50	≤50	≤50
3,4,4'-TrCB	37	50-150	50-150	50-150	≤50	≤50	≤50
3,4,5-TrCB	38	50-150	50-150	50-150	≤50	≤50	≤50
3,4',5-TrCB	39	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3'-TeCB	40	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4-TeCB	41	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4'-TeCB	42	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,5-TeCB	43	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,5'-TeCB	44	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,6-TeCB	45	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,6'-TeCB	46	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4'-TeCB	47	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,5-TeCB	48	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,5'-TeCB	49	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,6-TeCB	50	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,6'-TeCB	51	50-150	50-150	50-150	≤50	≤50	≤50
2,2',5,5'-TeCB	52	50-150	50-150	50-150	≤50	≤50	≤50
2,2',5,6'-TeCB	53	50-150	50-150	50-150	≤50	≤50	≤50
2,2',6,6'-TeCB	54	50-150	50-150	50-150	≤50	≤50	≤50

1668A - 209 Congeners - Acceptance Criteria

		Laboratory Spike/Laboratory Spike Duplicate Criteria (LCS & LCSD)					
	Congene	Accuracy (% Recovery)			Precision (% Recovery)		
PCB Congeners	Number	Water	Soil	Tissue	Water	Soil	Tissue
2,3,3',4'-TeCB	55	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4'-TeCB	56	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',5-TeCB	57	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',5'-TeCB	58	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',6-TeCB	59	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4,4'-TeCB	60	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4,5-TeCB	61	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4,6-TeCB	62	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4',5-TeCB	63	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4',6-TeCB	64	50-150	50-150	50-150	≤50	≤50	≤50
2,3,5,6-TeCB	65	50-150	50-150	50-150	≤50	≤50	≤50
2,3',4,4'-TeCB	66	50-150	50-150	50-150	≤50	≤50	≤50
2,3',4,5-TeCB	67	50-150	50-150	50-150	≤50	≤50	≤50
2,3',4,5'-TeCB	68	50-150	50-150	50-150	≤50	≤50	≤50
2,3',4,6-TeCB	69	50-150	50-150	50-150	≤50	≤50	≤50
2,3',4',5-TeCB	70	50-150	50-150	50-150	≤50	≤50	≤50
2,3',4',6-TeCB	71	50-150	50-150	50-150	≤50	≤50	≤50
2,3',5,5'-TeCB	72	50-150	50-150	50-150	≤50	≤50	≤50
2,3',5',6-TeCB	73	50-150	50-150	50-150	≤50	≤50	≤50
2,4,4',5-TeCB	74	50-150	50-150	50-150	≤50	≤50	≤50
2,4,4',6-TeCB	75	50-150	50-150	50-150	≤50	≤50	≤50
2',3,4',5-TeCB	76	50-150	50-150	50-150	≤50	≤50	≤50
3,3',4,4'-TeCB	77	50-150	50-150	50-150	≤50	≤50	≤50
3,3',4,5-TeCB	78	50-150	50-150	50-150	≤50	≤50	≤50
3,3',4,5'-TeCB	79	50-150	50-150	50-150	≤50	≤50	≤50
3,3',5,5'-TeCB	80	50-150	50-150	50-150	≤50	≤50	≤50
3,4,4',5-TeCB	81	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4-PeCB	82	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',5-PeCB	83	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',6-PeCB	84	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,4'-PeCB	85	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,5-PeCB	86	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,5'-PeCB	87	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,6-PeCB	88	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,6'-PeCB	89	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4',5-PeCB	90	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4',6-PeCB	91	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,5,5'-PeCB	92	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,5,6-PeCB	93	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,5,6'-PeCB	94	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,5',6-PeCB	95	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,6,6'-PeCB	96	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3',4,5-PeCB	97	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3',4,6-PeCB	98	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,4',5-PeCB	99	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,4',6-PeCB	100	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,5,5'-PeCB	101	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,5,6'-PeCB	102	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,5,6'-PeCB	103	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,6,6'-PeCB	104	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3'4,4'-PeCB	105	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4,5-PeCB	106	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4',5-PeCB	107	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4,5'-PeCB	108	50-150	50-150	50-150	≤50	≤50	≤50

1668A - 209 Congeners - Acceptance Criteria

		Laboratory Spike/Laboratory Spike Duplicate Criteria (LCS & LCSD)					
	Congene	Accuracy (% Recovery)			Precision (% Recovery)		
PCB Congeners	Number	Water	Soil	Tissue	Water	Soil	Tissue
2,3,3',4,6-PeCB	109	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4',6-PeCB	110	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',5,5'-PeCB	111	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',5,6-PeCB	112	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',5',6-PeCB	113	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4,4',5-PeCB	114	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4,4',6-PeCB	115	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4,5,6-PeCB	116	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4',5,6-PeCB	117	50-150	50-150	50-150	≤50	≤50	≤50
2,3',4,4',5-PeCB	118	50-150	50-150	50-150	≤50	≤50	≤50
2,3',4,4',6-PeCB	119	50-150	50-150	50-150	≤50	≤50	≤50
2,3',4,5,5'-PeCB	120	50-150	50-150	50-150	≤50	≤50	≤50
2,3',4,5,6-PeCB	121	50-150	50-150	50-150	≤50	≤50	≤50
2',3,3',4,5-PeCB	122	50-150	50-150	50-150	≤50	≤50	≤50
2',3,4,4',5-PeCB	123	50-150	50-150	50-150	≤50	≤50	≤50
2',3,4,5,5'-PeCB	124	50-150	50-150	50-150	≤50	≤50	≤50
2',3,4,5,6'-PeCB	125	50-150	50-150	50-150	≤50	≤50	≤50
3,3',4,4',5-PeCB	126	50-150	50-150	50-150	≤50	≤50	≤50
3,3',4,5,5'-PeCB	127	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,4'-HxCB	128	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,5-HxCB	129	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,5'-HxCB	130	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,6-HxCB	131	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,6'-HxCB	132	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',5,5'-HxCB	133	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',5,6-HxCB	134	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',5,6'-HxCB	135	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',6,6'-HxCB	136	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,4',5-HxCB	137	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,4',5'-HxCB	138	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,4',6-HxCB	139	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,4',6'-HxCB	140	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,5,5'-HxCB	141	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,5,6-HxCB	142	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,5,6'-HxCB	143	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,5',6-HxCB	144	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,6,6'-HxCB	145	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4',5,5'-HxCB	146	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4',5,6-HxCB	147	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4',5,6'-HxCB	148	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4',5',6-HxCB	149	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4',6,6'-HxCB	150	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,5,5',6-HxCB	151	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,5,6,6'-HxCB	152	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,4',5,5'-HxCB	153	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,4',5',6-HxCB	154	50-150	50-150	50-150	≤50	≤50	≤50
2,2',4,4',6,6'-HxCB	155	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4,4',5-HxCB	156	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4,4',5'-HxCB	157	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4,4',6-HxCB	158	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4,5,5'-HxCB	159	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4,5,6-HxCB	160	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4',5,6-HxCB	161	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4',5,5'-HxCB	162	50-150	50-150	50-150	≤50	≤50	≤50

1668A - 209 Congeners - Acceptance Criteria

		Laboratory Spike/Laboratory Spike Duplicate Criteria (LCS & LCSD)					
	Congene	Accuracy (% Recovery)			Precision (% Recovery)		
PCB Congeners	Number	Water	Soil	Tissue	Water	Soil	Tissue
2,3,3',4',5,6-HxCB	163	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4',5',6-HxCB	164	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',5,5',6-HxCB	165	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4,4',5,6-HxCB	166	50-150	50-150	50-150	≤50	≤50	≤50
2,3,4,4',5,5'-HxCB	167	50-150	50-150	50-150	≤50	≤50	≤50
2,3',4,4',5',6-HxCB	168	50-150	50-150	50-150	≤50	≤50	≤50
3,3',4,4',5,5'-HxCB	169	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,4',5-HpCB	170	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,4',6-HpCB	171	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,5,5'-HpCB	172	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,5,6-HpCB	173	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,5,6'-HpCB	174	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,5',6-HpCB	175	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,6,6'-HpCB	176	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4',5,6-HpCB	177	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',5,5',6-HpCB	178	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',5,6,6'-HpCB	179	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,4',5,5'-HpCB	180	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,4',5,6-HpCB	181	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,4',5,6'-HpCB	182	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,4',5',6-HpCB	183	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,4',6,6'-HpCB	184	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,5,5',6-HpCB	185	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,5,6,6'-HpCB	186	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,5,5',6-HpCB	187	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4',5,6,6'-HpCB	188	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4,4',5,5'-HpCB	189	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4,4',5,6-HpCB	190	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4,4',5',6-HpCB	191	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4,5,5',6-HpCB	192	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4',5,5',6-HpCB	193	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,4',5,5'-OcCB	194	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,4',5,6-OcCB	195	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,4',5,6'-OcCB	196	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,4',6,6'-OcCB	197	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,5,5',6-OcCB	198	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,5,5',6'-OcCB	199	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,5,6,6'-OcCB	200	50-150	50-150	50-150	≤50	≤50	≤50

1668A - 209 Congeners - Acceptance Criteria

		Laboratory Spike/Laboratory Spike Duplicate Criteria (LCS & LCSD)					
	Congene	Accuracy (% Recovery)			Precision (% Recovery)		
PCB Congeners	**Number**	**Water**	**Soil**	**Tissue**	**Water**	**Soil**	**Tissue**
2,2',3,3',4,5',6,6'-OcCB	201	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',5,5',6,6'-OcCB	202	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,4',5,5',6-OcCB	203	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,4,4',5,6,6'-OcCB	204	50-150	50-150	50-150	≤50	≤50	≤50
2,3,3',4,4',5,5',6-OcCB	205	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,4',5,5',6-NoCB	206	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,4',5,6,6'-NoCB	207	50-150	50-150	50-150	≤50	≤50	≤50
2,2',3,3',4,5,5',6,6'-NoCB	208	50-150	50-150	50-150	≤50	≤50	≤50
DeCB	209	50-150	50-150	50-150	≤50	≤50	≤50
Total Homologues					≤50	≤50	≤50
Total Monochlorobiphenyl		50-150	50-150	50-150	≤50	≤50	≤50
Total Dichlorobiphenyl		50-150	50-150	50-150	≤50	≤50	≤50
Total Trichlorobiphenyl		50-150	50-150	50-150	≤50	≤50	≤50
Total Tetrachlorobiphenyl		50-150	50-150	50-150	≤50	≤50	≤50
Total Pentachlorobiphenyl		50-150	50-150	50-150	≤50	≤50	≤50
Total Hexachlorobiphenyl		50-150	50-150	50-150	≤50	≤50	≤50
Total Heptachlorobiphenyl		50-150	50-150	50-150	≤50	≤50	≤50
Total Octachlorobiphenyl		50-150	50-150	50-150	≤50	≤50	≤50
Total Nonachlorobiphenyl		50-150	50-150	50-150	≤50	≤50	≤50
Total Decachlorobiphenyl		50-150	50-150	50-150	≤50	≤50	≤50
Labeled Standards							
13C-2-MoCB		15-140	15-140	15-140	NA	NA	NA
13C-4-MoCB		15-140	15-140	15-140	NA	NA	NA
13C-2,2'-DiCB		25-150	25-150	25-150	NA	NA	NA
13C-4,4'-DiCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',6-TrCB		25-150	25-150	25-150	NA	NA	NA
13C-3,4,4'-TrCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',6,6'-TeCB		25-150	25-150	25-150	NA	NA	NA
13C-3,3',4,4'-TeCB		25-150	25-150	25-150	NA	NA	NA
13C-3,4,4',5-TeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2'4,6,6'-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,3',4,4'-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,4,4',5-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3',4,4',5-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2',3,4,4',5-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-3,3'4,4',5-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',4,4',6,6'-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,3'4,4',5-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,3'4,4',5'-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3',4,4'5,5'-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-3,3'4,4'5,5'-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,4',5,6,6'-HpCB		25-150	25-150	25-150	NA	NA	NA
13C-2',3,3'4,4',5,5'-HpCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,3',5,5',6,6'-OcCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,3',4,4',5,5',6-OcCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,3',4,4',5,5',6-NoCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,3',4,5,5',6,6'-NoCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,3',4,4',5,5',6,6'-DeCB		25-150	25-150	25-150	NA	NA	NA
Cleanup Standards							
13C-2,4,4'-TrCB		30-135	30-135	30-135	NA	NA	NA
13C-2,3,3',5,5'-PeCB		30-135	30-135	30-135	NA	NA	NA
13C-2,2',3,3',5,5',6-HpCB		30-135	30-135	30-135	NA	NA	NA

1668A - 209 Congeners - Acceptance Criteria

		Matrix Spike/Matrix Spike Duplicate Criteria (MS & MSD)					
	Congener	Accuracy (% Recovery)			Precision (% Recovery)		
PCB Congeners	Number	Water	Soil	Tissue	Water	Soil	Tissue
2-MoCB	1	30-170	30-170	30-170	≤50	≤50	≤50
3-MoCB	2	30-170	30-170	30-170	≤50	≤50	≤50
4-MoCB	3	30-170	30-170	30-170	≤50	≤50	≤50
2,2'-DiCB	4	30-170	30-170	30-170	≤50	≤50	≤50
2,3-DiCB	5	30-170	30-170	30-170	≤50	≤50	≤50
2,3'-DiCB	6	30-170	30-170	30-170	≤50	≤50	≤50
2,4-DiCB	7	30-170	30-170	30-170	≤50	≤50	≤50
2,4'-DiCB	8	30-170	30-170	30-170	≤50	≤50	≤50
2,5-DiCB	9	30-170	30-170	30-170	≤50	≤50	≤50
2,6-DiCB	10	30-170	30-170	30-170	≤50	≤50	≤50
3,3'-DiCB	11	30-170	30-170	30-170	≤50	≤50	≤50
3,4-DiCB	12	30-170	30-170	30-170	≤50	≤50	≤50
3,4'-DiCB	13	30-170	30-170	30-170	≤50	≤50	≤50
3,5-DiCB	14	30-170	30-170	30-170	≤50	≤50	≤50
4,4'-DiCB	15	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3-TrCB	16	30-170	30-170	30-170	≤50	≤50	≤50
2,2',4-TrCB	17	30-170	30-170	30-170	≤50	≤50	≤50
2,2',5-TrCB	18	30-170	30-170	30-170	≤50	≤50	≤50
2,2',6-TrCB	19	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3'-TrCB	20	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4-TrCB	21	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4'-TrCB	22	30-170	30-170	30-170	≤50	≤50	≤50
2,3,5-TrCB	23	30-170	30-170	30-170	≤50	≤50	≤50
2,3,6-TrCB	24	30-170	30-170	30-170	≤50	≤50	≤50
2,3',4-TrCB	25	30-170	30-170	30-170	≤50	≤50	≤50
2,3',5-TrCB	26	30-170	30-170	30-170	≤50	≤50	≤50
2,3',6-TrCB	27	30-170	30-170	30-170	≤50	≤50	≤50
2,4,4'-TrCB	28	30-170	30-170	30-170	≤50	≤50	≤50
2,4,5-TrCB	29	30-170	30-170	30-170	≤50	≤50	≤50
2,4,6-TrCB	30	30-170	30-170	30-170	≤50	≤50	≤50
2,4',5-TrCB	31	30-170	30-170	30-170	≤50	≤50	≤50
2,4',6-TrCB	32	30-170	30-170	30-170	≤50	≤50	≤50
2',3,4-TrCB	33	30-170	30-170	30-170	≤50	≤50	≤50
2',3,5-TrCB	34	30-170	30-170	30-170	≤50	≤50	≤50
3,3',4-TrCB	35	30-170	30-170	30-170	≤50	≤50	≤50
3,3',5-TrCB	36	30-170	30-170	30-170	≤50	≤50	≤50
3,4,4'-TrCB	37	30-170	30-170	30-170	≤50	≤50	≤50
3,4,5-TrCB	38	30-170	30-170	30-170	≤50	≤50	≤50
3,4',5-TrCB	39	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3'-TeCB	40	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4-TeCB	41	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4'-TeCB	42	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,5-TeCB	43	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,5'-TeCB	44	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,6-TeCB	45	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,6'-TeCB	46	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4'-TeCB	47	30-170	30-170	30-170	≤50	≤50	≤50
2,2',4,5-TeCB	48	30-170	30-170	30-170	≤50	≤50	≤50
2,2',4,5'-TeCB	49	30-170	30-170	30-170	≤50	≤50	≤50
2,2',4,6-TeCB	50	30-170	30-170	30-170	≤50	≤50	≤50

1668A - 209 Congeners - Acceptance Criteria

		Matrix Spike/Matrix Spike Duplicate Criteria (MS & MSD)					
	Congene	Accuracy (% Recovery)			Precision (% Recovery)		
PCB Congeners	Number	Water	Soil	Tissue	Water	Soil	Tissue
2,2',4,6'-TeCB	51	30-170	30-170	30-170	≤50	≤50	≤50
2,2',5,5'-TeCB	52	30-170	30-170	30-170	≤50	≤50	≤50
2,2',5,6'-TeCB	53	30-170	30-170	30-170	≤50	≤50	≤50
2,2',6,6'-TeCB	54	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4'-TeCB	55	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4'-TeCB	56	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',5-TeCB	57	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',5'-TeCB	58	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',6-TeCB	59	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4,4'-TeCB	60	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4,5-TeCB	61	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4,6-TeCB	62	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4',5-TeCB	63	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4',6-TeCB	64	30-170	30-170	30-170	≤50	≤50	≤50
2,3,5,6-TeCB	65	30-170	30-170	30-170	≤50	≤50	≤50
2,3',4,4'-TeCB	66	30-170	30-170	30-170	≤50	≤50	≤50
2,3',4,5-TeCB	67	30-170	30-170	30-170	≤50	≤50	≤50
2,3',4,5'-TeCB	68	30-170	30-170	30-170	≤50	≤50	≤50
2,3',4,6-TeCB	69	30-170	30-170	30-170	≤50	≤50	≤50
2,3',4',5-TeCB	70	30-170	30-170	30-170	≤50	≤50	≤50
2,3',4',6-TeCB	71	30-170	30-170	30-170	≤50	≤50	≤50
2,3',5,5'-TeCB	72	30-170	30-170	30-170	≤50	≤50	≤50
2,3',5',6-TeCB	73	30-170	30-170	30-170	≤50	≤50	≤50
2,4,4',5-TeCB	74	30-170	30-170	30-170	≤50	≤50	≤50
2,4,4',6-TeCB	75	30-170	30-170	30-170	≤50	≤50	≤50
2',3,4',5-TeCB	76	30-170	30-170	30-170	≤50	≤50	≤50
3,3',4,4'-TeCB	77	30-170	30-170	30-170	≤50	≤50	≤50
3,3',4,5-TeCB	78	30-170	30-170	30-170	≤50	≤50	≤50
3,3',4,5'-TeCB	79	30-170	30-170	30-170	≤50	≤50	≤50
3,3',5,5'-TeCB	80	30-170	30-170	30-170	≤50	≤50	≤50
3,4,4',5-TeCB	81	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4-PeCB	82	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',5-PeCB	83	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',6-PeCB	84	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,4'-PeCB	85	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,5-PeCB	86	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,5'-PeCB	87	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,6-PeCB	88	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,6'-PeCB	89	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4',5-PeCB	90	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4',6-PeCB	91	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,5,5'-PeCB	92	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,5,6-PeCB	93	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,5,6'-PeCB	94	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,5',6-PeCB	95	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,6,6'-PeCB	96	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3',4,5-PeCB	97	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3',4,6-PeCB	98	30-170	30-170	30-170	≤50	≤50	≤50
2,2',4,4',5-PeCB	99	30-170	30-170	30-170	≤50	≤50	≤50
2,2',4,4',6-PeCB	100	30-170	30-170	30-170	≤50	≤50	≤50

1668A - 209 Congeners - Acceptance Criteria

		Matrix Spike/Matrix Spike Duplicate Criteria (MS & MSD)					
		Accuracy (% Recovery)			Precision (% Recovery)		
PCB Congeners	Congener Number	Water	Soil	Tissue	Water	Soil	Tissue
2,2',4,5,5'-PeCB	101	30-170	30-170	30-170	≤50	≤50	≤50
2,2',4,5,6'-PeCB	102	30-170	30-170	30-170	≤50	≤50	≤50
2,2',4,5,6'-PeCB	103	30-170	30-170	30-170	≤50	≤50	≤50
2,2',4,6,6'-PeCB	104	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3'4,4'-PeCB	105	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,5-PeCB	106	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4',5-PeCB	107	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,5'-PeCB	108	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,6-PeCB	109	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4',6-PeCB	110	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',5,5'-PeCB	111	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',5,6-PeCB	112	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',5',6-PeCB	113	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4,4',5-PeCB	114	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4,4',6-PeCB	115	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4,5,6-PeCB	116	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4',5,6-PeCB	117	30-170	30-170	30-170	≤50	≤50	≤50
2,3',4,4',5-PeCB	118	30-170	30-170	30-170	≤50	≤50	≤50
2,3',4,4',6-PeCB	119	30-170	30-170	30-170	≤50	≤50	≤50
2,3',4,5,5'-PeCB	120	30-170	30-170	30-170	≤50	≤50	≤50
2,3',4,5,6-PeCB	121	30-170	30-170	30-170	≤50	≤50	≤50
2',3,3',4,5-PeCB	122	30-170	30-170	30-170	≤50	≤50	≤50
2',3,4,4',5-PeCB	123	30-170	30-170	30-170	≤50	≤50	≤50
2',3,4,5,5'-PeCB	124	30-170	30-170	30-170	≤50	≤50	≤50
2',3,4,5,6'-PeCB	125	30-170	30-170	30-170	≤50	≤50	≤50
3,3',4,4',5-PeCB	126	30-170	30-170	30-170	≤50	≤50	≤50
3,3',4,5,5'-PeCB	127	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,4'-HxCB	128	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,5-HxCB	129	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,5'-HxCB	130	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,6-HxCB	131	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,6'-HxCB	132	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',5,5'-HxCB	133	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',5,6-HxCB	134	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',5,6'-HxCB	135	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',6,6'-HxCB	136	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,4',5-HxCB	137	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,4',5'-HxCB	138	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,4',6-HxCB	139	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,4',6'-HxCB	140	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,5,5'-HxCB	141	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,5,6-HxCB	142	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,5,6'-HxCB	143	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,5',6-HxCB	144	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,6,6'-HxCB	145	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4',5,5'-HxCB	146	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4',5,6-HxCB	147	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4',5,6'-HxCB	148	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4',5',6-HxCB	149	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4',6,6'-HxCB	150	30-170	30-170	30-170	≤50	≤50	≤50

1668A - 209 Congeners - Acceptance Criteria

		Matrix Spike/Matrix Spike Duplicate Criteria (MS & MSD)					
	Congene	Accuracy (% Recovery)			Precision (% Recovery)		
PCB Congeners	Number	Water	Soil	Tissue	Water	Soil	Tissue
2,2',3,5,5',6-HxCB	151	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,5,6,6'-HxCB	152	30-170	30-170	30-170	≤50	≤50	≤50
2,2',4,4',5,5'-HxCB	153	30-170	30-170	30-170	≤50	≤50	≤50
2,2',4,4',5',6-HxCB	154	30-170	30-170	30-170	≤50	≤50	≤50
2,2',4,4',6,6'-HxCB	155	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,4',5-HxCB	156	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,4',5'-HxCB	157	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,4',6-HxCB	158	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,5,5'-HxCB	159	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,5,6-HxCB	160	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,5',6-HxCB	161	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4',5,5'-HxCB	162	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4',5,6-HxCB	163	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4',5',6-HxCB	164	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',5,5',6-HxCB	165	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4,4',5,6-HxCB	166	30-170	30-170	30-170	≤50	≤50	≤50
2,3,4,4',5,5'-HxCB	167	30-170	30-170	30-170	≤50	≤50	≤50
2,3',4,4',5',6-HxCB	168	30-170	30-170	30-170	≤50	≤50	≤50
3,3',4,4',5,5'-HxCB	169	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,4',5-HpCB	170	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,4',6-HpCB	171	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,5,5'-HpCB	172	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,5,6-HpCB	173	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,5,6'-HpCB	174	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,5',6-HpCB	175	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,6,6'-HpCB	176	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4',5,6-HpCB	177	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',5,5',6-HpCB	178	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',5,6,6'-HpCB	179	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,4',5,5'-HpCB	180	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,4',5,6-HpCB	181	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,4',5,6'-HpCB	182	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,4',5',6-HpCB	183	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,4',6,6'-HpCB	184	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,5,5',6-HpCB	185	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,5,6,6'-HpCB	186	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,5,5',6-HpCB	187	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4',5,6,6'-HpCB	188	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,4',5,5'-HpCB	189	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,4',5,6-HpCB	190	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,4',5',6-HpCB	191	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,5,5',6-HpCB	192	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4',5,5',6-HpCB	193	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,4',5,5'-OcCB	194	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,4',5,6-OcCB	195	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,4',5,6'-OcCB	196	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,4',6,6'-OcCB	197	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,5,5',6-OcCB	198	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,5,5',6'-OcCB	199	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,5,6,6'-OcCB	200	30-170	30-170	30-170	≤50	≤50	≤50

1668A - 209 Congeners - Acceptance Criteria

		Matrix Spike/Matrix Spike Duplicate Criteria (MS & MSD)					
	Congener	Accuracy (% Recovery)			Precision (% Recovery)		
PCB Congeners	**Number**	**Water**	**Soil**	**Tissue**	**Water**	**Soil**	**Tissue**
2,2',3,3',4,5',6,6'-OcCB	201	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',5,5',6,6'-OcCB	202	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,4',5,5',6-OcCB	203	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,4,4',5,6,6'-OcCB	204	30-170	30-170	30-170	≤50	≤50	≤50
2,3,3',4,4',5,5',6-OcCB	205	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,4',5,5',6-NoCB	206	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,4',5,6,6'-NoCB	207	30-170	30-170	30-170	≤50	≤50	≤50
2,2',3,3',4,5,5',6,6'-NoCB	208	30-170	30-170	30-170	≤50	≤50	≤50
DeCB	209	30-170	30-170	30-170	≤50	≤50	≤50
Total Homologues					≤50		
Total Monochlorobiphenyl		30-170	30-170	30-170	≤50	≤50	≤50
Total Dichlorobiphenyl		30-170	30-170	30-170	≤50	≤50	≤50
Total Trichlorobiphenyl		30-170	30-170	30-170	≤50	≤50	≤50
Total Tetrachlorobiphenyl		30-170	30-170	30-170	≤50	≤50	≤50
Total Pentachlorobiphenyl		30-170	30-170	30-170	≤50	≤50	≤50
Total Hexachlorobiphenyl		30-170	30-170	30-170	≤50	≤50	≤50
Total Heptachlorobiphenyl		30-170	30-170	30-170	≤50	≤50	≤50
Total Octachlorobiphenyl		30-170	30-170	30-170	≤50	≤50	≤50
Total Nonachlorobiphenyl		30-170	30-170	30-170	≤50	≤50	≤50
Total Decachlorobiphenyl		30-170	30-170	30-170	≤50	≤50	≤50
Labeled Standards							
13C-2-MoCB		15-140	15-140	15-140	NA	NA	NA
13C-4-MoCB		15-140	15-140	15-140	NA	NA	NA
13C-2,2'-DiCB		25-150	25-150	25-150	NA	NA	NA
13C-4,4'-DiCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',6-TrCB		25-150	25-150	25-150	NA	NA	NA
13C-3,4,4'-TrCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',6,6'-TeCB		25-150	25-150	25-150	NA	NA	NA
13C-3,3',4,4'-TeCB		25-150	25-150	25-150	NA	NA	NA
13C-3,4,4',5-TeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2'4,6,6'-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,3',4,4'-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,4,4',5-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3',4,4',5-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2',3,4,4',5-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-3,3'4,4',5-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',4,4',6,6'-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,3'4,4',5-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,3'4,4',5'-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3',4,4'5,5'-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-3,3'4,4'5,5'-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,4',5,6,6'-HpCB		25-150	25-150	25-150	NA	NA	NA
13C-2',3,3'4,4',5,5'-HpCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,3',5,5',6,6'-OcCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,3',4,4',5,5',6-OcCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,3',4,4',5,5',6-NoCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,3',4,5,5',6,6'-NoCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,3',4,4',5,5',6,6'-DeCB		25-150	25-150	25-150	NA	NA	NA

1668A - 209 Congeners - Acceptance Criteria

PCB Congeners	Congener Number	Matrix Spike/Matrix Spike Duplicate Criteria (MS & MSD)					
		Accuracy (% Recovery)			Precision (% Recovery)		
		Water	Soil	Tissue	Water	Soil	Tissue
Cleanup Standards							
13C-2,4,4'-TrCB		30-135	30-135	30-135	NA	NA	NA
13C-2,3,3',5,5'-PeCB		30-135	30-135	30-135	NA	NA	NA
13C-2,2',3,3',5,5',6-HpCB		30-135	30-135	30-135	NA	NA	NA

1668A - Acceptance Criteria - Total Homologus & Labeled/Cleanup Standards

		Matrix Spike/Matrix Spike Duplicate Criteria (MS & MSD)					
		Accuracy (% Recovery)			Precision (% Recovery)		
Total Homologues	**CAS Number**	**Water**	**Soil**	**Tissue**	**Water**	**Soil**	**Tissue**
Total Monochlorobiphenyl		NA	NA	NA	NA	NA	NA
Total Dichlorobiphenyl		NA	NA	NA	NA	NA	NA
Total Trichlorobiphenyl		NA	NA	NA	NA	NA	NA
Total Tetrachlorobiphenyl		NA	NA	NA	NA	NA	NA
Total Pentachlorobiphenyl		NA	NA	NA	NA	NA	NA
Total Hexachlorobiphenyl		NA	NA	NA	NA	NA	NA
Total Heptachlorobiphenyl		NA	NA	NA	NA	NA	NA
Total Octachlorobiphenyl		NA	NA	NA	NA	NA	NA
Total Nonachlorobiphenyl		NA	NA	NA	NA	NA	NA
Total Decachlorobiphenyl		NA	NA	NA	NA	NA	NA
Labeled Standards							
13C-2-MoCB		15-140	15-140	15-140	NA	NA	NA
13C-4-MoCB		15-140	15-140	15-140	NA	NA	NA
13C-2,2'-DiCB		25-150	25-150	25-150	NA	NA	NA
13C-4,4'-DiCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',6-TrCB		25-150	25-150	25-150	NA	NA	NA
13C-3,4,4'-TrCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',6,6'-TeCB		25-150	25-150	25-150	NA	NA	NA
13C-3,3',4,4'-TeCB		25-150	25-150	25-150	NA	NA	NA
13C-3,4,4',5-TeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2'4,6,6'-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,3',4,4'-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,4,4',5-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3',4,4',5-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2',3,4,4',5-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-3,3'4,4',5-PeCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',4,4',6,6'-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,3'4,4',5-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,3'4,4',5'-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3',4,4'5,5'-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-3,3'4,4'5,5'-HxCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,4',5,6,6'-HpCB		25-150	25-150	25-150	NA	NA	NA
13C-2',3,3'4,4',5,5'-HpCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,3',5,5',6,6'-OcCB		25-150	25-150	25-150	NA	NA	NA
13C-2,3,3',4,4',5,5',6-OcCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,3',4,4',5,5',6-NoCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,3',4,5,5',6,6'-NoCB		25-150	25-150	25-150	NA	NA	NA
13C-2,2',3,3',4,4',5,5',6,6'-DeCB		25-150	25-150	25-150	NA	NA	NA
Cleanup Standards							
13C-2,4,4'-TrCB	208263-76-7	30-135	30-135	30-135	NA	NA	NA
13C-2,3,3',5,5'-PeCB	235416-29-2	30-135	30-135	30-135	NA	NA	NA
13C-2,2',3,3',5,5',6-HpCB	232919-67-4	30-135	30-135	30-135	NA	NA	NA

QUALITY ASSURANCE MANUAL

Columbia Analytical Services, Inc
19408 Park Row, Suite 320
Houston, TX 77084

Phone: 713-266-1599
Fax: 713-266-0130

Effective: 10/17/08

APPROVED BY

Laboratory Director: Xiangqiu 'Sam' Liang/Date 10/17/08

Quality Assurance Program Manager: Andrew Biddle/Date 10/17/08

Technical Director: Dr. Lan Le/Date 10/17/08

UNCONTROLLED DOCUMENT

WILL NOT BE UPDATED

2.0 TABLE OF CONTENTS

Figures Page

Appendices

3.0 INTRODUCTION AND COMPANY QUALITY ASSURANCE POLICY

Columbia Analytical Services, Inc (CAS) in Houston, Texas, is a professional consulting laboratory performing chemical testing by High-Resolution Mass-Spectrometry on a wide variety of sample matrices; including drinking water, groundwater, surface water, wastewater, soil, sediment, sludge, tissue, waste streams, ambient air, industrial air, foods and products.

The quality assurance program of Columbia Analytical Services, Inc (CAS) provides sufficient quality control activities to ensure all analytical data generated and processed is scientifically sound, legally defensible, of known and documented quality, and accurately reflects the measurements performed. We satisfy our quality assurance requirements by evaluating the quality control measures from each analytical process, and by auditing our procedures and data on a regular basis. We strive for continuous improvement.

Quality assurance requires an ethical commitment to data integrity by each person in the organization. As an integral part of the QA program at CAS, every employee is required to sign two policy statements annually; *CAS Holdings Commitment to Excellence in Data Quality* and *CAS Holdings Inc. Confidentiality and Conflicts of Interest Employee Agreement***.**

The information in the CAS-Houston Quality Assurance Manual has been organized according to the rules and regulations described in *National Environmental Laboratory Accreditation Conference (NELAC) Quality Systems Standards*, June 2003, and *Interim Guidance for the Preparation of Quality Assurance Project Plans,* QAM-005, USEPA, 1980; and *Guidance on Preparation of Laboratory Quality Assurance Plans*, USEPA, February 14, 1991.

The information within this document is confidential and is intended for use only by the receiving party. Unauthorized distribution of this document is unlawful and strictly prohibited. Outdated versions of this document shall be discarded and a new revision requested.

4.0 PROGRAM DESCRIPTION

The QA program at CAS ensures our clients are provided analytical results that are scientifically sound, of known and documented quality, legally defensible, and satisfy client-specific requirements. Our vision of quality assurance is reflected in the CAS Mission Statement:

> ***"The mission of Columbia Analytical Services, Inc. is to provide high quality, cost-effective and timely professional testing services to our customers. We recognize that our success as a company is based on our ability to maintain customer satisfaction. To do this requires constant attention to customer needs, maintenance of state-of-the-art testing capabilities and successful management of our most important asset – our people – in a way that encourages professional growth, personal development and company commitment."***

In support of our mission, our quality assurance program addresses all aspects of laboratory operations, including laboratory organization and personnel, standard operating procedures, sample management, sample and quality control data, calibration practices, standards traceability data, equipment maintenance records, method proficiency data (such as Initial Precision Requirements and Continuing Demonstration of Capability), document control/storage and staff training records.

4.1 Facilities and Equipment

CAS/Houston has 12,000 square feet of laboratory and administrative workspace. The layout of the facility provides safeguards against the cross-contamination of samples. The facility is organized into segregated laboratory areas according to primary function. The ventilation system has been specially designed to meet the procedural needs of each area. In addition, the segregated laboratory areas are designed for the safe and efficient handling of a variety of sample types.

The specialized laboratory areas include:

- Sample management/shipping & receiving
- Laboratories for sample preparation and extraction
- High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS) instrumentation
- Report processing/data review
- Data archives
- Sample kit/cooler storage

- Administration offices: Laboratory Director/Technical Director/Project Managers/QA Program Manager

Figure 4-1 shows the facility floor plan. The laboratory is equipped with state-of-the-art analytical and administrative support equipment. The equipment and instrumentation is appropriate for the testing procedures performed.

Appendix A lists the major analytical equipment supporting the laboratory's testing capabilities.

4.2 Technical Elements of the Quality Assurance Program

4.2.1 Standard Operating Procedures (SOPs) and Laboratory Notebooks

CAS/Houston shares administrative procedures (SOPs) with the other laboratories in the CAS network. The administrative SOPs are designed to standardize the administrative practices for each of the CAS network laboratories. These shared procedures are prepared, reviewed and updated through our CAS/Corporate Quality Assurance Department. Two examples of administrative SOPs include: Instructions for the preparation of a CAS SOP document ***(ADM-SOP)*** and instructions for controlling documents throughout each laboratory (***ADM-DOCCTRL).*** Each administrative SOP begins with the prefix, ***ADM***.

The CAS/Corporate Chief Quality Officer is responsible for the administrative SOPs. Each person on the CAS/Houston team is responsible for reading and following the administrative SOPs. The document control process ensures the most recent version of an SOP is used for training and operational guidance.

CAS/Houston has laboratory-specific procedural SOPs as well as technical SOPs detailing the measurements performed by the laboratory. The QA Program Manager is responsible for the preparation and implementation of the SOPs created by CAS/Houston. The QA Program Manager maintains a file of the current technical and procedural SOPs used to perform analyses. Controlled paper copies of the SOPs relevant to a work area are kept in a binder in the department, following the SOP for *Document Control,* ***ADM-CTRL***.

Laboratory logbooks are bound controlled documents. A master logbook of the logbooks is kept by the CAS/Houston QA Program Manager. Blank logbooks and archived logbooks are stored in a bookcase in the QA Program Manager's office. Entries into logbooks are made according to the CAS administrative SOP, *Making Entries into Logbooks and onto Bench Sheets* ***(ADM-DATANTRY).*** The entries made onto bench sheets and into laboratory notebooks are reviewed and approved by a second analyst.

4.2.2 Standard Reference Materials

All analytical measurements generated by CAS/Houston are performed using materials and/or processes that are traceable to a Standard Reference Material (SRM). Metrology equipment (e.g. analytical balance and thermometer) is calibrated using SRMs traceable to the National Institute of Standards and Technology (NIST).

Consumable SRMs routinely purchased by the laboratory (e.g. primary stock standards) are purchased from nationally recognized, reputable vendors. Most vendors have fulfilled the requirements for ISO 9001 certification.

Traceability of materials used throughout the laboratory is accomplished by following the guidelines set within the technical SOPs.

All sampling containers are purchased as pre-cleaned containers, with certificates of analysis available for each bottle type. Certificates of Analyses, provided by the vendors of reference materials and bottles, are kept on file by the laboratory.

4.2.3 Operational Assessments

CAS/Houston's laboratory management team, consisting of the Laboratory Director, Technical Director, Business Development Manager, QA Program Manager, Departmental Supervisors, and Project Managers, examines the projected up-coming workload at the beginning of each month.

The Laboratory Director assesses the laboratory facility and resources when anticipating an increased workload. Monthly lab management meetings, tracking proposals and an accurate, current forecast of incoming projects assist the management staff in properly allocating resources to satisfy client requirements and avoid an over-capacity situation.

4.2.4 Deviation from Standard Operating Procedures

When a customer requests a modification to an SOP, the Project Manager handling that project discusses the proposed deviation with the Laboratory Director to obtain approval for the deviation. A detailed description of the deviation is attached to the quotation and the service is documented on the Service Request (SR) and in CAS LIMS when logging in the samples.

4.3 Subcontracting

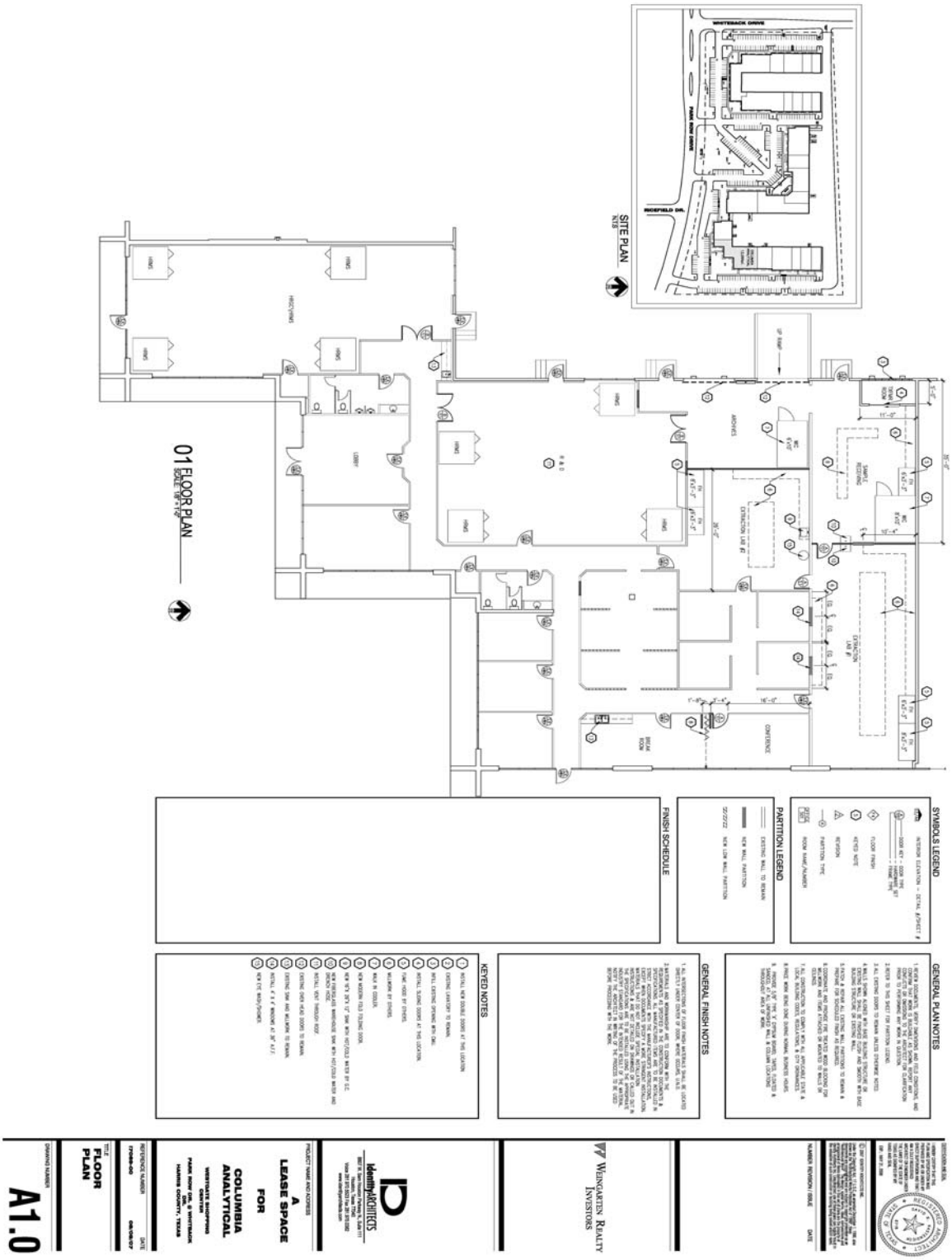
CAS/Houston performs HRGC/HRMS tests only and organizes projects with samples split in the field and sent to the appropriate lab by the client. This arrangement allows us to receive only HRGC/HRMS samples and avoids subcontracting. If we were to

subcontract, as a project specification, we would use the procedures described in the SOP for *Qualification of Subcontract Laboratories Outside of CAS Network* ***(ADM-SUBLAB).***

4.4 Certification

CAS/Houston is certified under numerous accrediting authorities based on compliance with method specific requirements. Certification is required by many states before work can be performed on samples within their jurisdictions. Certificates are posted on the wall in the CAS/Houston lobby and are available as pdf for distribution by email to clients. Appendix E reflects our current certifications.

Figure 4-1
CAS/Houston Laboratory Floor Plan



5.0 STATEMENT OF PROFESSIONAL CONDUCT AND LABORATORY PRACTICE

The success of Columbia Analytical Services, Inc (CAS), as a company, is reflected in the emphasis placed on the integrity of the data provided. This success relies on the professional conduct of all employees within CAS, as well as on consistent quality laboratory practices.

5.1 Professional Conduct

CAS requires specific professional standards of conduct and ethical performance among employees. The following examples of documented CAS policy are representative of these standards, and are not intended to be limiting or all-inclusive.

5.1.1 Under no circumstances is the willful act of fraudulent manipulation of analytical data condoned. Such acts are to be reported immediately to senior management for appropriate corrective action.

5.1.2 Unless specifically required in writing by a client, alteration, deviation, or omission of written contractual requirements is not permitted. Such changes must be in writing and approved by senior management.

5.1.3 Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented, and appropriate remedies and punitive measures will be taken toward those individuals responsible.

5.1.4 Unauthorized release of confidential information about the company, its clients, or concerning national security is taken very seriously and is subject to formal disciplinary action.

5.2 Prevention and Detection of Improper, Unethical or Illegal Actions

It is the intention of CAS to proactively prevent and/or detect any improper, unethical or illegal action conducted within the laboratory. This is performed by the implementation of a program designed for not only detection but also prevention. Prevention consists of educating all laboratory personnel in their roles and duties as employees, company policies, inappropriate practices, and the corresponding implications of inappropriate practices, as described in Section 5.3 of this document.

In addition to education, appropriate practices are detailed in SOPs such as manual integration, data review and technical procedures. Other aspects of the prevention program

include electronic data tape audits, post-analysis. All aspects of this program are documented and retained on file according to the company policy on record retention.

5.3 CAS Ethics Training Plan (Data Integrity Training)

Laboratory ethics training (8 hours within the first year with CAS) is held annually for every new on-site employee including full and part time personnel. The training includes at a minimum the following legal and ethical topics:

- Triggers and types of unethical behavior
- CAS Employee Handbook (overview including mechanism for reporting and seeking advice on ethical decisions)
- CAS' Commitment to Excellence in Data Quality (overview including legal consequences)
- Measures taken to prevent and detect fraud
- Examples of data falsification or misrepresentation
- Acceptable and unacceptable solutions to typical laboratory problems
- Data validation
- Implications of laboratory data fraud
- Potential punishments and penalties for improper, unethical, or illegal actions

The Quality Assurance Program Manager periodically audits the ethics training plan for completeness. All employees are trained on the appropriate mechanism for reporting unethical behaviors in co-workers. The CAS Employee Handbook and the CAS Commitment to Excellence in Data Quality Policy Statement also contain detailed information regarding CAS' standards of professional conduct. The Excellence in Data Quality Statement (data integrity document) is signed on an annual basis by all laboratory personnel. All employees are required to complete a semi-annual ethics "refresher" training (approximately 1-hour) session. The subject and content of the refresher are generally at the discretion of the CAS/Corporate Quality Assurance Department.

5.4 Laboratory Practices Affecting Personnel

CAS/Houston makes every attempt to ensure that employees are free from any commercial, financial, or other undue pressures that might adversely affect their quality of work. This is accomplished by using each of the following policies, programs, and procedures:

- Ethics Point Reporting System - The Ethics Point Reporting System provides several ways of reporting issues of concern. The reporting can be done anonymously or named, as desired by the reporter. Training on the Ethics Point Reporting System is conducted during the initial 8 hour Ethics Training for new employees.
- Open Door Policy (CAS Employee Handbook) - Employees are encouraged to bring any work related problems or concerns to the attention of local

management or their Human Resources representative. However, depending on the extent or sensitivity of the concern, employees are encouraged to directly contact any member of upper management.

- Project Scheduling - When upcoming project information is provided by the client, projects are forecast and summarized in a table by the Business Development Manager. Project scheduling is done so management and analysts can be better prepared for flexible work schedules to maintain the high level of CAS/Houston's quality during peak work loads.
- Laboratory Capacity - The maximum number of samples that can be analyzed by a particular department in a typical five-day week has been determined. The incoming sample load is used to estimate the laboratory's ability to accept new work and rush work during peak sample loads.
- Flexible Work Hours - Analysts are able to work flexible work hours (with management approval). Additionally, analysts may "team" with a co-worker (again with approval) and work split shifts to extend the work day and increase the number of samples that can be analyzed.
- Gifts and Favors (CAS Employee Handbook) - To avoid possible conflict of interest implications, employees do not receive unusual gifts or favors to, nor accept such gifts or favors from, persons outside the Company who are, or may be, in any way concerned with the projects on which the Company is professionally engaged. Anything beyond an occasional meal, an evening's entertainment, or a nominal holiday gift is considered an "unusual gift or favor".
- Using CAS Resources for Personal Gain (CAS Employee Handbook) - Employees are not allowed to use company resources; such as phones, computers, copiers, faxes or their time while at work, to work on personal or non-CAS business. The resources available at CAS are for working exclusively on CAS-related work.
- Internet access (CAS Employee Handbook) - CAS employees must limit internet access using a CAS computer to work-related web searches only. All other searches are forbidden, as are videos and RSS feeds that use bandwidth.

6.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

The CAS/Houston staff, consisting of approximately nineteen employees, includes chemists and support personnel. They represent diverse educational backgrounds and experience, and provide the comprehensive skills that an HRGC/HRMS analytical laboratory requires.

Columbia Analytical Services, Inc is committed to providing an environment that encourages excellence. Everyone within CAS/Houston shares the responsibility for maintaining and improving the quality of our analytical services. The responsibilities of key personnel within the laboratory are described below. An organizational chart of the laboratory can be found in Appendix B. CAS Resumes are kept by Corporate Human Resources. A job description is sent to each employee with his/her annual performance appraisal.

- The ***Laboratory Director*** provides technical, operational, and administrative leadership through planning, allocation and management of personnel and equipment resources. The Laboratory Director supports the CAS quality assurance program and is responsible for the quality, staffing, production capacity and financial performance of the Houston facility. The Laboratory Director also provides resources for implementation of the laboratory's quality program. The Laboratory Director approves technical documents. He/she leads the laboratory team in the continuous development and improvement of our HRGC/HRMS business by emphasizing quality, service and management in all lab activities.

  The Laboratory Director provides resources required to resolve corrective actions. He/she is a technical leader and is responsible for setting high standards of performance for the CAS/Houston team. The Laboratory Director is responsible for compliance with the requirements of NELAC.

- The ***Technical Director*** provides technical and operational leadership through planning, allocation and management of personnel and equipment resources. The Technical Director also supports the CAS quality assurance program and is responsible for the quality and production capacity of the Houston facility. The Technical Director also provides resources for implementation of the laboratory's quality program. The Technical Director approves technical documents. The Technical Directors encourages and directs development and application of state-of-the-art methodologies and techniques.

  The Technical Director also provides resources required to resolve corrective actions. He/she is a technical leader and is responsible for setting high standards of performance for the CAS/Houston team. The Technical Director is responsible for compliance with the requirements of NELAC.

- The ***Quality Assurance Program Manager (QAPM)*** oversees the implementation of the quality program and coordinates QA activities within the laboratory. The QA Program Manager works with the laboratory departments to establish and maintain effective quality control procedures. The QAPM prepares documents, including the Quality Assurance Manual. The QAPM also writes, reviews, approves and controls SOPs. He/she schedules PE sample analyses, and prepares corrective action reports for any missed PE sample results. The QAPM audits reports and electronic data, maintains the laboratory's certifications, performs internal audits, prepares QA reports and performs other QA activities as needed. The QAPM facilitates QA training of employees in every department.

  The QAPM establishes corrective action procedures. He/she is a technical leader and is responsible for reporting the laboratory's quality measurements; including reports to senior management, certification and accreditation, reference sample analyses and special studies. The QAPM is also responsible for compliance with the requirements of NELAC.

  The QAPM is given the authority to stop work at any time during a breach in quality practices. If a breach in quality occurs, the QAPM has the authority to keep the work stopped until an acceptable level of quality has been restored.

- The ***CAS/Corporate Chief Quality Officer (CQO)*** is responsible for the integrity of the QA program throughout the CAS laboratory network. The Chief Quality Officer is responsible for performing one annual on-site audit at each CAS laboratory and preparing a written report; maintaining a database of information about state certifications and accreditation programs; writing laboratory-wide SOPs; maintaining a database of CAS approved subcontract laboratories; providing assistance to all QA staff and laboratory managers; preparing an annual QA activity report for the CAS/Board of Directors, and other quality related activities as needed.

- The ***Environmental Health & Safety Officer (EH&S)*** is responsible for the administration of the laboratory health and safety policies. This includes formulating and implementing health and safety practices, supervising new employee safety training, reviewing incidents, the CAS/Houston Chemical Hygiene Plan, monitoring hazardous waste disposal and conducting safety inspections. The EH&S officer is also designated as the Chemical Hygiene Officer.

- The ***Sample Management Office (SMO)*** plays a key role in the laboratory QA program by maintaining custody for all samples received by the laboratory. The Sample Management Office is responsible for the proper storage and disposal of samples.

- The ***Project Managers*** are senior level chemists who are responsible for ensuring the data produced by the laboratory meets all project, contract, and regulatory-specific

requirements. Responsive, technical, professional and thorough communication is integral to the successful translation of client project requirements (compound lists, flagging, satisfying minimum compliance levels, EDD specifications, delivery schedules, etc.) into the appropriate instructions for the laboratory.

Analytical work is performed only with the approval of the client. If a portion of a project requires subcontracting, the CAS/Houston Project Managers notify the client and obtain written approval for any subcontracting activities.

- The ***CAS/Houston Testing Laboratory*** is divided into four departments; the Extraction Laboratory/Sample Management Department, the HRMS Instrumentation Department, the Reporting/Processing Department and the Administration Department. Each department is responsible for establishing, maintaining and documenting their portion of the CAS/Houston QA program. Each analyst is responsible for testing samples/extracts or reporting data according to the standard operating procedures and quality control guidelines in his/her department.

- The ***Extraction Laboratory/Sample Management*** department is responsible for receiving, storing, archiving and disposing samples. This department is also responsible for entering sample information into CAS LIMS, preparing bottle orders and returning coolers. This group also extracts and cleans up solid, aqueous, wipe, air, tissue, food and product samples according to established methods. The products of this department are the sample extracts and the extraction bench sheets.

- The ***HRMS Instrumentation*** department is responsible for loading the extracts into the auto-samplers, creating the associated run logs, tuning and trouble-shooting the instrumentation, keeping the instrument maintenance logs, preparing dilutions and verifying the initial and continuing calibrations are met.

- The ***Reporting/Processing*** department is responsible for processing data sequences using HRMS Opus Quan software, uploading data into CAS LIMS, assembling reports, writing case narratives and reviewing continuing calibrations. This group is also responsible for paginating, mailing and filing analytical reports, the production of electronic data, backing up electronic data and archiving analytical reports.

- The ***Administration*** department is responsible for reviewing and complying with contracts attached to client files in CAS LIMS, setting up new project requirements with clients, preparing quotations, reviewing reports for project compliance, responsive consultation with clients by phone or email, facilitating the set up of electronic data deliverables with the (CAS/Corporate) IT department and facilitating CAS/Houston's response to data validation questions.

6.1 Nominated Deputies

Deputies will be nominated just prior to each scheduled absence of the Laboratory Director, Technical Director, and Quality Assurance Program Manager. The following personnel are designated signatories for unscheduled absences:

Acting Laboratory Director	Technical Director
Acting Technical Director	Laboratory Director
Acting Quality Assurance Program Manager	Technical Director

6.2 Signatories

The Laboratory Director and Technical Director will be designated as signatories for the CAS/Houston laboratory. When representatives for CAS are required to sign critical documents, it is the responsibility of these individuals to verify CAS/Houston's compliance. If neither of these individuals are available, the Senior Vice President of the Eastern Region should be contacted for representation.

Any employee of CAS/Houston may sign for the delivery of packages or coolers in sample receiving. It is the responsibility of all employees to know the procedure outlined for sample receipt, in the situation that they are the only employees available at a particular time (primarily Saturday delivery).

A list of all CAS/Houston signatories can be found in Appendix F.

Table 6-1
Summary of Technical Qualifications

Team Member	*Degree/Major*	*Years of Experience*	*Team Role*
Xiangqiu 'Sam' Liang	MS/Chemistry	18	Laboratory Director & Signatory
Dr. Lan Le	BS/Chemical Eng.; PhD/Analytical Chemistry	19	Technical Director & Signatory
Karen Verschoor	BS/Chemistry	22	BD & Project Management
Andrew Biddle	BS/Astrophysics	2	QA Program Manager
Jeremiah Beck	BS/Biochemistry	3	HRMS Analyst
Darren Biles	BS/Biochemistry	3	Proj. Mgmt. & HRMS Analyst
Nicole Brown	BS/Biology	1	HRMS Analyst
Michael Cosson	BS/Biochemistry	3	HRMS Analyst
Karen Crawford	NA	9	Administration
Gisela Cruz	BS/Biology	3	HRMS Analyst
Rolando Diaz	BA/Microbiology	19	HRMS Analyst
Christopher Elhardt	BA/Zoology; MS/Labs	18	HRMS Analyst
Alexander Ennis	BS/Chemistry	1	HRMS Analyst
Claire Freemyer	NA	1	Report Assembly
Jane Freemyer	BA/Chemistry; MA/OrgMgmt	31	Project Management
Arthi Kodur	MS/Criminology	1	HRMS Analyst
Stefan Malhotra	BS/Biology	2	HRMS Analyst
Joseph Diaz	BS/Biology	1	HRMS Analyst
Pavai Shanmugam	MS/Rehabilitation Science	6	HRMS Analyst

7.0 SAMPLE PRESERVATION AND HANDLING PROCEDURES

The sample handling factors that are taken into account to ensure accurate, defensible analytical test results include:

- Amount of sample extracted
- Type of sample container used
- Type and amount of sample preservation
- Sample storage temperature
- Custodial documentation while in the laboratory
- Holding time
- Laboratory spiked XAD resin (air samples only)

The quality of analytical test results depends upon the quality of the procedures used to collect, preserve and store samples. CAS/Houston recommends that clients follow the sampling guidelines described in the specific reference methods, including, the Environmental Protection Agency (EPA), Safe Drinking Water Act (SDWA), Clean Water Act (CWA), Resource Conservation and Recovery Act (RCRA), Office of Air and Radiation (OAR) and Food and Drug Administration (FDA).

Approval from the appropriate federal, state or local regulatory agency is recommended prior to sample collection, since many tests are performed to comply with local, state and federal regulations.

Samples should be shipped to the laboratory using the most expedient means available. Potentially hazardous samples must comply with the US Department of Transportation shipping standards.

CAS/Houston routinely provides sample containers for our clients. The containers are pre-cleaned to EPA's Level 1 status. Certificates of analysis for the sampling containers are available upon request. Crushed ice and frozen blue/gel ice are the temperature preservatives used by CAS/Houston, unless otherwise specified by the client.

Our sample kits typically consist of lined, clean shipping coolers, sample containers, blank sample labels, blue ice, cooler temperature blank, bubble wrap packing material, blank chain-of-custody (COC) forms, and custody seals. Examples of a custody seal and sample container label are shown in Figures 7-1 and 7-2, respectively. Figure 7-3 shows the chain-of-custody form routinely used by CAS/Houston.

No chemical preservative is added to the pre-cleaned containers. CAS/Houston keeps client-specific shipping requirements on file and uses major transportation carriers to ensure shipping requirements are met.

For large shipments, the sample containers may be shipped in their original boxes. Such shipments consist of unopened boxes of sample containers and sufficient materials (such as; bubble wrap, labels, cooler temperature blanks, COC forms, custody seals, and coolers) to allow the sampling crew to prepare their own sample kits at the field site.

In the very rare event environmental samples are shipped from CAS/Houston to other CAS laboratories for testing, each sample bottle is individually wrapped in bubble wrap or a plastic sleeve. Any samples designated for volatiles analyses are also individually sealed in zip lock bags to avoid the possibility of cross-contamination. Proper laboratory practices are followed by Sample Management in the case that samples must be transferred.

Table 7-1
Sample Preservation and Holding Times

Dioxin/Furan Testing

Method	Matrix	Container	Preservation (upon receipt)	Holding Time	Amount of sample required
EPA 8290/8280A	Aqueous	1 L amber glass	4°C	30 days; 1 year, if frozen	2 x 1 L
EPA 8290/8280A	Solid	4-oz. glass jar	4°C	30 days; 1 year, if frozen	50 g
EPA 1613B	Aqueous	1 L amber glass	4°C	1 year	2 x 1 L
EPA 1613B	Solid	4-oz. glass jar	<-10°C (Frozen)	1 year	50 g
EPA 23	Air	XAD-filled glass trap; spiked with labeled standards; plus filter	Ambient	28 days from the day the labeled standards are spiked into the XAD	Entire contents of the glass trap; plus filter
EPA 1613B/8290	Tissue	4-oz glass jar	<-10°C (Frozen)	1 year, if frozen	50 g
EPA TO-9A	Air	PUF plug with quartz filter and wire screen, spiked with labeled standards	4°C	7 days until extraction	PUF plug, filter, and screen

Table 7-1 (cont.)
Sample Preservation and Holding Times

PCB Testing

Method	Matrix	Container	Preservation (upon receipt)	Holding Time	Amount of sample required
EPA 1668A	Aqueous	1 L amber glass	4°C	1 year	2 x 1 L
EPA 1668A	Solid	4-oz. glass jar	4°C	1 year	50 g
EPA 1668A	Tissue	4-oz glass jar	<-10°C (Frozen)	1 year, if frozen	50 g
CARB 428	Air	XAD-filled glass trap; spiked with labeled standards; plus filter	Ambient	45 days	Entire contents of the glass trap; plus filter

PAH Testing

Method	Matrix	Container	Preservation (upon receipt)	Holding Time	Amount of sample required
CARB 429	Air	XAD-filled glass trap; spiked with labeled standards; plus filter	4°C	21 days	Entire contents of the glass trap; plus filter

Figure 7-1
Sample Cooler Custody Seal

Custody Seal

Date_____ Project_____

Signature _____Container#_____ of_____

Figure 7-2
Sample Bottle Label

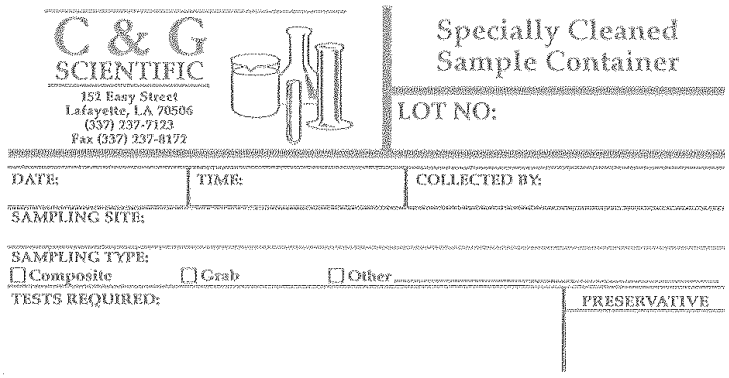


Figure 7-3
Chain of Custody Form

Columbia Analytical Services, Inc
19408 Park Row, Suite 320 Houston, TX 77084
(713) 266-1599 FAX (713) 266-0130

CHAIN OF CUSTODY / LABORATORY ANALYSIS REQUEST FORM

PAGE _____ OF _____

PO #:_____

Project Manager: _____ **Project:** _____

Company/Address: _____ **Phone:** _____

City, State, Zip: _____ **FAX:** _____

Sampler's Signature:

Sample I.D.	Date	Time			Sample Matrix		Number of Containers	Analysis Requested					REMARKS

TURNAROUND TIME

____ 72 hr ____ One week

____ Standard (14 days emailed results; 21 days hardcopy report)

QC-LEVEL NEEDED

____ I. Results, method blank, labeled std. rec.
____ II. QC Summary Reports: reports batch QC
____ III. Data Validation Report (without raw data)
____ IV. Data Validation Report (includes raw data)

Comments/Special Instructions:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: _____	Signature: _____	Signature: _____	Signature: _____
Printed Name: _____	Printed Name: _____	Printed Name: _____	Printed Name: _____
Firm: _____	Firm: _____	Firm: _____	Firm: _____
Date/Time: _____	Date/Time: _____	Date/Time: _____	Date/Time: _____

8.0 SAMPLE MANAGEMENT

Standard Operating Procedures have been established for sample receiving, storage and disposal. These procedures ensure samples are tested according to the project requirements as listed on the chain-of-custody form.

8.1 Sample Receiving and Acceptance

Samples are delivered to the CAS-Houston sample management office (SMO) by either commercial carrier or local courier and are received by a sample custodian. The chain-of-custody (COC) is reviewed for completeness and accuracy. The cooler receipt and preservation form (CRPF; Figure 8-1) is used to assess the shipping cooler and its contents as received by the laboratory personnel. Verification of sample integrity by the sample custodian includes the following documentation:

- Assessment of custody seal presence/absence, location and signature;
- Temperature of sample containers upon receipt;
- Chain of custody documents properly used (entries in ink, signature present, etc.):

  Entries should be made in waterproof ink and at a minimum shall include sample identification, matrix, date (and time) of sample collection, the name and signature(s) of the sample collector any intermediate sample custodian(s), date and time of each sample transfer, and signature, date, time and temperature of the cooler by the CAS sample custodian upon receipt.
- Sample containers checked for integrity (broken, leaking, etc.);
- Sample is clearly marked with the sample ID, date and time of collection;
- Appropriate containers (size, type) are received for the requested analyses;
- Sample container labels and/or tags agree with chain-of-custody entries (identification, required analyses, etc.); and
- Assessment of proper sample preservation (if inadequate, corrective action is required).

The shipment is compared to the Sample Acceptance Policy (Figure 8-2.) Any anomalies or discrepancies observed during the initial observations are recorded on the CRPF and chain-of-custody documents. All potential problems with a sample shipment are addressed by contacting the client, through the assigned CAS/Houston Project Manager, and discussing the pertinent issues. When a satisfactory resolution has been reached by the Project Manager and client, the log-in process is completed and analysis may begin. During the log-in process, each sample is given a unique laboratory code and a service request form is generated. The laboratory code consists of an order number and a sample submission number. Each sample

is given a consecutive order number in CAS LIMS based upon order of log-in. A submission number is assigned to a particular job in the same manner. The submission number is coded with the month and year of log-in as follows:

No. E0800692 = E (CAS/Houston's assigned alpha code in CAS)
08 (year/2008)
00692 (job number/692nd job logged in 2008)

The service request contains detailed client information, sample descriptions, sample matrix, requested analyses and compound lists, sample collection dates, due dates and other pertinent contract and testing information. The service request is reviewed by the Project Manager for accuracy, completeness, consistency of requested analyses, for client project objectives and chain of custody.

Laboratory internal chain-of-custody documents are stored in CAS LIMS each time a sample's barcode label is scanned into CAS LIMS. The samples are scanned into CAS LIMS upon sample receipt. The samples are scanned out of the refrigerator on the day of extraction and are scanned back into the refrigerator before the end of the work day. The extracts are delivered to the HRMS department, along with the folders containing all pertinent project information, such as the Service Request Summary, invoice, and extraction laboratory bench sheets. The sample IDs from the extracts are hand-written into the appropriate instrument log book when the auto-sampler is loaded. The sample IDs are verified against the computer-generated Opus Quan instrument log. The sample containers are archived in the refrigerator prior to disposal.

All samples, with the exclusion of sample extracts, are stored under refrigeration until they are analyzed or disposed. CAS/Houston stores samples in a walk-in refrigerator. The temperature of each storage facility used at CAS/Houston is monitored daily and the data recorded in a bound logbook.

After the analytical report is sent, aqueous and soil samples are stored in a 4°C refrigerator for 30 days. The samples are manifested and disposed according to the SOP ***SMO-WASTDISP***. Contract-specified archiving requirements and samples received from outside the continental US are detailed in CAS LIMS by the folder number.

It should be noted that all waste produced at the laboratory, including the laboratory's own hazardous waste, is treated in accordance with all applicable local and federal laws. Complete internal chain-of-custody documentation is maintained in CAS LIMS for each sample, from initial receipt through final disposal. This ensures an accurate history of each sample is documented.

Figure 8-1
Cooler Receipt and Preservation Check Form

Client/Project:_____ Service Request: E08_____

Received:_____ Opened (Date/Time): _____ By:_____

1. Samples were received via? *US Mail* *Fedex* *UPS* *DHL* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Other*_____ *NA*
3. Were custody seals present on coolers? Y N If yes, how many and where?_____
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N
4. Is shipper's air-bill filed? NA Y N If not, record air bill number:_____

_____ _____ _____

5. Temperature of cooler(s) upon receipt (°C): _____ _____ _____ _____
6. If applicable, list Chain of Custody numbers: _____ _____ _____ _____
7. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
8. Packing material used: *Inserts* *Bubble Wrap* *Blue Ice* *Wet Ice* *Sleeves* *Other*_____
9. Were the correct types of bottles used for the tests indicated? Y N
   Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* Y N

Sample ID	Bottle Count	Bottle Type	Out of Temp	Broken	Initials

10. Were all bottle labels complete (i.e. analysis, ID, etc.)? Y N
    Did all bottle labels and tags agree with custody papers? *Indicate in the table below.* Y N

Sample ID on Bottle	Sample ID on COC		Sample ID on Bottle	Sample ID on COC

11. Additional notes, discrepancies, and resolutions:_____

_____

_____

Figure 8-2

Sample Acceptance Policy

Custody Seals (desirable, mandatory if specified in SAP):

- ✓ On outside of cooler
- ✓ Seals intact, signed and dated

Chain-of-Custody documentation (mandatory):

- ✓ Properly filled out in ink & signed by the client
- ✓ Sign and date the coc for CAS/HOU upon cooler receipt
- ✓ Coc must list method number
- ✓ If no coc was submitted with the samples, complete a CAS/HOU coc for the client

Sample Integrity (mandatory):

- ✓ Sample containers must arrive in good condition (not broken or leaking)
- ✓ Sample IDs on the bottles must match the sample IDs on the coc
- ✓ The correct type of sample bottle must be used for the method requested
- ✓ The correct number of sample containers received must agree with the documentation on the coc
- ✓ The correct sample matrix must appear on the coc
- ✓ An appropriate sample volume or weight must be received

Temperature Preservatives (varies by sample matrix):

- ✓ Aqueous and Non-aqueous samples must be shipped and stored cold, at 0 to 6ºC
- ✓ Tissue samples must be shipped and stored frozen, at -20 to -10ºC
- ✓ Air samples can be shipped and stored at ambient temperature, ~23ºC
- ✓ The sample temperature must be recorded on the coc
- ✓ Notify a Project Chemist if any samples are outside the acceptance temperature or have compromised sample integrity – the client must decide re: replacement sample submittal or continue with the analysis

Cooler Receipt Form, CRF (mandatory):

- ✓ Cooler receipt forms must be completed for each coc & SR#
- ✓ Sample integrity issues must be documented on the CRF
- ✓ A scan of the carrier and the airbill number must be recorded in CAS LIMS

Sample Integrity Issues/Resolutions (mandatory):

- ✓ Sample integrity issues are documented on the CRF and given to the Project Chemist for resolution with the client
- ✓ Client resolution is documented in writing (typically email or on the CRF) and filed in the project folder(s)

9.0 QUALITY CONTROL OBJECTIVES

A primary focus of Columbia Analytical Services Quality Assurance (QA) Program is to ensure the accuracy, precision and comparability of all analytical results. CAS has established Quality Control (QC) objectives for precision and accuracy that are used to determine the acceptability of the data that is generated in its laboratories. These QC limits are either specified in the methodology or are statistically derived based on the laboratory's historical data for each analytical method. The QC objectives are defined below and the numeric values are shown in the table in Appendix C.

9.1 Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of standard reference materials, laboratory control samples and labeled, internal standards. In addition, matrix-spiked samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery (% Rec) of the measured value, relative to the true or expected value.

The acceptance limits for accuracy (Appendix C) originate from two different sources. Where acceptance limits are defined and stated in the individual methods, CAS has adopted the limits without modification. Where no acceptance limits are given in a method, CAS adopts the limits derived from control charts that are generated for each method. These control charts are updated once a year for the associated labeled standards, laboratory control samples and matrix spike compounds.

$$\text{Accuracy (\%Rec)} = \frac{A-B}{C}\times 100$$

Where A = Analyte total concentration from spiked sample
B = Analyte concentration from unspiked sample
C = Concentration of spike added

9.2 Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling and in laboratory analysis.

Precision is measured through the use of replicate sample analyses within the same batch and is expressed as the relative percent difference (RPD) between replicate measurements.

$$RPD = \frac{(D_1 - D_2)}{D_{ave}} \times 100$$

Where D_1 = Original result
D_2 = Duplicate result
D_{ave} = Average result of original and duplicate measurements.

9.3 Method Reporting Limits

The MRLs used at CAS/Houston are the lowest limits of quantification. The MRLs are specified in the methodology.

9.4 Representativeness

Representativeness is the degree to which the field sample represents the overall sample site or material. This can be extended to the sample itself, in that representativeness is the degree to which the subsample that is analyzed gives results identical to analysis of the entire field sample. CAS has sample handling procedures and protocols to ensure that the sample used for analysis is representative of the entire sample. Analytical SOPs specify appropriate sample handling and sample sizes to ensure the sample aliquot that is analyzed is representative of the entire sample.

9.5 Completeness

Completeness is a measure of the amount of valid data that is obtained, compared to the amount that is expected. It is expected that all analyses conducted in accordance with the approved analytical methods and standard laboratory operating procedures will meet QC acceptance criteria for 95% of the samples tested.

$$\text{Completeness (\%)} = \frac{\text{valid data obtained}}{\text{total data planned}} \times 100$$

9.6 Comparability

Comparability expresses the confidence with which one data set can be compared to another. To ensure comparability, standard operating procedures are used for the preservation, handling, and analysis of all samples. Data is reported in units specified by the customer.

10.0 QUALITY CONTROL PROCEDURES

The specific types, frequencies, and processes for quality control sample analysis are described in detail in method-specific standard operating procedures. These sample types and frequencies have been adopted for each method and a definition of each type of QC sample is provided below. In addition, a number of other quality control processes which may affect analytical results are also described below.

10.1 Modified Procedures

CAS/Houston strives to perform published methods as described in the referenced documents. If there is a material deviation from the published method, the method is cited as a "Modified" method in the analytical report. Standard operating procedures are available to analysts and are also available to our clients for review. If the modification is such that the method becomes "Performance Based," client approval is obtained for the use of the method prior to the performance of the analysis.

10.2 Procedures for Accepting New Work

Due to the increase in analytes used in the industry and found in the environment, analytes new to the laboratory may be requested for analysis using existing methodologies and/or new methodologies. These requests must be reviewed prior to accepting new work and creating new methodologies. These requests typically include:

- The addition of analytes to an existing scan.
- Complete start-up of an established method.
- Analyte(s) requested with no established method.

10.2.1 <u>The addition of analytes to an existing scan</u>

The analytical method is reviewed to determine if the method is appropriate for the new analyte. The analyte standards are purchased from a commercial vendor and prepared. If the analyte is available from more than one source, a second source may be purchased to verify the calibration standard. A reference is spiked with a mid-level concentration of the appropriate standard and analyzed to determine retention time, resolution, etc. Temperature programs and instrument conditions may be modified to optimize resolution for the analyte. The detection limit will follow the other signal/noise detection limit standards established in similar HRMS methods. An in-house SOP may be written or modified to include the analyte.

10.2.2 Complete start-up of an established method

The method is obtained and reviewed by the analyst, Technical Director, and/or supervisor to determine if the instrumentation and reagents needed by the method are available. If the required instrumentation is available, then reagents, standards, equipment, and supplies are gathered and purchased. If the analyte(s) are available from more than one source, a second source may be purchased to verify the calibration source. A qualified analyst performs the method, elution times are determined, temperature programs are optimized, and batch QC is performed to monitor accuracy and precision. Each analyst performing the method must complete an Initial Demonstration of Capability (IDC) study. An internal SOP is written and used by the analysts.

10.2.3 Analyte(s) requested with no established method

The analyte to be analyzed is researched and reviewed by the technical manager for chemical nature, formula, and other related information. The Merck Index and CRC Handbook are reviewed for boiling point and vapor pressure to determine the type of compound. After determining the type of compound, it is assumed that it can be analyzed by an existing method. If not, perhaps a modification of a method or the creation of a method could be tried. The different approaches to testing the analyte may be tried, comparing the efficiency of the various approaches. The method which allows for acceptable precision and accuracy shall be used.

10.3 Analytical Batch

The basic unit for analytical quality control is the analytical batch. The overriding principle for describing an analytical batch is that all the samples in a batch, both field samples and quality control samples are to be handled and processed in exactly the same way, and all of the data from each analysis is to be manipulated in exactly the same manner.

The minimum requirements of an analytical batch are:

10.3.1 The number of (field) samples in a batch is not to exceed 20.

10.3.2 All (field) samples in a batch are of the same matrix. Soils, wipes and tissues are all considered different matrices.

10.3.3 The QC samples to be processed with the (field) samples include:

- Method Blank - to determine possible laboratory contamination.
- Laboratory Control Sample - to assess method performance.
- Duplicate Laboratory Control Sample - to assess batch precision.

Note: The assessment of possible matrix problems can be determined by an evaluation of the labeled standard recoveries for each sample.

10.3.4 Reagent lots are not changed in the middle of a batch of samples.

10.3.5 Each task within the analysis is performed by a single analyst or by a defined team of analysts.

10.3.6 A batch cannot exceed 24-hours from beginning to end. Allowances are made for instrumentation constraints, such as soxhlet extraction time.

10.3.7 (Field) samples are assigned to batches starting at the time sample extraction begins. Proficiency Testing (PT) samples are considered field samples.

10.3.8 The batch QC samples are analyzed in conjunction with the associated field samples prepared with them.

10.3.9 Batch QC refers to the QC samples that are analyzed in a batch of (field) samples.

10.3.10 Specific project, program, or method SOP requirements may be exceptions. The more stringent QC requirements shall be followed in all cases.

10.3.11 'Prep/Hold' samples must be 'held' as extracts only and not in an intermediary solvent step of the procedure.

10.4 Method Blank

The method blank is analyte-free water, analyte-free soil (when available), or analyte-free fish tissue subjected to the entire analytical process. When analyte-free soil is not available, anhydrous sodium sulfate, organic-free sand, or an acceptable substitute may be used instead. The method blank is analyzed to demonstrate the analytical system is not contaminated with the analytes being measured. The method blank results should be below the Method Reporting Limit (MRL) for the analytes being tested, with the exception of OCDD and/or OCDF. These two compounds are allowed to be reported at three times the MRL in the method blank according to the *National Functional Guidelines, September 2005*. A method blank is included with the analysis of every analytical batch.

10.5 Calibration Blank

Calibration blanks are prepared along with calibration standards in order to create a calibration curve. Calibration blanks are free of the analyte of interest, and provide the zero point of the calibration curve. The term, 'calibration blank' is used interchangeably with the term, 'instrument blank.'

10.6 Calibration Standards

Calibration standards are solutions of known concentration prepared from primary standard solutions which are prepared from stock standard materials. Calibration standards are used to calibrate the instrument response for the analyte concentration. Standards are analyzed in accordance with the requirements stated in the particular method being used.

10.7 Continuing Calibration Verification Standards

Continuing calibration verification standards (CCVs) are midrange standards that are analyzed in order to verify the 'daily' calibration of the analytical system is still acceptable. The frequency of CCV analysis is either once every ten samples, or as indicated in the method.

10.8 Labeled standards

Labeled standards are organic compounds which are similar in chemical composition and chromatographic behavior to the analytes of interest, but which are not normally found in environmental samples. The method-specific labeled standards are added to method blanks, laboratory control samples, and client samples, including matrix spike samples, duplicate matrix spike samples, and duplicate field samples prior to extraction and analysis. The purpose of the labeled standard is to monitor the method performance of each sample. The percent recovery is calculated for each labeled standard and the recovery is a measurement of the overall method performance. The acceptance criteria for these various analytes are listed in Appendix C, along with other method acceptance criteria.

10.9 Matrix Spikes

Matrix-spiked samples are aliquots of samples to which a known amount of the target analytes has been added. The matrix-spiked samples are extracted along with the samples. The matrix spike recovery measures the effects of interferences caused by the sample matrix and reflects the accuracy of the method for the particular matrix in question. Matrix spike recoveries are calculated as follows:

$$\text{Recovery (\%)} = \frac{S - A}{T} \times 100$$

Where: S=The observed concentration of analyte in the spiked sample;
A=The analyte concentration in the original sample; and
T=The theoretical concentration of analyte added to the spiked sample.

Matrix spiked samples are prepared and analyzed as indicated by the client on the chain-of-custody documentation.

10.10 Duplicate Matrix Spikes

Duplicate matrix spikes are additional replicates of matrix spiked samples that are subjected to the same preparation and analytical scheme as the original sample. A matrix spiked sample and duplicate matrix spiked sample (MS/DMS) is analyzed upon request by the client on the chain-of-custody. The relative percent difference between an MS and DMS is a measure of the precision for a given method and analytical batch. The relative percent difference (RPD) for these analyses is calculated as follows:

$$RPD = \frac{S_1 - S_2}{S_{ave}} \times 100$$

Where: S_1, S_2 = The observed concentrations of analyte in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike; and
S_{ave} = The average of observed analyte concentrations in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike.

A batch precision measurement (either MS/DMS or LCS/DLCS) is performed for each analytical batch. If the batch precision is determined using MS/DMS, a DLCS does not need to be performed.

A sample identified as field blank, equipment blank, or trip blank is not to be used for a precision sample measurement (MS/DMS.)

10.11 Laboratory Control Samples

The laboratory control sample and duplicate laboratory control sample (LCS/DLCS) are aliquots of analyte-free water, analyte-free soil (or anhydrous sodium sulfate or equivalent) or analyte-free tissue to which a known amount of the method analytes are added. [A standard reference material (SRM) of known matrix type, containing certified amounts of target analytes, may also be used as an LCS.] The LCS/DLCS sample is prepared and analyzed in the same analytical batch, and in exactly the same manner, as the other field samples. The percent recoveries of the target analytes in the LCS/DLCS

assist in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements. Comparison of batch-to-batch LCS/DLCS analyses enables the laboratory to evaluate batch-to-batch precision and accuracy. Acceptance criteria for LCS/DLCS analyses are based on EPA methods. An LCS/DLCS is prepared and analyzed with every analytical batch.

If an analytical batch contains an MS/DMS requested by the client on the chain-of-custody, a DLCS is not required for batch quality control.

10.12 Source and Preparation of Standard Reference Materials

CAS relies on several primary vendors for the majority of its analytical supplies and reagents. Consumable primary stock standards are obtained from a certified commercial source. Cambridge Isotope Laboratories (CIL) supplies the primary stock standards used by CAS/Houston. The primary stock standards are stored under the conditions suggested by the supplier. These conditions provide maximum protection against deterioration and contamination.

All reference materials that are received by CAS/Houston are recorded by an analyst in the appropriate logbook. The logbook entry includes such information as an assigned logbook identification code, the source of the material, solvents, concentrations of analytes, reference to the certificate of analysis and an assigned expiration date. In addition, the date the standard is received in the laboratory is marked on the container as well as in the logbook.

When the container containing the primary stock standard is used for the first time, the date opened and the initials of the analyst are also recorded on the container. Stock solutions and/or calibration standard solutions are prepared as often as necessary to maintain their stability. After preparation, all standard solutions are labeled with the name, concentration, date, preparer, and expiration date. These entries are also recorded in the standards notebook.

To ensure traceability, all prepared standards are labeled with an in-house code that can be traced back to the original stock standard received by the vendor and thus to the certificate of analysis.

An independent source of reference material, purchased from Wellington Laboratories, is used to verify the mid-point of each new initial calibration curve.

10.13 Proficiency Testing Participation

Each test method is monitored using NIST approved vendors for Proficiency Testing on an annual basis. Results of the proficiency samples are reviewed by the Laboratory Director, the QAPM and the laboratory staff. Any problems surfacing during the review

are investigated, and corrective action is taken regarding deficiencies. See the SOP for *Proficiency Testing Sample Analysis*, ***ADM-PTS***, for more information.

10.14 Cleaning Glassware and Equipment

Glassware washing plays a crucial role in the daily operation of a laboratory. The glassware used at CAS-Houston undergoes a rigorous cleansing procedure prior to every usage. The procedures for cleaning the various types of glassware used by CAS/Houston are included in the SOP *Washing Glassware*, ***SMO-WASH***.

The technical SOPs also detail any cleaning instructions for specific equipment. In addition, other equipment that may be routinely used at the laboratory is also cleaned following instructions in the appropriate SOP.

11.0 CALIBRATION PROCEDURES AND FREQUENCY

All equipment and instrumentation used at CAS/Houston is operated, maintained and calibrated according to the manufacturer's guidelines and recommendations, along with the criteria set forth in the analytical methodology. Only personnel who have been properly trained in these procedures perform operation and calibration. Documentation of calibration information is maintained in appropriate reference files. Brief descriptions of the calibration procedures for our major laboratory equipment and instrumentation are described below.

11.1 Temperature Control Devices

Temperatures are monitored and recorded for the laboratory's temperature-regulating devices including ovens and refrigerators. Bound logbooks are kept which contain daily recorded temperatures, identification of equipment, acceptance criteria and the initials of the analyst who performed the measurements. The procedure for performing these measurements is provided in the SOP *Calibration Check of Measuring Devices* ***(SMO-DALYCK.)*** The thermometers are identified according to serial number, and the calibration of these thermometers has been certified by the manufacturer.

11.2 Analytical Balances

Analytical balances are serviced on an annual basis by a professional metrology organization. New certificates of calibration for each balance are issued to the laboratory. The calibration of each analytical balance is checked daily with three class-S or S-1 weights, which assess the accuracy of the balance at low, mid-level and high ranges. As needed, the balances are recalibrated using the manufacturer's recommended operating procedures. Bound logbooks are kept which contain the recorded measurements, identification and location of equipment, acceptance criteria and the initials of the technician who performed the checks. The procedure for performing these measurements is provided in ***SMO-DALYCK.***

11.3 Water Purification System

CAS purchases drinking water for the preparation of standards and reagents. This purchased water meets specifications for ASTM Type I water.

11.4 High-Resolution GC/MS Systems

The HRMS instruments are calibrated at five different concentration levels for the analytes of interest (unless specified otherwise) using procedures outlined in the CAS Standard Operating Procedures and/or appropriate USEPA method citations. All standard reference materials used for this function are "EPA-Certified" standards. Method-specific instrument tuning is regularly checked using perfluorokerosene (PFK). Mass spectral peaks for the tuning compounds must conform to the mass numbers and relative intensity criteria before analyses can proceed.

11.5 Pipets

The calibration of pipets and automatic pipettors used to make critical-volume measurements is verified following the SOP ***SMO-DALCYK***. Both accuracy and precision verifications are performed. Auto-pipet calibration is verified each day of use. The results of all calibration verifications are recorded in bound logbooks.

12.0 DATA REDUCTION, VALIDATION, AND REPORTING

CAS reports the analytical data produced in its laboratories to the client via the certified analytical report. This report typically includes a transmittal letter, a case narrative, client project information, specific test results, quality control data, chain of custody information, and any other project-specific support documentation. The following procedures describe the data reduction, validation and reporting procedures.

12.1 Sample Login System

CAS/Houston maintains a login and reporting database through CAS LIMS.

12.2 Data Reduction and Data Custody

All data is initially reviewed and processed by analysts using appropriate technical software. A file of all raw data is printed, reviewed for completeness and quality criteria against an in-house checklist and signed off by the analyst. A second chemist/scientist reviews all reported data against the raw data; validating completeness and quality. The final data package is then reviewed by the Project Manager for compliance with previously established project requirements.

Assessment of the analytical data includes a check on data consistency by looking for comparability of duplicate analyses, comparability of previous data from the same sampling location (if available), adherence to accuracy and precision control limits, and anomalous low or high parameter values. The results of this review will be discussed with either the departmental supervisor or Laboratory Director for resolution prior to final release of the package.

Once the data has been checked for accuracy and acceptability, the final report and raw data is forwarded to the Laboratory Director or QAPM, who further reviews the data package for errors. When the entire data set has been found to be acceptable the Laboratory Director signs the report, the report is distributed and the raw data is filed for approximately one year; after which it is archived. All hard copy and electronic backups are archived in a secured file room for a period of at least 5 years from the date of the final report. It is not unusual to have various clients require a10-year retention of records, therefore, the archivist, Project Manager, and possibly the client are consulted prior to destruction of the records.

12.3 Confirmation Analysis of 2,3,7,8-tetrachlorodibenzofuran (2,3,7,8-TCDF)

12.3.1 All positive results of the 2,3,7,8-TCDF that are quantified on the DB-5 column, are confirmed by a second (DB-225) column.

When sample results are confirmed by two dissimilar columns, the agreement between quantitative results must be evaluated.

12.3.2 Confirmation Data

Confirmation data will be provided as specified in the method. Identification criteria for high-resolution GC/MS methods are summarized below:

- High-resolution GC/MS methods – criteria used to verify identification:
    1. Elution of the analyte in the sample will occur at the same relative retention time (RRT) as that of the analyte in the standard.
    2. Signal/noise ratio (S/N) $\geq$ 2.5.
    3. Satisfy ion abundance ratio criteria.

12.4 Data Validation

The integrity of the data generated in the laboratory is primarily assessed by the analyst, supervisor and Project Manager through the use of a variety of measures that may include reagent blanks, laboratory fortified blanks, duplicates, matrix spikes and QC samples. The numerical criteria for evaluation of these QC samples are listed in Appendix C; these various QC sample analyses are evaluated using the flow diagrams found in Figures 12-1 through 12-8. Other validation measures of the data include a check of the linearity of the calibration curve, an accuracy check of the QC standards and a check of the system sensitivity. Data transcriptions and calculations are also reviewed. Specific calculations used for determining the concentrations, or values, of the measured parameters from the raw data are given in each of the analytical methods or CAS SOPs.

12.5 Data Reporting

When an analyst determines that the data has met the data quality objectives (and/or any client-specific data quality objectives) of the method and has qualified any anomalies in a clear, acceptable fashion, the data is validated by the supervisor. Prior to release of the report to the client, the Project Manager must also review the entire body of data for completeness and to ensure that any and all client-specified objectives were successfully achieved. Sample toxicities are reported to the client using procedures outlined in the methods and interpretation is left up to the judgment of the client. CAS/Houston provides unbiased reports and cannot be held liable for decisions made based upon delivered data. A case narrative may be written

by the Project Manager to explain any unusual problems with a specific analysis or sample, client-specific objectives, exceedences, etc. The original raw data, along with a copy of the final report, is archived. CAS maintains control of analytical results by adhering to standard operating procedures and by observing sample custody requirements. All data are calculated and reported in units consistent with project specifications, to enable easy comparison of data from report to report. Typical qualifiers used to flag analytical results are listed in Appendix D.

12.6 Documentation

A document control system ensures that all documents are accounted for when the project is complete. A service request number is assigned to each project for reporting and filing purposes. This number is associated with each order number (sample).

12.6.1 Documentation and Archiving of Routine Analysis Data

The archiving system includes all of the following items for each set of analyses performed:

- Chain-of-custody documentation
- Bench sheets describing sample preparation
- Sample analysis sequence
- Analysis bench sheets and instrument printouts
- Chromatograms and peak integration reports for all samples, standards, blanks, spikes and reruns
- Logbook ID number for the appropriate standards
- Copies of report submitted to the client
- Copies of Nonconformity and Corrective Action Report (NCAR) forms, if needed

Individual sets of analyses are indexed by analysis date and/or service request number. Since many analyses are performed with computer-based data systems, the final sample concentrations can be automatically calculated. If additional calculations are needed, they are written on the integration report or securely stapled to the chromatogram, if done on a separate sheet.

The archive room is an off-site file room in which files shall be maintained for a period of at least five years (from date of report issue). It is not unusual to have various clients require 10-year retention of records, therefore, the archivist, project manager, and possibly the client are consulted prior to destruction of the records. The archive cabinet and/or off site storage area is kept locked and access keys are controlled. All documents must be signed out if needed outside of the archive room and returned in a timely manner. A designated archivist monitors filing, incoming, and outgoing data from the archive.

12.6.2 Reporting Deliverables

In order to meet individual project needs, CAS provides several levels of analytical reports. Basic specifications for each level of deliverable are described in Figure 12-9. Turnaround time and package level are negotiable on a project to project basis.

12.6.3 Electronic Data Deliverables (EDD)

CAS/Houston offers standard Excel format as well as a variety of custom developed EDDs such as ASCII, dBase, and GISKEY. EDDs are available upon request on a project to project basis.

12.6.4 In the event that the laboratory transfers ownership or goes out of business, laboratory records shall be maintained for a minimum of five years or for the contracted period (if it exceeds five years) or transferred according to the clients' instructions. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records shall be followed.

Figure 12-1
Evaluation of Initial Calibration

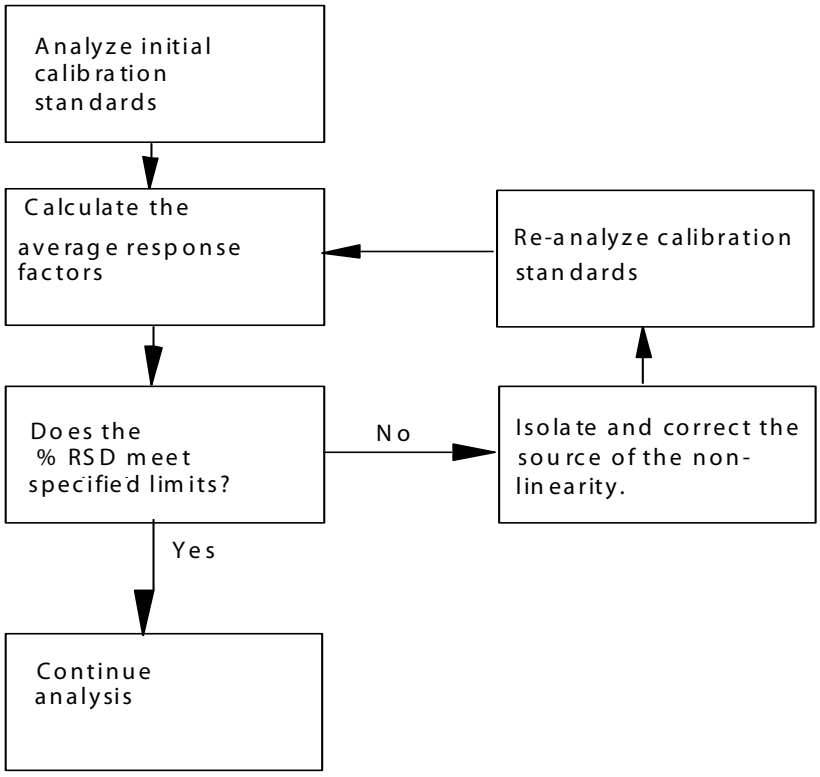


Figure 12-2
Evaluation of Continuing Calibration

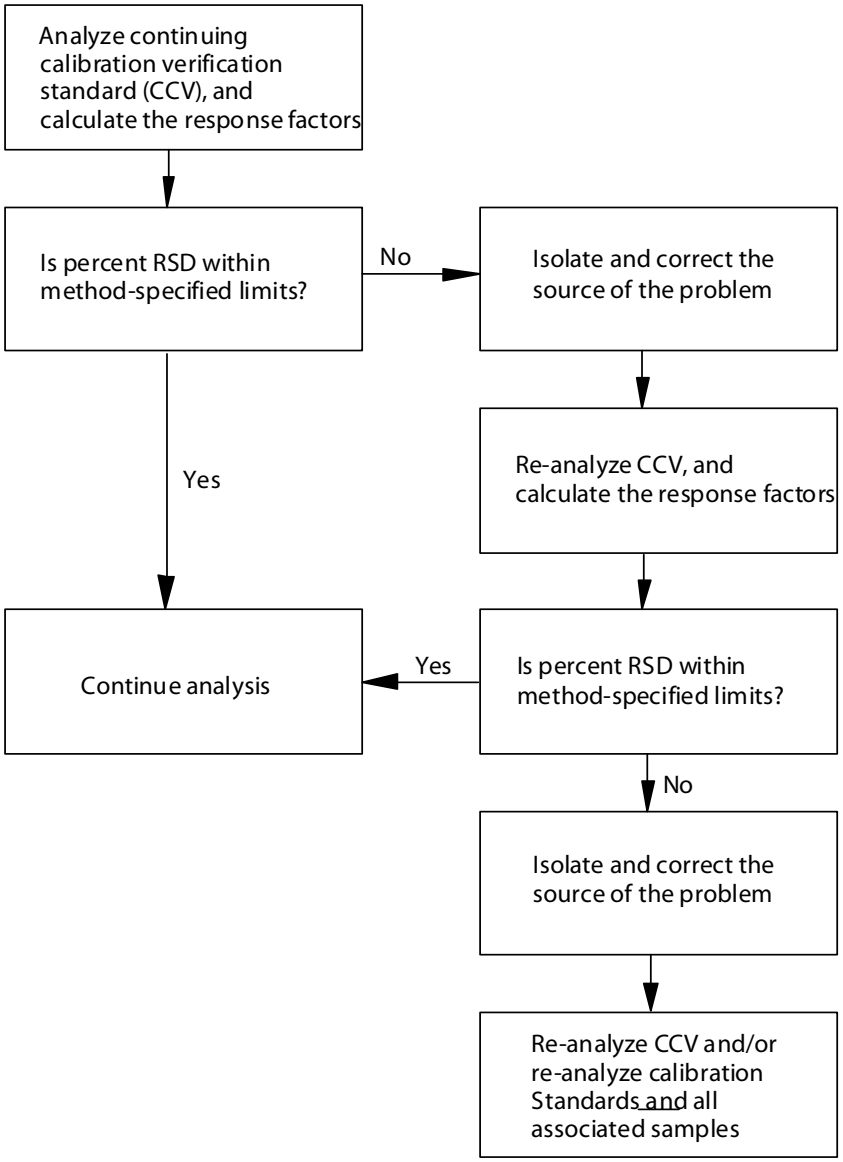


Figure 12-3
Evaluation of Method Blank and Instrument Blank Results

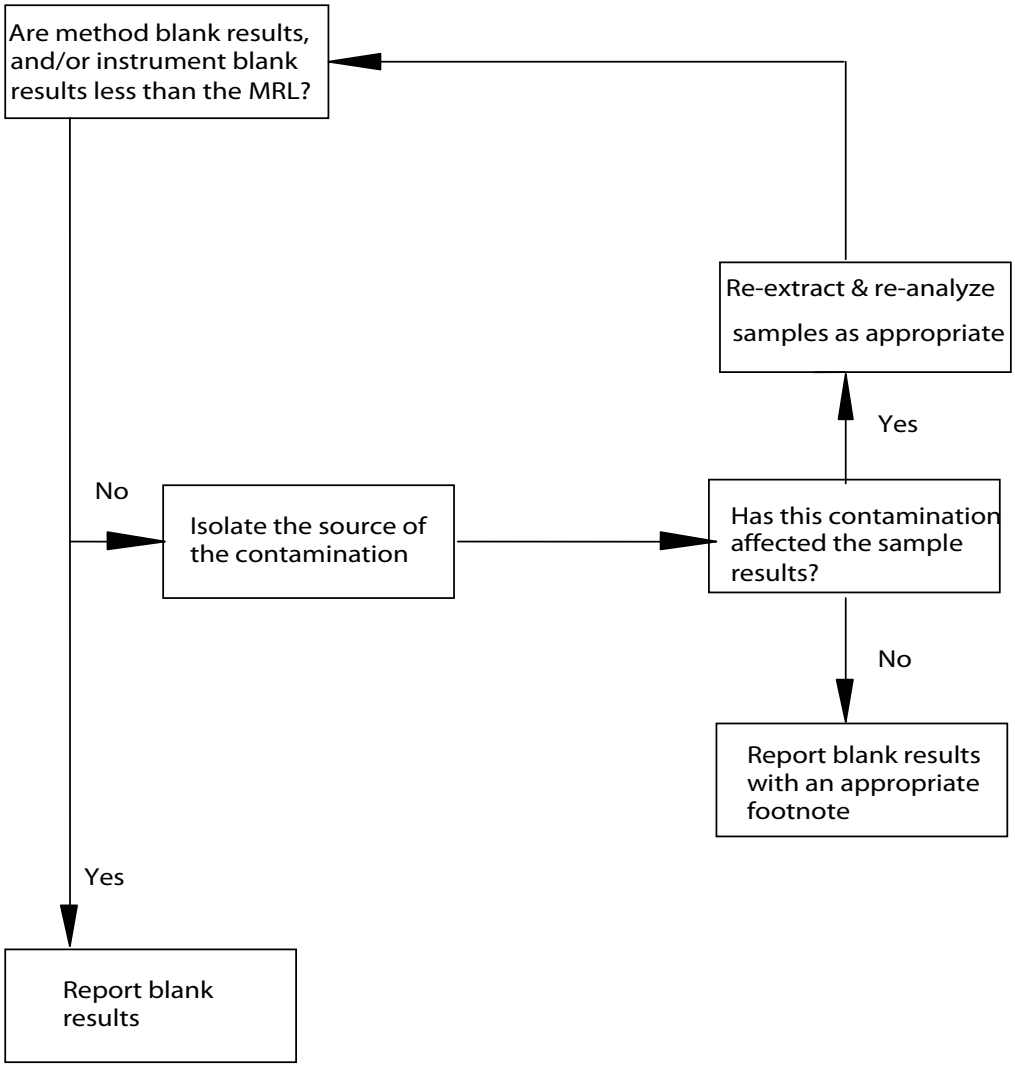


Figure 12-4
Evaluation of Sample Results

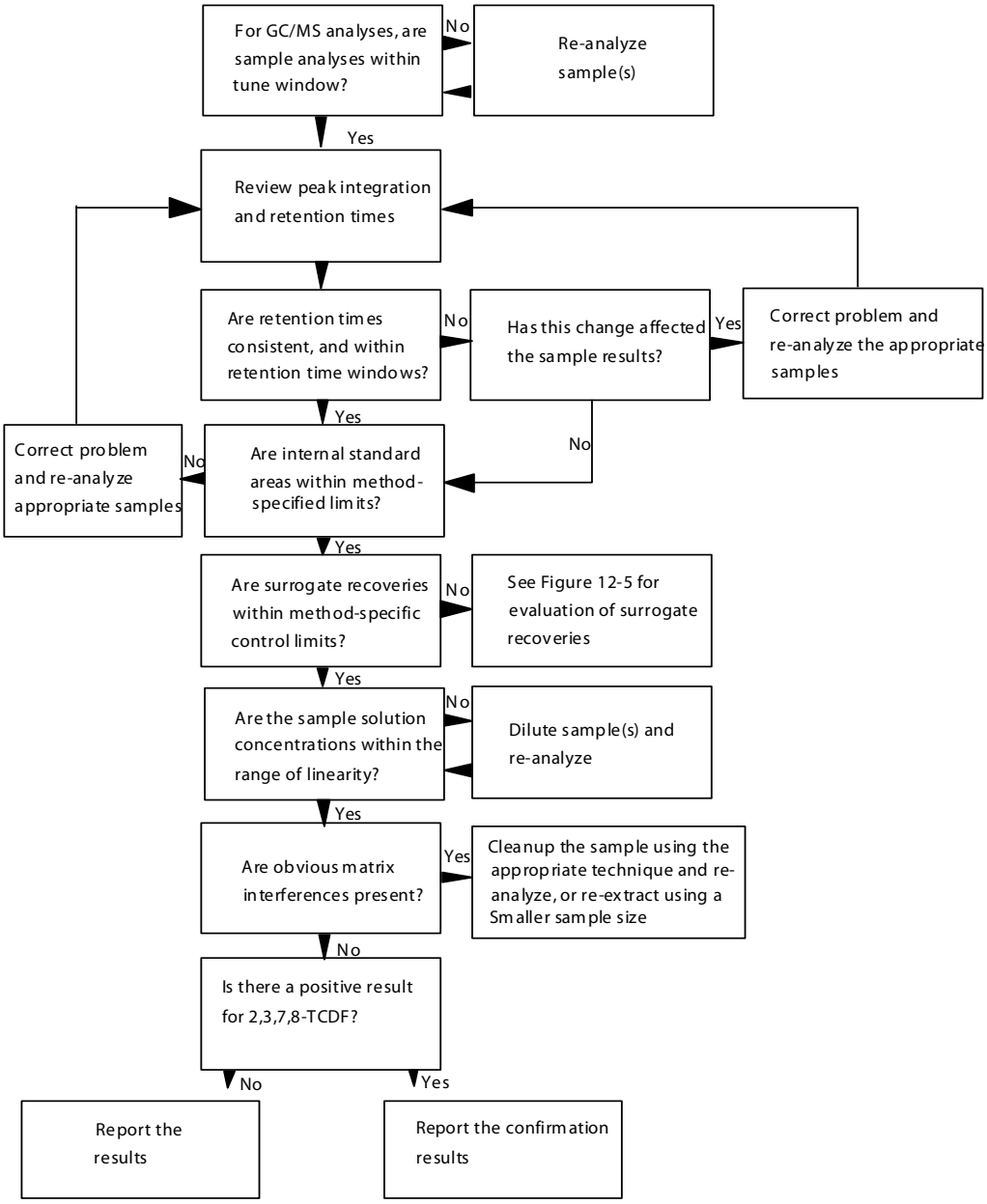


Figure 12-5
Evaluation of Labeled Standards

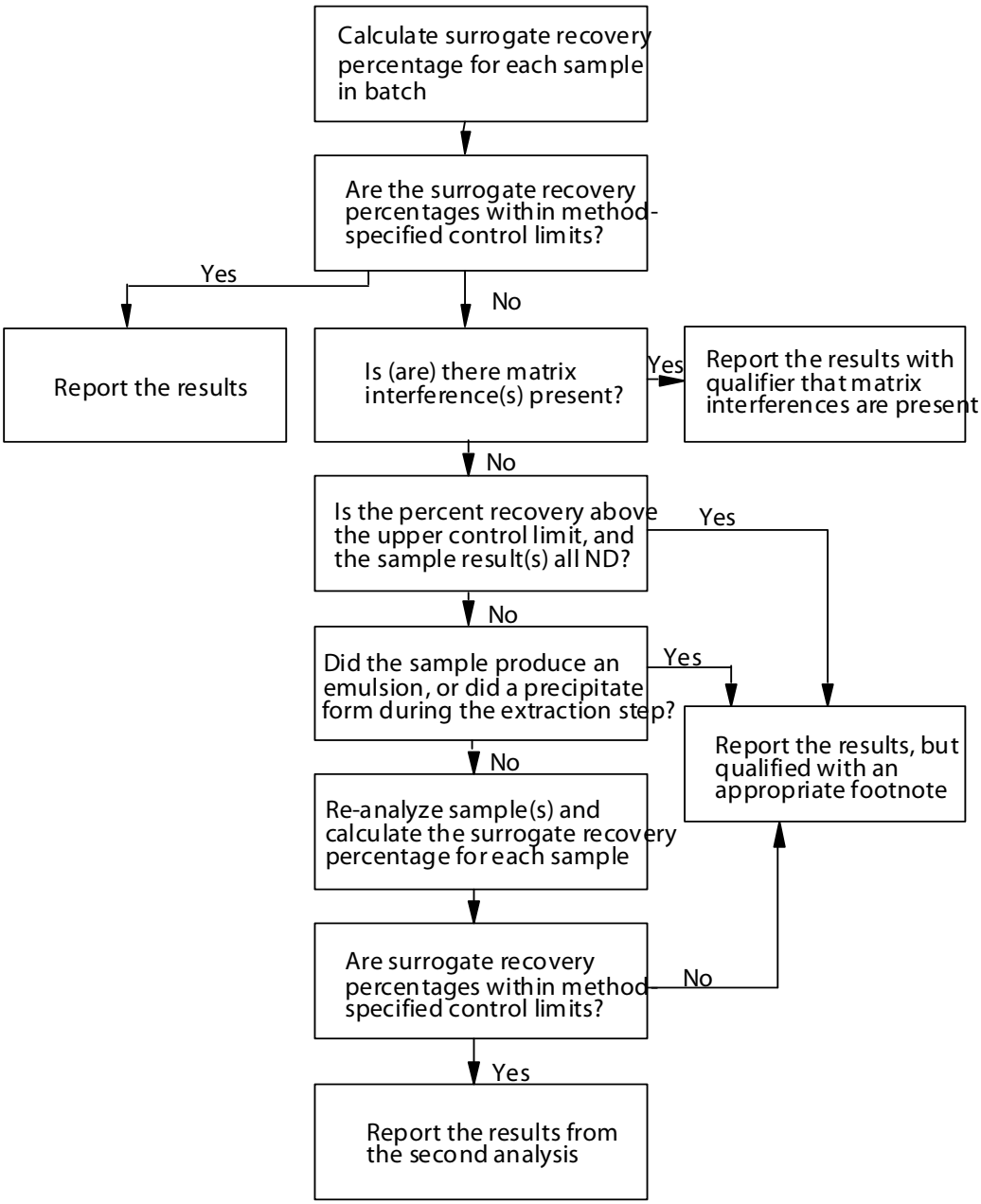


Figure 12-6
Evaluation of Precision (LCS/DLCS or MS/DMS) Results

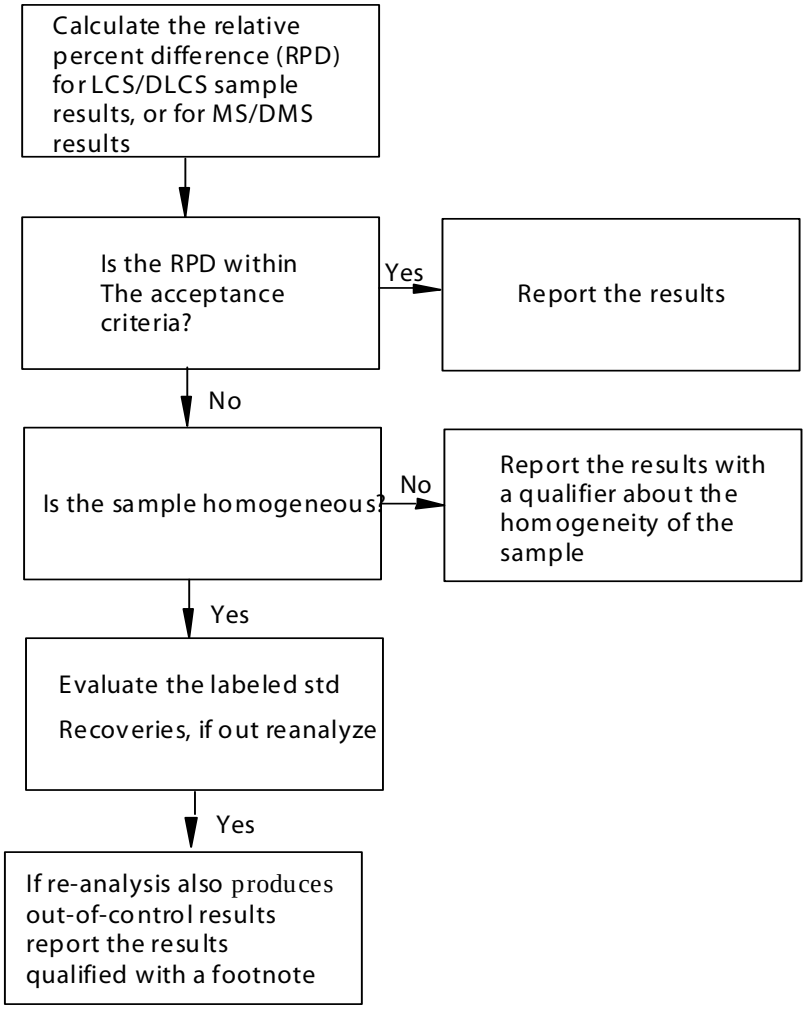


Figure 12-7
Evaluation of Matrix Spike Recoveries

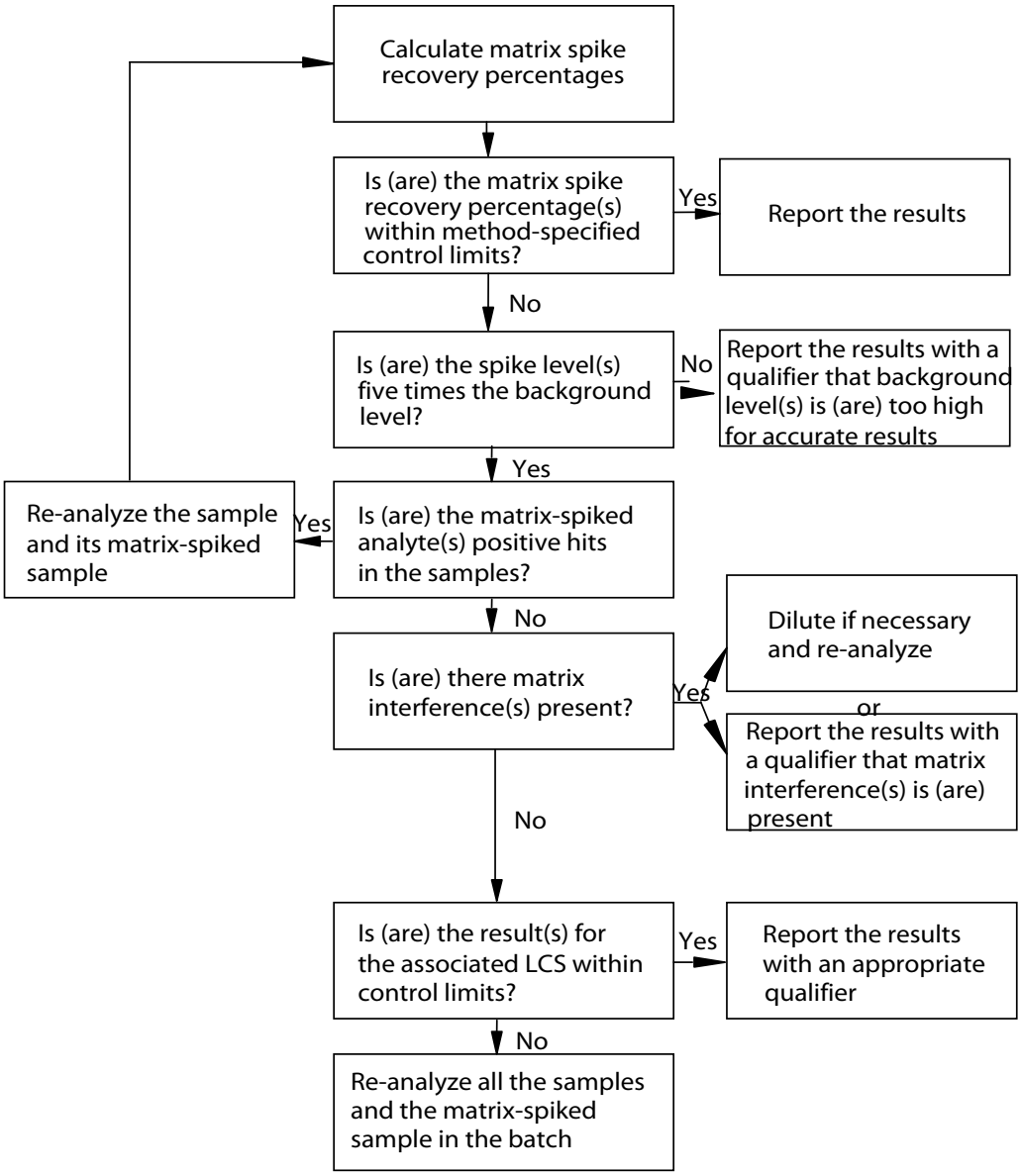


Figure 12-8
Evaluation of Laboratory Control Sample Recoveries

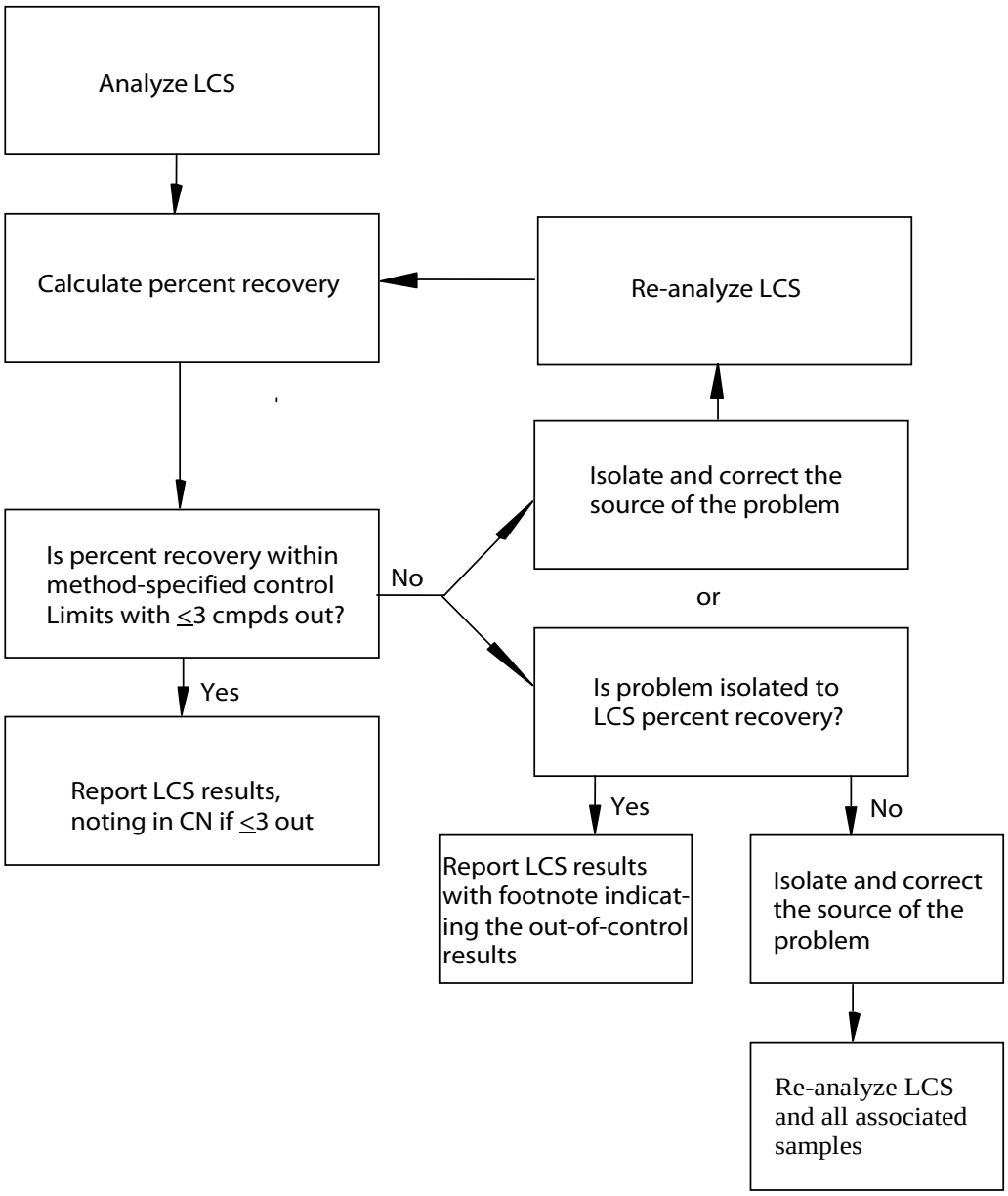


Figure 12-9
Data Packages

Tier 1 A Certified Analytical Report includes the following

1. Transmittal Letter
2. Case Narrative
2. Method Blank Results
3. Analytical Results
4. Surrogate Recovery Results, including associated acceptance criteria
5. Chain of Custody Documents

Tier 2 In Addition to the Tier 1 deliverables, this report includes the following:

1. Batch Quality Control summaries and results

Tier 3 In Addition to the Tier 2 deliverables, this report includes the following:

1. Selected ion monitoring summaries (without chromatograms)
2. Continuing calibration summaries (without chromatograms)
3. Initial calibration summaries (without chromatograms)

Tier 4 In Addition to the Tier 2 deliverables, this report includes the following:

1. Chromatograms and selected ion monitoring
2. Continuing calibration summaries and results
3. Initial calibration summaries and results

DLM02.0 Includes everything listed in Tier 4, presented in CLP format

1. Results and calibrations on DLM02.0 forms
2. Data packages organized according to DLM02.0 instructions

13.0 SYSTEM AND PERFORMANCE AUDITS

Quality Control (QC) audits are an essential part of CAS's QA program. There are two types of audits used at the facility: System Audits are conducted to qualitatively evaluate the operational details of the field and laboratory QA program, while Performance Audits are conducted by analyzing performance evaluation samples in order to quantitatively evaluate the outputs of the various measurement systems.

The system audit examines the presence and appropriateness of laboratory systems. External system audits of CAS are conducted regularly by various regulatory agencies and clients. Appendix E summarizes some of the major programs in which CAS/Houston participates. Additionally, internal system audits of CAS/Houston are conducted regularly by the Quality Assurance Program Manager and by the CAS/Corporate Chief Quality Officer. The internal system audits are scheduled as auditing events as follows:

- Comprehensive lab-wide system audit - annually
- Comprehensive "vertical" project audits examining compliance with all QA program requirements as applied to selected projects and implementation of QA program requirements - 1 per year
- Focused audits examining the lab-wide implementation of a selected QA program requirement – 1 per year

The results of each audit are reported to the Laboratory Director for review and comment. Any deficiencies noted by the auditor are summarized in an audit report and corrective action is taken within a specified length of time to correct each deficiency. If problems impacting data quality are found during an internal audit, any client whose data is adversely impacted will be given written notification if not already provided.

Additionally, CAS/Houston participates in the analysis of performance evaluation (PE) samples. Results of the performance evaluation samples and audits are reviewed by the Laboratory Director, the QA Program Manager, the CAS/Corporate Chief Quality Officer and the laboratory staff. Any problems surfacing during the audit are investigated, and corrective action is taken regarding any and all deficiencies.

14.0 PREVENTIVE MAINTENANCE

Preventive maintenance is a crucial element of Columbia Analytical Services Quality Assurance program. Instruments at CAS (e.g., high-resolution GC/MS systems, analytical balances, etc.) are maintained under commercial service contracts. All instruments are operated and maintained according to the instrument operating manuals and technical SOPs. All routine and special maintenance activities pertaining to the instruments are recorded in instrument maintenance logbooks. The maintenance logbooks used at CAS contain relevant information about the instruments used at the laboratory.

A system calibration check (CCV) is performed to demonstrate a return to analytical control after an analytical instrument has undergone maintenance, before sample analysis is resumed. System calibration checks bracket sample analysis, as described in the analytical methods. Instrument failure or anomalies determined to have an impact on previous calibrations or tests are investigated and documented using Nonconformity and Corrective Action Reports. These reports are filed in the analytical project files by SR#.

An initial demonstration of analytical control is required on each instrument used at CAS before proceeding with sample analyses. If an instrument is modified or repaired, a return to analytical control is required before subsequent sample analyses can continue. When an instrument is acquired at the laboratory, the following information is noted in a bound maintenance logbook specifically associated with the new equipment:

- The equipment's serial number.
- Date the equipment was received.
- Date the equipment was placed into service.
- Condition of equipment when received (new, used, reconditioned, etc...)
- Prior history of damage, malfunction, modification or repair (if known).

Preventative maintenance procedures, frequencies, etc. are available for each instrument used at CAS. They may be found in the various SOPs for routine methods performed on an instrument and may also be found in the operating or maintenance manuals provided with the equipment at the time of purchase. Responsibility for ensuring that routine maintenance is performed lies with the laboratory director. Each laboratory maintains a critical parts inventory. The parts inventories include the items needed to perform the preventative maintenance procedures listed in Table 14-1. This inventory or "parts list" also includes the items needed to perform any other routine maintenance and certain in-house non-routine repairs.

When performing maintenance on an instrument (whether preventative or otherwise), additional information about the problem, attempted repairs, etc. is also recorded in the logbook. Typical logbook entries include the following information:

- Details and symptoms of the problem.
- Repairs and/or maintenance performed.
- Description and/or part number of replaced parts.
- Source(s) of the replaced parts.
- Analyst signature and date.
- Demonstration of return to analytical control.

For most major equipment, back-up equipment is available to avoid downtime. All major analytical equipment is summarized in Appendix A. The Laboratory Director coordinates repair with the manufacturer. The Project Manager shall assess the effect of the downtime on the samples in-house and notify the appropriate clients of any delays and/or the possibilities of subcontracting within 24 to 48 hours.

Table 14-1
Preventive Maintenance Procedures

Instrument	Activity	Frequency
Refrigerators and coolers	▪ Record temperatures ▪ Clean coils ▪ Check coolant	▪ Daily ▪ Annually ▪ Annually
Vacuum Pumps	▪ Clean and change pump oil	▪ Monthly
Fume Hoods	▪ Face velocity measured ▪ Sash operation ▪ Change filters ▪ Inspect fan belts	▪ Quarterly ▪ As needed ▪ Annually ▪ Annually
Ovens	▪ Clean ▪ Record temperatures	▪ Annually ▪ Daily
Analytical Balances	▪ Check alignment ▪ Check calibration ▪ Clean pans	▪ Daily ▪ Daily ▪ After each use
High Resolution GC/MS	▪ Check gas supplies ▪ Change in-line filters ▪ Change septum ▪ Change injection port liner ▪ Clip first foot of capillary column ▪ Change guard column ▪ Replace analytical column ▪ Clean source ▪ Change pump oil	▪ Daily; replace when pressure reaches 50psi ▪ Quarterly ▪ Daily ▪ As needed ▪ As needed ▪ As needed ▪ As needed ▪ As needed ▪ Every six months

15.0 CORRECTIVE ACTION

Failure to meet established analytical controls, such as the quality control objectives outlined in Section 9.0, prompts corrective action. In general, corrective action may take several forms and may involve a review of the calculations, a check of the instrument maintenance and operation, a review of analytical technique and methodology, and reanalysis of quality control and field samples. If a potential problem develops that cannot be solved directly by the responsible analyst, the Laboratory Director, the Technical Director, and/or the Quality Assurance Program Manager may examine and pursue alternative solutions. In addition, the appropriate Project Manager may be notified in order to ascertain if contact with the client is necessary. If contact is needed, the client must be notified within 24 to 48 hours of the final assessment of the problem. This is to ensure the client's feedback can be taken into consideration when implementing a corrective action.

If the Quality Assurance Program Manager initiates corrective action due to a performance audit or check sample problem; the affected laboratory personnel are promptly informed.

A Nonconformity and Corrective Action Report is generated, following the guidelines in the SOP for *Corrective Action*, ***ADM-CA,*** to document and notify the appropriate personnel of the nonconformity. Nonconformity can include, but is not limited to, method blank contamination, re-extractions, dilutions, etc. Nonconformity reports are assigned time frames for completion. It is the responsibility of the QAPM to ensure that the corrective action is implemented and maintained.

In special cases, the Laboratory Director may give permission to the analyst or Project Manager to deviate from CAS Policy. A Nonconformity form must be signed by the Quality Assurance Program Manager.

In cases where there are complaints from the clients, follow policy procedures outlined in the SOP, ***ADM-CMPLT*** *(Dealing with Complaints).*

Figure 15-1
Nonconformity and Corrective Action Report

NONCONFORMITY

PROCEDURE (SOP or METHOD):

EVENT: ☐ Missed Holding Time ☐ QC Failure ☐ Lab Error (spilled sample, spiking error, etc.)
☐ Method Blank Contamination ☐ Login Error ☐ Project Management Error
☐ Equipment Failure ☐ Unacceptable PT Sample Result
☐ SOP Deviation ☐ Other (describe**):**

SAMPLES / PROJECTS / CUSTOMERS / SYSTEMS AFFECTED

DETAILED DESCRIPTION

ORIGINATOR: DATE:_____

CORRECTIVE ACTION AND OUTCOME

Re-establishment of conformity must be demonstrated and documented. Describe the steps that were taken, or are planned to be taken, to correct the particular Nonconformity and prevent its reoccurrence. Include any Project Manager instructions here.

Is the data to be flagged in the Analytical Report with an appropriate qualifier? ☐ **No** ☐ **Yes**

APPROVAL AND NOTIFICATION

Supervisor Verification and Approval of Corrective Action _____ Date: _____
Comments:

QA PM Verification and Approval of Corrective Action _____Date:_____
Comments:

Customer Notified by ☐ Telephone ☐ Fax ☐ E-mail ☐ Narrative ☐ Not notified

Project Manager Verification and Approval of Corrective Action _____Date:_____
Comments:

(Attach record or cite reference where record is located.) Project folder archives

16.0 QUALITY ASSURANCE REPORTS

Quality assurance requires an active, ongoing commitment by CAS personnel at all levels of the organization. Information flow and feedback mechanisms are designed so that analysts, supervisors and managers are aware of quality assurance issues in the laboratory.

Analysts performing routine tests in the laboratory are aware of the various method acceptance criteria and in-house control limits that must be met in order to generate acceptable results. Any non-conformities and corrective actions may also be attached to the data prior to review. Supervisors review all of the completed analytical batches to ensure that all QC criteria have been examined and any deficiencies noted and corrected if possible.

It is the responsibility of each laboratory unit to provide the Project Manager with a final report of the data, accompanied by signature approval. Footnotes and/or narrative notes must also accompany any data package if problems were encountered that require further explanation to the client. Each data package is submitted to the appropriate Project Manager, who in turn reviews the entire collection of analytical data for completeness. The Project Manager must also review the entire body of data to ensure that any and all client-specified objectives were successfully achieved. A case narrative may be written by the Project Manager to explain any unusual problems with a specific analysis or sample, etc.

The Quality Assurance Program Manager (QAPM) provides overview support to the Project Managers if required to do so (e.g. contractually specified, etc.) The QAPM is also responsible for the oversight of all internal and external audits, for all performance evaluation sample and analysis programs, and for all laboratory certification/accreditation responsibilities.

The QAPM also prepares quarterly reports for the Laboratory Director which summarize the various QA/QC activities that have occurred during the previous quarter. These reports may include a summary of the findings of the various audits performed during the last quarter, copies of audit-deficiency correspondence between the laboratory and external auditors, new accreditations/certifications received by the laboratory, scores of the most current performance evaluation studies, updates/revisions to controlled documents, etc. Any problems noted by the Laboratory Director are then discussed during the regularly-scheduled staff operations meetings with all appropriate staff.

Annually, the QAPM must facilitate a management review, to be performed by the Laboratory Director. This review is designed to ensure the continuing suitability and effectiveness of the laboratory's quality systems and testing activities and to introduce any necessary changes or improvements. More information can be found in the SOP for *Managerial Review of the Laboratory's Quality Systems,* ***ADM-MGMTRVW.***

17.0 TRAINING

Technical position descriptions are available for all employees, regardless of position or level of seniority. These documents are maintained by the QA Program Manager and Human Resources. In order to assess the technical capabilities and qualifications of a potential employee, all candidates for employment at CAS are evaluated, in part, against the appropriate technical description.

Information of previously acquired skills and abilities for a new employee is entered into a centralized database maintained by Human Resources. The database is also used to record the various technical skills and abilities acquired and maintained by an employee while employed by CAS. Information in the database includes the employee's name, a description of the skill including the appropriate method reference, the name of the supervisor who certified completion of the training, and the date the training was completed. Technical training is documented following CAS SOP requirements. CAS/Houston maintains a training summary file for all Houston employees. The training summary lists all Standard Operating Procedures for the facility and is a tool for tracking individual employee training status for those procedures. The training summary is a tracking and scheduling tool for the employee. This summary can also be used to track procedural training, as well. The training summary for all employees within a department are analyzed to ensure there is adequate training for all procedures, such that the absence of one employee will not cause an entire procedure to go idle.

Training begins the first day of employment at CAS (***ADM-TRANDOC***) when the company policies are presented and discussed. Training in analytical procedures typically begins with the reading of the SOP for the method. Hands-on training begins with the observation of an experienced analyst performing the method, followed by the trainee performing the method under close supervision, and culminating with independent performance of the method on quality control samples. Successful completion of the analysis must include an Initial Demonstration of Capability Study of four replicate quality control samples. Continued demonstration of capability is monitored with batch QC to maintain continuing qualification. Initial Demonstration of Capability is required anytime a new method is used, a new analyst is performing the method, or new instrumentation is installed.

Safety training begins with the reading of the *Chemical Hygiene Plan,* ***CHP***. All employees are required to attend quarterly safety meetings during which safety training is presented by the Environmental, Health and Safety Officer. Monthly safety committee meetings shall also be held by the EH&S Officer to discuss safety programs and check vital laboratory safety systems. A representative from each major department is required to attend these meetings. All employees are encouraged to either report safety concerns to their department representative or attend the meetings.

Quality assurance training begins with the reading of the *Quality Assurance Manual,* ***QAM***. It is in this document that all major quality assurance and quality control measures are set forth. All employees are required to read this document annually (or when a new revision is distributed.) Annual review of this document is required by the QAPM.

CAS encourages its personnel to continue to learn and develop new skills that will enhance their performance and value to the company. Ongoing training occurs for all employees through a variety of mechanisms. The "CAS University" education system, external and internal technical seminars and training courses, laboratory-specific training exercises and performance of external PE samples analysis are all used to provide employees with professional growth opportunities.

Safety and QA/QC requirements are integral parts of all technical SOPs and, consequently, are integral parts of all processes at CAS.

18.0 REFERENCES FOR ANALYTICAL PROCEDURES

The analytical methods used at CAS generally depend upon the end-use of the data. Since most of our work involves the analysis of environmental samples for regulatory purposes, specified federal and/or state testing methodologies are used and followed closely. Several factors are involved with the selection of analytical methods to be used in the laboratory. These include the method detection limit, the concentration of the analyte being measured, method selectivity, accuracy and precision of the method, the type of sample being analyzed, and the regulatory compliance objectives. Typical methods used at CAS are taken from the following references:

- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, 1986 and Updates I (7/92), II (9/94), IIA (8/93), IIB (1/95), and III (12/96). See Chapters 1, 2, 3, and 4.

- *Methods for the Determination of Organic Compounds in Drinking Water*, EPA 600/4-88-039, December 1988 and Supplement I (7/90) and Supplement II (8/92).

- 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act.

- 40 CFR Part 141, National Primary Drinking Water Regulations.

- EPA Contract Laboratory Program, Statement of Work for Dioxin/Furan Analysis, OLM02.0. May 2003.

- *U. S. EPA Contract Laboratory Program National Functional Guidelines for Dioxin/Furan Data Review*, EPA-540/R-94/012, September 2005.

- *Good Automated Laboratory Practices, Principles and Guidance to Regulations For Ensuring Data Integrity In Automated Laboratory Operations*, EPA 2185, August 1995.

- *National Environmental Laboratory Accreditation Conference*, *Quality Standards, Chapters 1-5*, July 2003.

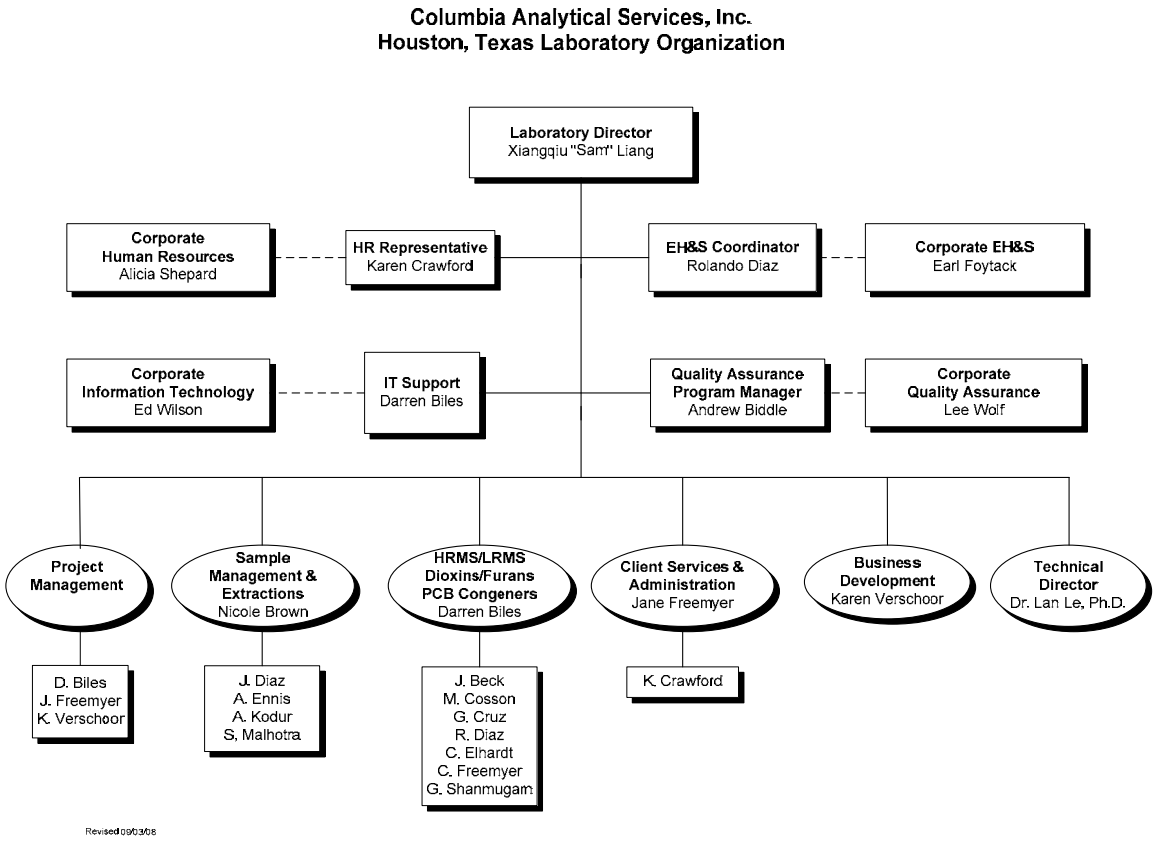
- *Uniform Federal Policy for Implementing Environmental Quality Systems,* EPA 505/F-03-001, March 2005.

APPENDIX A: MAJOR ANALYTICAL EQUIPMENT

Major Analytical Equipment

Equipment	Machine ID	Year Purchased	Manufacturer Maintained or Laboratory Maintained MM or LM	Number of trained operators
HRMS Systems (5):				
▪ Waters Autospec Ultima HRMS w/Opus Quan data system	E-HRMS-01	2004	MM	4
▪ Waters Autospec Ultima HRMS w/Opus Quan data system	E-HRMS-02	2004	MM	4
▪ VG Analytical HRMS 70S w/Opus Quan data system	E-HRMS-70	2002	LM	4
▪ Waters Autospec Premier HRMS w/Opus Quan data system	E-HRMS-03	2008	MM	4
▪ Waters Autospec Premier HRMS w/Opus Quan data system	E-HRMS-04	2008	MM	4
Extraction Lab:				
Dionex ASE200 Accelerated Solvent Extractor	-	2003	MM/LM	5
Eberbach Shaker	-	2007	LM	5
Rotavap Buchi R-200	-	1999	LM	5
Evaporator NVAPIIII	-	1999	LM	3
GS Drying Ovens	-	2002	LM	5
Mettler PG603-S Balance	-	2004	LM	5
Clay Adams Centrifuge	-	1999	LM	4
Branson Ultrasonic Cleaner	-	2008	LM	5
Mettler AJ100 Balance	-	1999	LM	5
Denver Instruments XE300 Balance	-	1999	LM	5
Tumbler	-	1999	LM	5
VWR Drying Oven	-	1999	LM	5
Glas-col Combination Mantle (4)	-	2008	LM	5

Appendix B: Organizational Chart



Appendix C: Data Quality Capabilities

Test Methods Performed

Method Number	Method Name	Sample Matrices
EPA 8290	Dioxins & furans	Water, soil, sediment, tissue, industrial products, food, wipes
EPA 8280A	Dioxins & furans	Water, soil, sediment, tissue, industrial products, food, wipes
EPA 1613B	Dioxins & furans	Water, drinking water, soil, sediment, tissue, industrial products, food, wipes
EPA 23/TO9A	Dioxins & furans	Industrial air and ambient air
EPA 1668A	PCB Congeners	Water, soil, sediment, tissue, wipes
CARB 428	PCB Congeners	Air
CARB 429	Polycyclic Aromatic Hydrocarbons	Air

Acceptance Criteria

8290

	Laboratory Control Sample Criteria (LCS & DLCS)					
	Accuracy (% Recovery)			Precision (% Difference)		
Compounds	**Water**	**Soil**	**Tissue**	**Water**	**Soil**	**Tissue**
2378-TCDD	88-135	87-135	87-135	≤25	≤25	≤25
12378-PeCDD	91-135	88-135	88-135	≤25	≤25	≤25
123478-HxCDD	76-140	81-138	81-138	≤25	≤25	≤25
123678-HxCDD	84-129	82-136	82-136	≤25	≤25	≤25
123789-HxCDD	66-140	77-135	77-135	≤25	≤25	≤25
1234678-HpCDD	92-136	93-144	93-144	≤25	≤25	≤25
OCDD	101-151	93-162	93-162	≤25	≤25	≤25
2378-TCDF	95-126	82-141	82-141	≤25	≤25	≤25
12378-PeCDF	92-130	92-139	92-139	≤25	≤25	≤25
23478-PeCDF	68-151	74-145	74-145	≤25	≤25	≤25
123478-HxCDF	77-137	86-142	86-142	≤25	≤25	≤25
123678-HxCDF	80-148	88-162	88-162	≤25	≤25	≤25
123789-HxCDF	62-147	66-156	66-156	≤25	≤25	≤25
234678-HxCDF	75-137	80-150	80-150	≤25	≤25	≤25
1234678-HpCDF	86-151	91-131	91-131	≤25	≤25	≤25
1234789-HpCDF	86-151	69-169	69-169	≤25	≤25	≤25
OCDF	81-201	82-200	82-200	≤25	≤25	≤25
13C-2378-TCDD	40-135	40-135	40-135	≤25	≤25	≤25
13C-12378-PeCDD	40-135	40-135	40-135	≤25	≤25	≤25
13C-123678-HxCDD	40-135	40-135	40-135	≤25	≤25	≤25
13C-1234678-HpCDD	40-135	40-135	40-135	≤25	≤25	≤25
13C-OCDD	40-135	40-135	40-135	≤25	≤25	≤25
13C-2378-TCDF	40-135	40-135	40-135	≤25	≤25	≤25
13C-12378-PeCDF	40-135	40-135	40-135	≤25	≤25	≤25
13C-123478-HxCDF	40-135	40-135	40-135	≤25	≤25	≤25
13C-1234678-HpCDF	40-135	40-135	40-135	≤25	≤25	≤25

Note: Soils are reported as dry-weight and tissues are reported as wet-weight.

Acceptance Criteria

1613B

	Laboratory Control Sample Criteria (LCS & LCSD)					
	Accuracy (% Recovery)			Precision (% Difference)		
Compounds	**Water**	**Soil**	**Tissue**	**Water**	**Soil**	**Tissue**
2378-TCDD	67-158	67-158	67-158	≤50	≤50	≤50
12378-PeCDD	70-142	70-142	70-142	≤50	≤50	≤50
123478-HxCDD	70-164	70-164	70-164	≤50	≤50	≤50
123678-HxCDD	76-134	76-134	76-134	≤50	≤50	≤50
123789-HxCDD	64-162	64-162	64-162	≤50	≤50	≤50
1234678-HpCDD	70-140	70-140	70-140	≤50	≤50	≤50
OCDD	78-144	78-144	78-144	≤50	≤50	≤50
2378-TCDF	75-158	75-158	75-158	≤50	≤50	≤50
12378-PeCDF	80-134	80-134	80-134	≤50	≤50	≤50
23478-PeCDF	68-160	68-160	68-160	≤50	≤50	≤50
123478-HxCDF	72-134	72-134	72-134	≤50	≤50	≤50
123678-HxCDF	84-130	84-130	84-130	≤50	≤50	≤50
123789-HxCDF	78-130	78-130	78-130	≤50	≤50	≤50
234678-HxCDF	70-156	70-156	70-156	≤50	≤50	≤50
1234678-HpCDF	82-132	82-132	82-132	≤50	≤50	≤50
1234789-HpCDF	78-138	78-138	78-138	≤50	≤50	≤50
OCDF	63-170	63-170	63-170	≤50	≤50	≤50
13C-2378-TCDD	25-164	25-164	25-164	≤50	≤50	≤50
13C-12378-PeCDD	25-181	25-181	25-181	≤50	≤50	≤50
13C-123478-HxCDD	32-141	32-141	32-141	≤50	≤50	≤50
13C-123678-HxCDD	28-130	28-130	28-130	≤50	≤50	≤50
13C-1234678-HpCDD	23-140	23-140	23-140	≤50	≤50	≤50
13C-OCDD	17-157	17-157	17-157	≤50	≤50	≤50
13C-2378-TCDF	24-169	24-169	24-169	≤50	≤50	≤50
13C-12378-PeCDF	24-185	24-185	24-185	≤50	≤50	≤50
13C-23478-PeCDF	21-178	21-178	21-178	≤50	≤50	≤50
13C-123478-HxCDF	26-152	26-152	26-152	≤50	≤50	≤50
13C-123678-HxCDF	26-123	26-123	26-123	≤50	≤50	≤50
13C-234678-HxCDF	28-136	28-136	28-136	≤50	≤50	≤50
13C-1234678-HpCDF	28-143	28-143	28-143	≤50	≤50	≤50
13C-1234789-HpCDF	26-138	26-138	26-138	≤50	≤50	≤50

Acceptance Criteria

8280A

	Laboratory Control Sample Criteria (LCS & LCSD)					
	Accuracy (% Recovery)			Precision (% Difference)		
Compounds	**Water**	**Soil**	**Tissue**	**Water**	**Soil**	**Tissue**
2378-TCDD	50-150	50-150	50-150	≤20	≤20	≤20
12378-PeCDD	50-150	50-150	50-150	≤20	≤20	≤20
123678-HxCDD	50-150	50-150	50-150	≤20	≤20	≤20
123478-HxCDD	50-150	50-150	50-150	≤20	≤20	≤20
123789-HxCDD	50-150	50-150	50-150	≤20	≤20	≤20
1234678-HpCDD	50-150	50-150	50-150	≤20	≤20	≤20
OCDD	50-150	50-150	50-150	≤20	≤20	≤20
2378-TCDF	50-150	50-150	50-150	≤20	≤20	≤20
12378-PeCDF	50-150	50-150	50-150	≤20	≤20	≤20
23478-PeCDF	50-150	50-150	50-150	≤20	≤20	≤20
123678-HxCDF	50-150	50-150	50-150	≤20	≤20	≤20
123789-HxCDF	50-150	50-150	50-150	≤20	≤20	≤20
123478-HxCDF	50-150	50-150	50-150	≤20	≤20	≤20
234678-HxCDF	50-150	50-150	50-150	≤20	≤20	≤20
1234678-HpCDF	50-150	50-150	50-150	≤20	≤20	≤20
1234789-HpCDF	50-150	50-150	50-150	≤20	≤20	≤20
OCDF	50-150	50-150	50-150	≤20	≤20	≤20
13C-2378-TCDD	25-150	25-150	25-150	≤20	≤20	≤20
13C-123678-HxCDD	25-150	25-150	25-150	≤20	≤20	≤20
13C-OCDD	25-150	25-150	25-150	≤20	≤20	≤20
13C-2378-TCDF	25-150	25-150	25-150	≤20	≤20	≤20
13C-1234678-HpCDF	25-150	25-150	25-150	≤20	≤20	≤20

Note: Soils/solids are reported as dry-weight and tissues are reported as wet-weight.

Acceptance Criteria

23/TO-9A

	Laboratory Control Sample Criteria (LCS & LCSD)	
	Accuracy (% Recovery)	Precision (% Difference)
Compounds	**Air**	**Air**
2378-TCDD	70-130	≤30
12378-PeCDD	70-130	≤30
123478-HxCDD	70-130	≤30
123678-HxCDD	70-130	≤30
123789-HxCDD	70-130	≤30
1234678-HpCDD	70-130	≤30
OCDD	70-130	≤30
2378-TCDF	70-130	≤30
12378-PeCDF	70-130	≤30
23478-PeCDF	70-130	≤30
123478-HxCDF	70-130	≤30
123678-HxCDF	70-130	≤30
123789-HxCDF	70-130	≤30
234678-HxCDF	70-130	≤30
1234678-HpCDF	70-130	≤30
1234789-HpCDF	70-130	≤30
OCDF	70-130	≤30
13C-2378-TCDD	50-120	≤30
13C-12378-PeCDD	50-120	≤30
13C-123678-HxCDD	50-120	≤30
13C-1234678-HpCDD	40-120	≤30
13C-OCDD	40-120	≤30
13C-2378-TCDF	50-120	≤30
13C-12378-PeCDF	50-120	≤30
13C-123678-HxCDF	50-120	≤30
13C-1234789-HpCDF	40-120	≤30
13C-123478-HxCDD	50-120	≤30
13C-23478-PeCDF	50-120	≤30
13C-123478-HxCDF	50-120	≤30
13C-1234789-HpCDF	40-120	≤30

Acceptance Criteria

1668A

	Laboratory Control Sample Criteria (LCS & LCSD)					
	Accuracy (% Recovery)			Precision (% Difference)		
Chlorination Level	**Water**	**Soil**	**Tissue**	**Water**	**Soil**	**Tissue**
Monochlorobiphenyl	15-150	15-150	15-150	≤50	≤50	≤50
Dichlorobiphenyl	50-150	50-150	50-150	≤50	≤50	≤50
Trichlorobiphenyl	50-150	50-150	50-150	≤50	≤50	≤50
Tetrachlorobiphenyl	50-150	50-150	50-150	≤50	≤50	≤50
Pentachlorobiphenyl	50-150	50-150	50-150	≤50	≤50	≤50
Hexachlorobiphenyl	50-150	50-150	50-150	≤50	≤50	≤50
Heptachlorobiphenyl	50-150	50-150	50-150	≤50	≤50	≤50
Octachlorobiphenyl	50-150	50-150	50-150	≤50	≤50	≤50
Nonachlorobiphenyl	50-150	50-150	50-150	≤50	≤50	≤50
Decachlorobiphenyl	50-150	50-150	50-150	≤50	≤50	≤50
13C-2-MoCB	15-140	15-140	15-140	≤50	≤50	≤50
13C-4-MoCB	15-140	15-140	15-140	≤50	≤50	≤50
13C-2,2'-DiCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-4,4'-DiCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,2',6-TrCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-3,4,4'-TrCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,2',6,6'-TeCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-3,3',4,4'-TeCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-3,4,4',5-TeCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,2'4,6,6'-PeCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,3,3',4,4'-PeCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,3,4,4',5-PeCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,3',4,4',5-PeCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2',3,4,4',5-PeCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-3,3'4,4',5-PeCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,2',4,4',6,6'-HxCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,3,3'4,4',5-HxCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,3,3'4,4',5'-HxCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,3',4,4'5,5'-HxCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-3,3'4,4'5,5'-HxCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,2',3,4',5,6,6'-HpCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2',3,3'4,4',5,5'-HpCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,2',3,3',5,5',6,6'-OcCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,3,3',4,4',5,5',6-OcCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,2',3,3',4,4',5,5',6-NoCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,2',3,3',4,5,5',6,6'-NoCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,2',3,3',4,4',5,5',6,6'-DeCB	25-150	25-150	25-150	≤50	≤50	≤50
13C-2,4,4'-TrCB	30-135	30-135	30-135	≤50	≤50	≤50
13C-2,3,3',5,5'-PeCB	30-135	30-135	30-135	≤50	≤50	≤50
13C-2,2',3,3',5,5',6-HpCB	30-135	30-135	30-135	≤50	≤50	≤50

Appendix D: Abbreviations and Data Qualifiers

Abbreviations, acronyms and definitions

Cal	Calibration
Conc	CONCentration
Dioxin(s)	Polychlorinated dibenzo-p-dioxin(s)
EDL	Estimated Detection Limit
EMPC	Estimated Maximum Possible Concentration
Flags	Data qualifiers
Furan(s)	Polychlorinated dibenzofuran(s)
g	Grams
ICAL	Initial CALibration
ID	IDentifier
Ions	Masses monitored for the analyte during data acquisition
L	Liter (s)
LCS	Laboratory Control Sample
DLCS	Duplicate Laboratory Control Sample
MB	Method Blank
MCL	Method Calibration Limit
MDL	Method Detection Limit
mL	Milliliters
MS	Matrix Spiked sample
DMS	Duplicate Matrix Spiked sample
NO	Number of peaks meeting all identification criteria
PCDD(s)	Polychlorinated dibenzo-p-dioxin(s)
PCDF(s)	Polychlorinated dibenzofuran(s)
ppb	Parts per billion
ppm	Parts per million
ppq	Parts per quadrillion
ppt	Parts per trillion
QA	Quality Assurance
QC	Quality Control
Ratio	Ratio of areas from monitored ions for an analyte
% Rec.	Percent recovery
RPD	Relative Percent Difference
RRF	Relative Response Factor
RT	Retention Time
SDG	Sample Delivery Group
S/N	Signal-to-noise ratio
TEF	Toxicity Equivalence Factor
TEQ	Toxicity Equivalence Quotient

Data Qualifiers (Flags)

- **B** Indicates the associated analyte is found in the method blank, as well as in the sample.
- **C** Confirmation of the TCDF compound: When 2378-TCDF is detected on the DB-5 column, confirmation analyses are performed on a second column (DB-225). The results from both the DB-5 column and the DB-225 column are included in this data package. The results from the DB-225 analyses should be used to evaluate the 2378-TCDF in the samples. The confirmed result should be used in determining the TEQ value for TCDF.
- **E** Indicates an estimated value – used when the analyte concentration exceeds the upper end of the linear calibration range.
- **J** Indicates an estimated value – used when the analyte concentration is below the method reporting limit (MRL) and above the estimated detection limit (EDL).
- **K** EMPC - When the ion abundance ratios associated with a particular compound are outside the QC limits, samples are flagged with a 'K' flag. A 'K' flag indicates an estimated maximum possible concentration for the associated compound.
- **U** Indicates the compound was analyzed and not detected
- **Y** Samples that had recoveries of labeled standards outside the acceptance limits are flagged with 'Y'. In all cases, the signal-to-noise ratios are greater than 10:1, making these data acceptable.
- **ND** Indicates concentration is reported as 'Not Detected.'
- **S** Peak is saturated; data not reportable.
- **Q** Lock-mass interference by ether compounds.

Appendix E: Current Certifications (dated 08/27/08)

Laboratory Certifications

2008 - 2009

STATE/PROGRAM	AGENCY	CERT#	EXP DATE	CERTIFIED?
ARIZONA	AZ-DHS	AZ0725	05/27/09	Yes
ARKANSAS	ADEQ	08-056-0	06/16/09	Yes
CALIFORNIA	CA-ELAP	2452	02/28/09	Yes
FLORIDA/NELAP	FL-DOHS	E87611	06/30/09	Yes
HAWAII	HI-DOH	N/A	06/30/09	Yes
ILLINOIS/NELAP	IL-EPA	002122	10/06/09	Yes
LOUISIANA/NELAP	LELAP	03048	06/30/09	Yes
MAINE	ME-DOHS	TX901	06/05/10	Yes
MINNESOTA	MDH	048-999-427	03/25/10	Yes
NEVADA	NDEP	N/A	07/31/09	Yes - Extension
NEW JERSEY	NJDEP	TX008	06/30/09	Yes
NEW YORK/NELAP	NY-DOH	11707	04/01/09	Yes
NFESC/NAVY	NFESC	N/A	01/09/10	Yes
OKLAHOMA	OKDEQ		08/31/09	Yes
OREGON/NELAP	ORELAP	TX200002-005	03/24/09	Yes
TENNESSEE	TNDEC	04016	06/30/09	Yes
TEXAS/NELAP	TCEQ	T104704216-06-TX	06/30/09	Yes
UTAH/NELAP	UTELCP	COLU2	06/30/09	Yes
SOIL IMPORT PERMIT	USDA	S-76664	12/31/09	Yes
WASHINGTON/NELAP	WA-Ecology	C291	11/14/08	Yes
WEST VIRGINIA	WVDEP	347	06/30/09	Yes

Appendix F: CAS/Houston Signatories

Columbia Analytical Services, Inc. Houston Signatories

Analyst	Signature	Initials
Jeremiah Beck		
Andrew Biddle		
Darren Biles		
Nicole Brown		
Michael Cosson		
Karen Crawford		
Gisela Cruz		
Rolando Diaz		
Christopher Elhardt		
Alexander Ennis		
Claire Freemyer		
Jane Freemyer		
Arthi Kodur		
Xiangqiu Liang		
Stefan Malhotra		
Pavai Shanmugam		
Karen Verschoor		
Lan Le		
Joseph Diaz		

Appendix G: List of Current SOPs

Preparation of SOPs	ADM-SOP
Document Control	ADM-DOC_CTRL
Documentation of Training	ADM-TRANDOC
Purchasing Through CAS Purchasing Department in Kelso	ADM-PUR
Checking New Lots of Chemicals for Contamination	ADM-CTMN
Sample Batches	ADM-BATCH
Making Entries into Logbooks and onto Benchsheets	ADM-DATANTRY
Determination of Method Detection Limits	ADM-MDL
Significant Figures	ADM-SIGFIG
Determination of Control Limits	ADM-CTRL_LIM
Manual Integration of Chromatographic Peaks	ADM-INT
Corrective Action	ADM_CA
Handling Customer Feedback	ADM-FDBK
Software Quality Assurance Plan	ADM_SQAP
Preparation of Electronic-Data for Organic Analyses for Electronic-Data Audits	ADM-E_DATA
Estimation of Uncertainty Measurements	ADM-UNCERT
Confirmation of Organic Analyte Identification and Quantitation	ADM-CONFIRM
Managerial Review of the Laboratory's Quality Systems	ADM-MGMTRVW
Data Recall	ADM-DATARECALL
Proficiency Testing Sample Analysis	ADM-PTS
Sample Receiving	SMO-WET
Waste Disposal	SMO-WASTDISP
HRMS Data Review & Reporting	HRMS-DATAREV
Data Archiving - Reports	REPORT-ARCH
Chemical Hygiene Plan	CHP
Bottle Order Preparation and Shipping	SMO-BOT
Washing Glassware	SMO-WASH
Archiving Data for HRMS	ARCH_HRMS
Air Sampling Trap Preparation	PREP_XAD_TRAP
Percent Lipids in Tissues or Solids	PREP-LIPIDS
Method 1613B: Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS	HRMS-1613B
Method 8290: Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	HRMS-8290
Method 23: Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	HRMS-M23
Method 8280A: Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/LRMS	HRMS-8280A
Method 1668A: Chlorinated Biphenyl Congeners in Water, Soil, Sediment Biosolids and Tissue by High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry (GC/HRMS)	HRMS-1668A
Method TO9A: Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air	HRMS-TO9A
Method 428: Determination of Polychlorinated dibenzo-p-dioxin (PCDD), Polychlorinated Dibenzo-p-furan (PCDF) and Polychlorinated biphenyl Emissions from Stationary Sources	HRMS/CA-428
Method VCP - Tetra- Through Octa-Chlorinated Dioxins and Furans By Isotope Dilution GC/HRMS	HRMS-VCP
Method 429: Determination of Polycyclic Aromatic Hydrocarbon (PAH) Emissions From Stationary Sources	HRMS/CA-429
Screening of Dioxins & Furans	D&F Screening
Quality Assurance Manual/CAS-Houston	QAM
Calibration Check of Measuring Devices	WET-DALCYK
Best Practices Initiative #2 Project Management	HOU-PM
Internal Quality Audits	QA-INT-AUD
Total Solids	SMO-TS

Changed	Item	Revisions (from/to)	Date/initials
Cover letter	Address changed	6-7	11/17/07jf
Table 7-1	Holding times corrected	6-7	11/17/07jf
Format	Consistent	7.1-7.2	08/27/08asb
Minor text alterations	QA Manager to QAPM	7.1-7.2	08/27/08asb
Acceptance Criteria	Added	7.1-7.2	08/27/08asb

Texas Commission on Environmental Quality

NELAP-Recognized Laboratory Accreditation is hereby awarded to

COLUMBIA ANALYTICAL SERVICES, INC. - HOUSTON
19408 PARK ROW, SUITE 320
HOUSTON, TX 77084-4949

in accordance with Texas Water Code Chapter 5, Subchapter R, Title 30 Texas Administrative Code Chapter 25, and the National Environmental Laboratory Accreditation Program.

The laboratory's scope of accreditation includes the fields of accreditation that accompany this certificate. Continued accreditation depends upon successful ongoing participation in the program. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Certificate Number: T104704216-08-TX
Effective Date: 7/1/2008
Expiration Date: 6/30/2009

Executive Director
Texas Commission on Environmental Quality

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Columbia Analytical Services, Inc. - Houston
19408 Park Row, Suite 320
Houston, TX 77084-4949

Certificate T104704216-08-TX
Issue Date: 7/1/2008
Expiration Date: 6/30/2009

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: Drinking Water

Category / Method: EPA 1613

Analytes:	Code	AA	Analytes:	Code	AA
2 3 7 8-Tetrachloro dibenzo- p-dioxin	9618	TX			

Matrix: Solid and Chemical Materials

Category / Method: EPA 1668

Analytes:	Code	AA	Analytes:	Code	AA
Decachlorobiphenyl	9105	TX	Dichlorobiphenyls	464	TX
Heptachlorobiphenyls	486	TX	Hexachlorobiphenyls	487	TX
Monochlorobiphenyls	501	TX	Nonachlorobiphenyls	507	TX
Octachlorobiphenyls	508	TX	Pentachlorobiphenyls	515	TX
Tetrachlorobiphenyls	528	TX	Trichlorobiphenyls	541	TX

Category / Method: EPA 8280A

Analytes:	Code	AA	Analytes:	Code	AA
1 2 3 4 6 7 8 9-Octachlorodibenzofuran (OCDF)	9516	TX	1 2 3 4 6 7 8 9-Octachlorodibenzo-p-dioxin (OCDD)	9519	TX
1 2 3 4 6 7 8-Heptachlorodibenzofuran (1 2 3 4 6 7 8-hpcdf)	9420	TX	1 2 3 4 6 7 8-Heptachlorodibenzo-p-dioxin (1 2 3 4 6 7 8-hpcdd)	9426	TX
1 2 3 4 7 8 9-Heptachlorodibenzofuran (1 2 3 4 7 8 9-hpcdf)	9423	TX	1 2 3 4 7 8-Hxcdd	9453	TX
1 2 3 4 7 8-Hxcdf	9471	TX	1 2 3 6 7 8-Hxcdd	9456	TX
1 2 3 6 7 8-Hxcdf	9474	TX	1 2 3 7 8 9-Hxcdd	9459	TX
1 2 3 7 8 9-Hxcdf	9477	TX	1 2 3 7 8-Pecdd	9540	TX
1 2 3 7 8-Pecdf	9543	TX	2 3 4 6 7 8-Hxcdf	9480	TX
2 3 4 7 8-Pecdf	9549	TX	2 3 7 8-TCDD	9606	TX
2 3 7 8-TCDF	9612	TX	Hpcdd total	9438	TX
Hpcdf total	9444	TX	Hxcdd total	9468	TX
Hxcdf total	9483	TX	Pecdd total	9555	TX
Pecdf total	9552	TX	TCDD total	9609	TX
TCDF total	9615	TX			

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Columbia Analytical Services, Inc. - Houston
19408 Park Row, Suite 320
Houston, TX 77084-4949

Certificate T104704216-08-TX
Issue Date: 7/1/2008
Expiration Date: 6/30/2009

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: Solid and Chemical Materials

Category / Method: EPA 8290

Analytes:	Code	AA	Analytes:	Code	AA
1 2 3 4 6 7 8 9-Octachlorodibenzofuran (OCDF)	9516	TX	1 2 3 4 6 7 8 9-Octachlorodibenzo-p-dioxin (OCDD)	9519	TX
1 2 3 4 6 7 8-Heptachlorodibenzofuran (1 2 3 4 6 7 8-hpcdf)	9420	TX	1 2 3 4 6 7 8-Heptachlorodibenzo-p-dioxin (1 2 3 4 6 7 8-hpcdd)	9426	TX
1 2 3 4 7 8 9-Heptachlorodibenzofuran (1 2 3 4 7 8 9-hpcdf)	9423	TX	1 2 3 4 7 8-Hxcdd	9453	TX
1 2 3 4 7 8-Hxcdf	9471	TX	1 2 3 6 7 8-Hxcdd	9456	TX
1 2 3 6 7 8-Hxcdf	9474	TX	1 2 3 7 8 9-Hxcdd	9459	TX
1 2 3 7 8 9-Hxcdf	9477	TX	1 2 3 7 8-Pecdd	9540	TX
1 2 3 7 8-Pecdf	9543	TX	2 3 4 6 7 8-Hxcdf	9480	TX
2 3 4 7 8-Pecdf	9549	TX	2 3 7 8-TCDD	9606	TX
2 3 7 8-TCDF	9612	TX	Hpcdd total	9438	TX
Hpcdf total	9444	TX	Hxcdd total	9468	TX
Hxcdf total	9483	TX	Pecdd total	9555	TX
Pecdf total	9552	TX	TCDD total	9609	TX
TCDF total	9615	TX			

Matrix: Non-Potable Water

Category / Method: EPA 1613

Analytes:	Code	AA	Analytes:	Code	AA
1 2 3 4 6 7 8-Heptachlorodibenzofuran (1 2 3 4 6 7 8-hpcdf)	9420	TX	1 2 3 4 6 7 8-Heptachlorodibenzo-p-dioxin (1 2 3 4 6 7 8-hpcdd)	9426	TX
1 2 3 4 7 8 9-Heptachlorodibenzofuran (1 2 3 4 7 8 9-hpcdf)	9423	TX	1 2 3 4 7 8-Hxcdd	9453	TX
1 2 3 4 7 8-Hxcdf	9471	TX	1 2 3 6 7 8-Hxcdd	9456	TX
1 2 3 6 7 8-Hxcdf	9474	TX	1 2 3 7 8 9-Hxcdd	9459	TX
1 2 3 7 8 9-Hxcdf	9477	TX	1 2 3 7 8-Pecdd	9540	TX
1 2 3 7 8-Pecdf	9543	TX	2 3 4 6 7 8-Hxcdf	9480	TX
2 3 4 7 8-Pecdf	9549	TX	2 3 7 8-TCDD	9606	TX
2 3 7 8-TCDF	9612	TX	Hpcdd total	9438	TX
Hpcdf total	9444	TX	Hxcdd total	9468	TX
Hxcdf total	9483	TX	Octachlorodibenzofuran	10294	TX
Octachlorodibenzo-p-dioxin	10310	TX	Pecdd total	9555	TX
Pecdf total	9552	TX	TCDD total	9609	TX
TCDF total	9615	TX			

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Columbia Analytical Services, Inc. - Houston
19408 Park Row, Suite 320
Houston, TX 77084-4949

Certificate T104704216-08-TX
Issue Date: 7/1/2008
Expiration Date: 6/30/2009

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: Non-Potable Water

Category / Method: EPA 8280A

Analytes:	Code	AA	Analytes:	Code	AA
1 2 3 4 6 7 8 9-Octachlorodibenzofuran (OCDF)	9516	TX	1 2 3 4 6 7 8 9-Octachlorodibenzo-p-dioxin (OCDD)	9519	TX
1 2 3 4 6 7 8-Heptachlorodibenzofuran (1 2 3 4 6 7 8-hpcdf)	9420	TX	1 2 3 4 6 7 8-Heptachlorodibenzo-p-dioxin (1 2 3 4 6 7 8-hpcdd)	9426	TX
1 2 3 4 7 8 9-Heptachlorodibenzofuran (1 2 3 4 7 8 9-hpcdf)	9423	TX	1 2 3 4 7 8-Hxcdd	9453	TX
1 2 3 4 7 8-Hxcdf	9471	TX	1 2 3 6 7 8-Hxcdd	9456	TX
1 2 3 6 7 8-Hxcdf	9474	TX	1 2 3 7 8 9-Hxcdd	9459	TX
1 2 3 7 8 9-Hxcdf	9477	TX	1 2 3 7 8-Pecdd	9540	TX
1 2 3 7 8-Pecdf	9543	TX	2 3 4 6 7 8-Hxcdf	9480	TX
2 3 4 7 8-Pecdf	9549	TX	2 3 7 8-TCDD	9606	TX
2 3 7 8-TCDF	9612	TX	Hpcdd total	9438	TX
Hpcdf total	9444	TX	Hxcdd total	9468	TX
Hxcdf total	9483	TX	Pecdd total	9555	TX
Pecdf total	9552	TX	TCDD total	9609	TX
TCDF total	9615	TX			

Category / Method: EPA 8290

Analytes:	Code	AA	Analytes:	Code	AA
1 2 3 4 6 7 8 9-Octachlorodibenzofuran (OCDF)	9516	TX	1 2 3 4 6 7 8 9-Octachlorodibenzo-p-dioxin (OCDD)	9519	TX
1 2 3 4 6 7 8-Heptachlorodibenzofuran (1 2 3 4 6 7 8-hpcdf)	9420	TX	1 2 3 4 6 7 8-Heptachlorodibenzo-p-dioxin (1 2 3 4 6 7 8-hpcdd)	9426	TX
1 2 3 4 7 8 9-Heptachlorodibenzofuran (1 2 3 4 7 8 9-hpcdf)	9423	TX	1 2 3 4 7 8-Hxcdd	9453	TX
1 2 3 4 7 8-Hxcdf	9471	TX	1 2 3 6 7 8-Hxcdd	9456	TX
1 2 3 6 7 8-Hxcdf	9474	TX	1 2 3 7 8 9-Hxcdd	9459	TX
1 2 3 7 8 9-Hxcdf	9477	TX	1 2 3 7 8-Pecdd	9540	TX
1 2 3 7 8-Pecdf	9543	TX	2 3 4 6 7 8-Hxcdf	9480	TX
2 3 4 7 8-Pecdf	9549	TX	2 3 7 8-TCDD	9606	TX
2 3 7 8-TCDF	9612	TX	Hpcdd total	9438	TX
Hpcdf total	9444	TX	Hxcdd total	9468	TX
Hxcdf total	9483	TX	Pecdd total	9555	TX
Pecdf total	9552	TX	TCDD total	9609	TX
TCDF total	9615	TX			

FLORIDA DEPARTMENT OF HEALTH

State of Florida
Department of Health, Bureau of Laboratories

This is to certify that

E87611

COLUMBIA ANALYTICAL SERVICES, INC. - TX
19408 PARK ROW, SUITE 320
HOUSTON, TX 77084

has complied with Florida Administrative Code 64E-1,
for the examination of Environmental samples in the following categories

DRINKING WATER - DIOXIN, NON-POTABLE WATER - EXTRACTABLE ORGANICS, NON-POTABLE WATER - PESTICIDES-HERBICIDES-PCB'S, SOLID AND CHEMICAL MATERIALS - EXTRACTABLE ORGANICS, SOLID AND CHEMICAL MATERIALS - PESTICIDES-HERBICIDES-PCB'S, BIOLOGICAL TISSUE - EXTRACTABLE ORGANICS, BIOLOGICAL TISSUE - PESTICIDES-HERBICIDES-PCB'S

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

EFFECTIVE July 29, 2008 THROUGH June 30, 2009

Max Salfinger, M.D.
Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1697, 7/04
NON-TRANSFERABLE E87611-07-07/29/2008
Supersedes all previously issued certificates

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code:** TX01411 **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,7,8-TCDD (Dioxin, 2,3,7,8-Tetrachlorodibenzo-p-dioxin)	EPA 1613	Dioxin	NELAP	7/1/2006

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,4,7,8-Hxcdd	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,4,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,4,7,8-Hxcdf	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,4,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,6,7,8-Hxcdd	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,6,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,6,7,8-Hxcdf	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,7,8,9-Hxcdd	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,7,8,9-Hxcdd	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,7,8,9-Hxcdf	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,7,8,9-Hxcdf	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,7,8-Pecdd	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,7,8-Pecdd	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,7,8-Pecdf	EPA 1613	Extractable Organics	NELAP	7/1/2006
1,2,3,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	7/1/2006
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ 194)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ 207)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ 196)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,3',4,4',6,6'+2,2',3,3',4,5,6,6'-Octachlorobiphenyls (BZ 197+200)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',6+2,2',3,3',4,5,6-Heptachlorobiphenyls (BZ 171+173)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4'+2,3,4,4',5,6-Hexachlorobiphenyls (BZ 128+166)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ 208)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5,5',6+2,2',3,3',4,5,5',6'-Octachlorobiphenyls (BZ 198+199)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ 201)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ 175)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 177)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5+2,2',3,4,4',5'+2,3,3',4',5,6-Hexachlorobiphenyls (BZ 129+138+163)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5'-Hexachlorobiphenyl (BZ 130)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,6'-Hexachlorobiphenyl (BZ 132)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4-Pentachlorobiphenyl (BZ 82)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ 202)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,6'+2,2',3,5,5',6+2,2',4,4',5,6'-Hexachlorobiphenyls (BZ 135+151+154)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,6-Hexachlorobiphenyl (BZ 134)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5-Pentachlorobiphenyl (BZ 83)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',6,6'-Hexachlorobiphenyl (BZ 136)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',6-Pentachlorobiphenyl (BZ 84)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3'+2,3',4',6-Tetrachlorobiphenyls (BZ 40+71)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,5'+2,3,3',4',5,5',6-Heptachlorobiphenyls (BZ 180+193)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5',6+2,2',3,4,5,5',6-Heptachlorobiphenyls (BZ 183+185)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ 182)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',6+2,2',3,4,4',6'-Hexachlorobiphenyls (BZ 139+140)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4'+2,3,4,5,6+2,3,4',5,6-Pentachlorobipheny ls (BZ 85+116+117)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,6+2,2',3,4',5',6-Hexachlorobiphenyls (BZ 147+149)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5,6-Hexachlorobiphenyl (BZ 142)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5',6-Hexachlorobiphenyl (BZ 144)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5+2,2',3,4,5'+2,2',3,4',5'+2,2',4,4',6-Pentac hlorobiphenyls (BZ 86+87+97+100)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5+2,2',4,5,5'+2,3,3',5',6-Pentachlorobiphen yls (BZ 90+101+113)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 145)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',6,6'-Hexachlorobiphenyl (BZ 150)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,6+2,2',3,4',6-Pentachlorobiphenyls (BZ 88+91)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',6'+2,2',4,5,6'-Pentachlorobiphenyls (BZ 98+102)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,6'-Pentachlorobiphenyl (BZ 89)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4-Tetrachlorobiphenyl (BZ 41)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4'-Tetrachlorobiphenyl (BZ 42)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,5'-Pentachlorobiphenyl (BZ 92)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,6+2,2',4,4',6-Pentachlorobiphenyls (BZ 93+100)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,6'-Pentachlorobiphenyl (BZ 94)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,5',6-Pentachlorobiphenyl (BZ 95)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5'+2,2',4,4'+2,3,5,6-Tetrachlorobiphenyls (BZ 44+47+65)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5+2,3',5',6-Tetrachlorobiphenyls (BZ 43+73)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,6,6'-Pentachlorobiphenyl (BZ 96)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,6-Tetrachlorobiphenyl (BZ 45)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,6'-Tetrachlorobiphenyl (BZ 46)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3-Trichlorobiphenyl (BZ 16)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',5,5'+2,3',4,4',5',6-Hexachlorobiphenyls (BZ 153+168)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',5-Pentachlorobiphenyl (BZ 99)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5',6-Pentachlorobiphenyl (BZ 103)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5'+2,3',4,6-Tetrachlorobiphenyls (BZ 49+69)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5-Tetrachlorobiphenyl (BZ 48)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,6,6'-Pentachlorobiphenyl (BZ 104)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,6+2,2',5,6'-Tetrachlorobiphenyls (BZ 50+53)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,6'-Tetrachlorobiphenyl (BZ 51)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4-Trichlorobiphenyl (BZ 17)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',5+2,4,6-Trichlorobiphenyls (BZ 18+30)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',6,6'-Tetrachlorobiphenyl (BZ 54)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',6-Trichlorobiphenyl (BZ 19)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2'-Dichlorobiphenyl (BZ 4)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ 205)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ 190)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ 191)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5+2,3,3',4,4',5'-Hexachlorobiphenyls (BZ 156+157)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,3',4,4',6-Hexachlorobiphenyl (BZ 158)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ 192)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5,6-Hexachlorobiphenyl (BZ 160)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5',6-Hexachlorobiphenyl (BZ 161)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',5',6-Hexachlorobiphenyl (BZ 164)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',5+2,3',4',5,5'-Pentachlorobiphenyls (BZ 107+124)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5-Pentachlorobiphenyl (BZ 106)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',5'-Pentachlorobiphenyl (BZ 122)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',6+2,3,4,4',6-Pentachlorobiphenyls (BZ 110+115)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,6-Pentachlorobiphenyl (BZ 109)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4-Tetrachlorobiphenyl (BZ 55)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4'-Tetrachlorobiphenyl (BZ 56)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5,5',6-Hexachlorobiphenyl (BZ 165)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5,5'-Pentachlorobiphenyl (BZ 111)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5,6-Pentachlorobiphenyl (BZ 112)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5-Tetrachlorobiphenyl (BZ 57)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5'-Tetrachlorobiphenyl (BZ 58)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',6+2,3,3',6+2,4,4',6-Tetrachlorobiphenyls (BZ 59+62+75)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3'+2,4,4'-Trichlorobiphenyls (BZ 20+28)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,4'-Tetrachlorobiphenyl (BZ 60)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,5,5'-Pentachlorobiphenyl (BZ 120)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,5',6-Pentachlorobiphenyl (BZ 121)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4',5+2,4,4',5+2,3',4',5'-Tetrachlorobiphenyls (BZ 70+74+76)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,5-Tetrachlorobiphenyl (BZ 61)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4',5-Tetrachlorobiphenyl (BZ 63)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3',4,5-Tetrachlorobiphenyl (BZ 67)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,5'-Tetrachlorobiphenyl (BZ 68)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,6,7,8-Hxcdf	EPA 1613	Extractable Organics	NELAP	7/1/2006
2,3,4,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	7/1/2006
2,3,4',6-Tetrachlorobiphenyl (BZ 64)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,7,8-Pecdf	EPA 1613	Extractable Organics	NELAP	7/1/2006
2,3,4,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	7/1/2006
2,3,4+2,3',4'-Trichlorobiphenyls (BZ 21+33)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4'-Trichlorobiphenyl (BZ 22)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4-Trichlorobiphenyl (BZ 25)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',5,5'-Tetrachlorobiphenyl (BZ 72)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',5+2,4,5-Trichlorobiphenyls (BZ 26+29)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,5-Trichlorobiphenyl (BZ 23)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',5-Trichlorobiphenyl (BZ 26)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',5'-Trichlorobiphenyl (BZ 34)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,6-Trichlorobiphenyl (BZ 24)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',6-Trichlorobiphenyl (BZ 27)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,7,8-TCDD	EPA 1613	Extractable Organics	NELAP	7/1/2006
2,3,7,8-TCDD (Dioxin, 2,3,7,8-Tetrachlorodibenzo-p-dioxin)	EPA 8290	Extractable Organics	NELAP	7/1/2006
2,3,7,8-TCDF	EPA 1613	Extractable Organics	NELAP	7/1/2006
2,3,7,8-TCDF	EPA 8290	Extractable Organics	NELAP	7/1/2006
2,3-Dichlorobiphenyl (BZ 5)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3'-Dichlorobiphenyl (BZ 6)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,4,4'-Trichlorobiphenyl (BZ 28)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,4',6-Trichlorobiphenyl (BZ 32)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,4-Dichlorobiphenyl (BZ 7)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,4'-Dichlorobiphenyl (BZ 8)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,5-Dichlorobiphenyl (BZ 9)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,6-Dichlorobiphenyl (BZ 10)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2-Chlorobiphenyl (BZ 1)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,5,5'-Pentachlorobiphenyl (BZ 127)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,5-Tetrachlorobiphenyl (BZ 78)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
3,3',4,5'-Tetrachlorobiphenyl (BZ 79)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4-Trichlorobiphenyl (BZ 35)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',5,5'-Tetrachlorobiphenyl (BZ 80)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',5-Trichlorobiphenyl (BZ 36)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3'-Dichlorobiphenyl (BZ 11)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4,4',5-Tetrachlorobiphenyl (BZ 81)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4,4'-Trichlorobiphenyl (BZ 37)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4,5-Trichlorobiphenyl (BZ 38)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4',5-Trichlorobiphenyl (BZ 39)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4+3,4'-Dichlorobiphenyls (BZ 12+13)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,5-Dichlorobiphenyl (BZ 14)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3-Chlorobiphenyl (BZ 2)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
4,4'-Dichlorobiphenyl (BZ 15)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
4-Chlorobiphenyl (BZ 3)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
Decachlorobiphenyl (BZ 209)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
Total Heptachlorodibenzofuran	EPA 1613	Extractable Organics	NELAP	7/1/2006
Total Heptachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Heptachlorodibenzo-p-dioxin	EPA 1613	Extractable Organics	NELAP	7/1/2006
Total Heptachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Hexachlorodibenzofuran	EPA 1613	Extractable Organics	NELAP	7/1/2006
Total Hexachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Hexachlorodibenzo-p-dioxin	EPA 1613	Extractable Organics	NELAP	7/1/2006
Total Hexachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Pentachlorodibenzofuran	EPA 1613	Extractable Organics	NELAP	7/1/2006
Total Pentachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Pentachlorodibenzo-p-dioxin	EPA 1613	Extractable Organics	NELAP	7/1/2006
Total Pentachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Tetrachlorodibenzofuran	EPA 1613	Extractable Organics	NELAP	7/1/2006
Total Tetrachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Tetrachlorodibenzo-p-dioxin	EPA 1613	Extractable Organics	NELAP	7/1/2006
Total Tetrachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	7/1/2006

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,4,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,4,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,6,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,7,8,9-Hxcdd	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,7,8,9-Hxcdf	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,7,8-Pecdd	EPA 8290	Extractable Organics	NELAP	7/1/2006
1,2,3,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	7/1/2006
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ 194)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ 207)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ 196)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',6,6'+2,2',3,3',4,5,6,6'-Octachlorobiphenyls (BZ 197+200)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',6+2,2',3,3',4,5,6-Heptachlorobiphenyls (BZ 171+173)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4'+2,3,4,4',5,6-Hexachlorobiphenyls (BZ 128+166)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ 208)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5,5',6+2,2',3,3',4,5,5',6'-Octachlorobiphenyls (BZ 198+199)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ 201)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ 175)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 177)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5+2,2',3,4,4',5'+2,3,3',4',5,6-Hexachlorobiphenyls (BZ 129+138+163)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5'-Hexachlorobiphenyl (BZ 130)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,6'-Hexachlorobiphenyl (BZ 132)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4-Pentachlorobiphenyl (BZ 82)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ 202)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,6'+2,2',3,5,5',6+2,2',4,4',5,6'-Hexachloro biphenyls (BZ 135+151+154)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,6-Hexachlorobiphenyl (BZ 134)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5-Pentachlorobiphenyl (BZ 83)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',6,6'-Hexachlorobiphenyl (BZ 136)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',6-Pentachlorobiphenyl (BZ 84)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3'+2,3',4',6-Tetrachlorobiphenyls (BZ 40+71)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,5'+2,3,3',4',5,5',6-Heptachlorobiphenyl s (BZ 180+193)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5',6+2,2',3,4,5,5',6-Heptachlorobiphenyl s (BZ 183+185)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ 182)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',6+2,2',3,4,4',6'-Hexachlorobiphenyls (BZ 139+140)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4'+2,3,4,5,6+2,3,4',5,6-Pentachlorobipheny ls (BZ 85+116+117)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,6+2,2',3,4',5',6-Hexachlorobiphenyls (BZ 147+149)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5,6-Hexachlorobiphenyl (BZ 142)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,4,5',6-Hexachlorobiphenyl (BZ 144)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5+2,2',3,4,5'+2,2',3,4',5'+2,2',4,4',6-Pentachlorobiphenyls (BZ 86+87+97+100)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5+2,2',4,5,5'+2,3,3',5',6-Pentachlorobiphenyls (BZ 90+101+113)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 145)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',6,6'-Hexachlorobiphenyl (BZ 150)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,6+2,2',3,4',6-Pentachlorobiphenyls (BZ 88+91)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',6'+2,2',4,5,6'-Pentachlorobiphenyls (BZ 98+102)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,6'-Pentachlorobiphenyl (BZ 89)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4-Tetrachlorobiphenyl (BZ 41)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4'-Tetrachlorobiphenyl (BZ 42)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,5'-Pentachlorobiphenyl (BZ 92)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,6+2,2',4,4',6-Pentachlorobiphenyls (BZ 93+100)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,6'-Pentachlorobiphenyl (BZ 94)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5',6-Pentachlorobiphenyl (BZ 95)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5'+2,2',4,4'+2,3,5,6-Tetrachlorobiphenyls (BZ 44+47+65)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5+2,3',5',6-Tetrachlorobiphenyls (BZ 43+73)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,6,6'-Pentachlorobiphenyl (BZ 96)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,6-Tetrachlorobiphenyl (BZ 45)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,6'-Tetrachlorobiphenyl (BZ 46)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3-Trichlorobiphenyl (BZ 16)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',5,5'+2,3',4,4',5',6-Hexachlorobiphenyls (BZ 153+168)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',5-Pentachlorobiphenyl (BZ 99)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5',6-Pentachlorobiphenyl (BZ 103)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5'+2,3',4,6-Tetrachlorobiphenyls (BZ 49+69)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',4,5-Tetrachlorobiphenyl (BZ 48)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,6,6'-Pentachlorobiphenyl (BZ 104)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,6+2,2',5,6'-Tetrachlorobiphenyls (BZ 50+53)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,6'-Tetrachlorobiphenyl (BZ 51)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4-Trichlorobiphenyl (BZ 17)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',5+2,4,6-Trichlorobiphenyls (BZ 18+30)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',6,6'-Tetrachlorobiphenyl (BZ 54)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',6-Trichlorobiphenyl (BZ 19)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2'-Dichlorobiphenyl (BZ 4)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ 205)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ 190)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ 191)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5+2,3,3',4,4',5'-Hexachlorobiphenyls (BZ 156+157)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',6-Hexachlorobiphenyl (BZ 158)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ 192)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5,6-Hexachlorobiphenyl (BZ 160)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5',6-Hexachlorobiphenyl (BZ 161)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',5',6-Hexachlorobiphenyl (BZ 164)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',5+2,3',4',5,5'-Pentachlorobiphenyls (BZ 107+124)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5-Pentachlorobiphenyl (BZ 106)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',5'-Pentachlorobiphenyl (BZ 122)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',6+2,3,4,4',6-Pentachlorobiphenyls (BZ 110+115)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,6-Pentachlorobiphenyl (BZ 109)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4-Tetrachlorobiphenyl (BZ 55)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4'-Tetrachlorobiphenyl (BZ 56)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5,5',6-Hexachlorobiphenyl (BZ 165)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5,5'-Pentachlorobiphenyl (BZ 111)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5,6-Pentachlorobiphenyl (BZ 112)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,3',5-Tetrachlorobiphenyl (BZ 57)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5'-Tetrachlorobiphenyl (BZ 58)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',6+2,3,3',6+2,4,4',6-Tetrachlorobiphenyls (BZ 59+62+75)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3'+2,4,4'-Trichlorobiphenyls (BZ 20+28)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,4'-Tetrachlorobiphenyl (BZ 60)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,5,5'-Pentachlorobiphenyl (BZ 120)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,5',6-Pentachlorobiphenyl (BZ 121)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4',5+2,4,4',5+2,3',4',5'-Tetrachlorobiphenyls (BZ 70+74+76)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,5-Tetrachlorobiphenyl (BZ 61)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4',5-Tetrachlorobiphenyl (BZ 63)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,5-Tetrachlorobiphenyl (BZ 67)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,5'-Tetrachlorobiphenyl (BZ 68)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	7/1/2006
2,3,4',6-Tetrachlorobiphenyl (BZ 64)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	7/1/2006
2,3,4+2,3',4'-Trichlorobiphenyls (BZ 21+33)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4'-Trichlorobiphenyl (BZ 22)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4-Trichlorobiphenyl (BZ 25)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',5,5'-Tetrachlorobiphenyl (BZ 72)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',5+2,4,5-Trichlorobiphenyls (BZ 26+29)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,5-Trichlorobiphenyl (BZ 23)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',5'-Trichlorobiphenyl (BZ 34)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,6-Trichlorobiphenyl (BZ 24)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',6-Trichlorobiphenyl (BZ 27)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,7,8-TCDD (Dioxin, 2,3,7,8-Tetrachlorodibenzo-p-dioxin)	EPA 8290	Extractable Organics	NELAP	7/1/2006
2,3,7,8-TCDF	EPA 8290	Extractable Organics	NELAP	7/1/2006
2,3-Dichlorobiphenyl (BZ 5)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3'-Dichlorobiphenyl (BZ 6)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,4',6-Trichlorobiphenyl (BZ 32)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,4-Dichlorobiphenyl (BZ 7)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,4'-Dichlorobiphenyl (BZ 8)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,5-Dichlorobiphenyl (BZ 9)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,6-Dichlorobiphenyl (BZ 10)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2-Chlorobiphenyl (BZ 1)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,5,5'-Pentachlorobiphenyl (BZ 127)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,5-Tetrachlorobiphenyl (BZ 78)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,5'-Tetrachlorobiphenyl (BZ 79)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4-Trichlorobiphenyl (BZ 35)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',5,5'-Tetrachlorobiphenyl (BZ 80)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',5-Trichlorobiphenyl (BZ 36)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3'-Dichlorobiphenyl (BZ 11)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4,4',5-Tetrachlorobiphenyl (BZ 81)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4,4'-Trichlorobiphenyl (BZ 37)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4,5-Trichlorobiphenyl (BZ 38)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4',5-Trichlorobiphenyl (BZ 39)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4+3,4'-Dichlorobiphenyls (BZ 12+13)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,5-Dichlorobiphenyl (BZ 14)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3-Chlorobiphenyl (BZ 2)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
4,4'-Dichlorobiphenyl (BZ 15)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
4-Chlorobiphenyl (BZ 3)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
Decachlorobiphenyl (BZ 209)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
Total Heptachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Heptachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Hexachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Hexachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Pentachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Pentachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Tetrachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	7/1/2006
Total Tetrachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	7/1/2006

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290	Extractable Organics	NELAP	7/1/2003
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290	Extractable Organics	NELAP	7/1/2003
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290	Extractable Organics	NELAP	7/1/2003
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290	Extractable Organics	NELAP	7/1/2003
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290	Extractable Organics	NELAP	7/1/2003
1,2,3,4,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	7/1/2003
1,2,3,4,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	7/1/2003
1,2,3,6,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	7/1/2003
1,2,3,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	7/1/2003
1,2,3,7,8,9-Hxcdd	EPA 8290	Extractable Organics	NELAP	7/1/2003
1,2,3,7,8,9-Hxcdf	EPA 8290	Extractable Organics	NELAP	7/1/2003
1,2,3,7,8-Pecdd	EPA 8290	Extractable Organics	NELAP	7/1/2003
1,2,3,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	7/1/2003
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ 194)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ 207)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ 196)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',6,6'+2,2',3,3',4,5,6,6'-Octachlorobiphenyls (BZ 197+200)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4',6+2,2',3,3',4,5,6-Heptachlorobiphenyls (BZ 171+173)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,4'+2,3,4,4',5,6-Hexachlorobiphenyls (BZ 128+166)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ 208)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5,5',6+2,2',3,3',4,5,5',6'-Octachlorobiphenyls (BZ 198+199)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ 201)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ 175)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 177)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5+2,2',3,4,4',5'+2,3,3',4',5,6-Hexachlorobiphenyls (BZ 129+138+163)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,5'-Hexachlorobiphenyl (BZ 130)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4,6'-Hexachlorobiphenyl (BZ 132)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',4-Pentachlorobiphenyl (BZ 82)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ 202)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,6'+2,2',3,5,5',6+2,2',4,4',5,6'-Hexachlorobiphenyls (BZ 135+151+154)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5,6-Hexachlorobiphenyl (BZ 134)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',5-Pentachlorobiphenyl (BZ 83)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',6,6'-Hexachlorobiphenyl (BZ 136)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3',6-Pentachlorobiphenyl (BZ 84)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,3'+2,3',4',6-Tetrachlorobiphenyls (BZ 40+71)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,5'+2,3,3',4',5,5',6-Heptachlorobiphenyls (BZ 180+193)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5',6+2,2',3,4,5,5',6-Heptachlorobiphenyls (BZ 183+185)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ 182)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4',6+2,2',3,4,4',6'-Hexachlorobiphenyls (BZ 139+140)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,4'+2,3,4,5,6+2,3,4',5,6-Pentachlorobiphenyls (BZ 85+116+117)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,6+2,2',3,4',5',6-Hexachlorobiphenyls (BZ 147+149)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5,6-Hexachlorobiphenyl (BZ 142)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,4,5',6-Hexachlorobiphenyl (BZ 144)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5+2,2',3,4,5'+2,2',3,4',5'+2,2',4,4',6-Pentachlorobiphenyls (BZ 86+87+97+100)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',5+2,2',4,5,5'+2,3,3',5',6-Pentachlorobiphenyls (BZ 90+101+113)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 145)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',6,6'-Hexachlorobiphenyl (BZ 150)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,6+2,2',3,4',6-Pentachlorobiphenyls (BZ 88+91)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4',6'+2,2',4,5,6'-Pentachlorobiphenyls (BZ 98+102)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4,6'-Pentachlorobiphenyl (BZ 89)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4-Tetrachlorobiphenyl (BZ 41)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,4'-Tetrachlorobiphenyl (BZ 42)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,5'-Pentachlorobiphenyl (BZ 92)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,6+2,2',4,4',6-Pentachlorobiphenyls (BZ 93+100)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5,6'-Pentachlorobiphenyl (BZ 94)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5',6-Pentachlorobiphenyl (BZ 95)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5'+2,2',4,4'+2,3,5,6-Tetrachlorobiphenyls (BZ 44+47+65)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5+2,3',5',6-Tetrachlorobiphenyls (BZ 43+73)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,6,6'-Pentachlorobiphenyl (BZ 96)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,6-Tetrachlorobiphenyl (BZ 45)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3,6'-Tetrachlorobiphenyl (BZ 46)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',3-Trichlorobiphenyl (BZ 16)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',5,5'+2,3',4,4',5',6-Hexachlorobiphenyls (BZ 153+168)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',5-Pentachlorobiphenyl (BZ 99)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5',6-Pentachlorobiphenyl (BZ 103)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5'+2,3',4,6-Tetrachlorobiphenyls (BZ 49+69)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',4,5-Tetrachlorobiphenyl (BZ 48)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,6,6'-Pentachlorobiphenyl (BZ 104)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,6+2,2',5,6'-Tetrachlorobiphenyls (BZ 50+53)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4,6'-Tetrachlorobiphenyl (BZ 51)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',4-Trichlorobiphenyl (BZ 17)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',5+2,4,6-Trichlorobiphenyls (BZ 18+30)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',6,6'-Tetrachlorobiphenyl (BZ 54)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2',6-Trichlorobiphenyl (BZ 19)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,2'-Dichlorobiphenyl (BZ 4)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ 205)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ 190)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ 191)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',5+2,3,3',4,4',5'-Hexachlorobiphenyls (BZ 156+157)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4',6-Hexachlorobiphenyl (BZ 158)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ 192)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5,6-Hexachlorobiphenyl (BZ 160)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5',6-Hexachlorobiphenyl (BZ 161)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',5',6-Hexachlorobiphenyl (BZ 164)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',5+2,3',4',5,5'-Pentachlorobiphenyls (BZ 107+124)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,5-Pentachlorobiphenyl (BZ 106)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',5'-Pentachlorobiphenyl (BZ 122)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4',6+2,3,4,4',6-Pentachlorobiphenyls (BZ 110+115)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4,6-Pentachlorobiphenyl (BZ 109)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4-Tetrachlorobiphenyl (BZ 55)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',4'-Tetrachlorobiphenyl (BZ 56)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5,5',6-Hexachlorobiphenyl (BZ 165)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5,5'-Pentachlorobiphenyl (BZ 111)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5,6-Pentachlorobiphenyl (BZ 112)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,3',5-Tetrachlorobiphenyl (BZ 57)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',5'-Tetrachlorobiphenyl (BZ 58)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3',6+2,3,3',6+2,4,4',6-Tetrachlorobiphenyls (BZ 59+62+75)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,3'+2,4,4'-Trichlorobiphenyls (BZ 20+28)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,4'-Tetrachlorobiphenyl (BZ 60)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,5,5'-Pentachlorobiphenyl (BZ 120)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,5',6-Pentachlorobiphenyl (BZ 121)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4',5+2,4,4',5+2,3',4',5'-Tetrachlorobiphenyls (BZ 70+74+76)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,5-Tetrachlorobiphenyl (BZ 61)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4',5-Tetrachlorobiphenyl (BZ 63)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,5-Tetrachlorobiphenyl (BZ 67)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4,5'-Tetrachlorobiphenyl (BZ 68)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	7/1/2003
2,3,4',6-Tetrachlorobiphenyl (BZ 64)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	7/1/2003
2,3,4+2,3',4'-Trichlorobiphenyls (BZ 21+33)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,4'-Trichlorobiphenyl (BZ 22)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',4-Trichlorobiphenyl (BZ 25)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',5,5'-Tetrachlorobiphenyl (BZ 72)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',5+2,4,5-Trichlorobiphenyls (BZ 26+29)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,5-Trichlorobiphenyl (BZ 23)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',5'-Trichlorobiphenyl (BZ 34)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,6-Trichlorobiphenyl (BZ 24)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3',6-Trichlorobiphenyl (BZ 27)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3,7,8-TCDD (Dioxin, 2,3,7,8-Tetrachlorodibenzo-p-dioxin)	EPA 8290	Extractable Organics	NELAP	7/1/2003
2,3,7,8-TCDF	EPA 8290	Extractable Organics	NELAP	7/1/2003
2,3-Dichlorobiphenyl (BZ 5)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,3'-Dichlorobiphenyl (BZ 6)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,4',6-Trichlorobiphenyl (BZ 32)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87611-07, expiration date June 30, 2009. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87611 **EPA Lab Code: TX01411** **(713) 266-1599**

E87611
Columbia Analytical Services, Inc. - TX
19408 Park Row, Suite 320
Houston, TX 77084

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,4-Dichlorobiphenyl (BZ 7)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,4'-Dichlorobiphenyl (BZ 8)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,5-Dichlorobiphenyl (BZ 9)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2,6-Dichlorobiphenyl (BZ 10)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
2-Chlorobiphenyl (BZ 1)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,5,5'-Pentachlorobiphenyl (BZ 127)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,5-Tetrachlorobiphenyl (BZ 78)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4,5'-Tetrachlorobiphenyl (BZ 79)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',4-Trichlorobiphenyl (BZ 35)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',5,5'-Tetrachlorobiphenyl (BZ 80)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3',5-Trichlorobiphenyl (BZ 36)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,3'-Dichlorobiphenyl (BZ 11)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4,4',5-Tetrachlorobiphenyl (BZ 81)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4,4'-Trichlorobiphenyl (BZ 37)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4,5-Trichlorobiphenyl (BZ 38)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4',5-Trichlorobiphenyl (BZ 39)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,4+3,4'-Dichlorobiphenyls (BZ 12+13)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3,5-Dichlorobiphenyl (BZ 14)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
3-Chlorobiphenyl (BZ 2)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
4,4'-Dichlorobiphenyl (BZ 15)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
4-Chlorobiphenyl (BZ 3)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
Decachlorobiphenyl (BZ 209)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	9/26/2005
Total Heptachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	7/14/2004
Total Heptachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	7/14/2004
Total Hexachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	7/14/2004
Total Hexachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	7/14/2004
Total Pentachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	7/14/2004
Total Pentachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	7/14/2004
Total Tetrachlorodibenzofuran	EPA 8290	Extractable Organics	NELAP	7/14/2004
Total Tetrachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	7/14/2004

Columbia Analytical Services, Inc.

Kelso, WA

Columbia Analytical Services, Inc.

Kelso, WA

QC Limits May 2009

			CAS-KELSO METALS ANALYSES			
Method	**Prep Method**	**Matrix**	**Analyte**	**LCS Accuracy (% Rec.)**	**Matrix Spike (% Rec.)**	**Precision (RPD)**
200.7 (ICP)	Method	Soil	Aluminum	85-115	70-130	30
200.7 (ICP)	Method	Soil	Antimony	85-115	70-130	30
200.7 (ICP)	Method	Soil	Barium	85-115	70-130	30
200.7 (ICP)	Method	Soil	Beryllium	85-115	70-130	30
200.7 (ICP)	Method	Soil	Boron	85-115	70-130	30
200.7 (ICP)	Method	Soil	Cadmium	85-115	70-130	30
200.7 (ICP)	Method	Soil	Calcium	85-115	70-130	30
200.7 (ICP)	Method	Soil	Chromium	85-115	70-130	30
200.7 (ICP)	Method	Soil	Cobalt	85-115	70-130	30
200.7 (ICP)	Method	Soil	Copper	85-115	70-130	30
200.7 (ICP)	Method	Soil	Iron	85-115	70-130	30
200.7 (ICP)	Method	Soil	Lead	85-115	70-130	30
200.7 (ICP)	Method	Soil	Magnesium	85-115	70-130	30
200.7 (ICP)	Method	Soil	Manganese	85-115	70-130	30
200.7 (ICP)	Method	Soil	Molybdenum	85-115	70-130	30
200.7 (ICP)	Method	Soil	Nickel	85-115	70-130	30
200.7 (ICP)	Method	Soil	Potassium	85-115	70-130	30
200.7 (ICP)	Method	Soil	Silver	85-115	70-130	30
200.7 (ICP)	Method	Soil	Sodium	85-115	70-130	30
200.7 (ICP)	Method	Soil	Tin	85-115	70-130	30
200.7 (ICP)	Method	Soil	Vanadium	85-115	70-130	30
200.7 (ICP)	Method	Soil	Zinc	85-115	70-130	30
200.7 (ICP)	Method	Water	Aluminum	85-115	70-130	20
200.7 (ICP)	Method	Water	Antimony	85-115	70-130	20
200.7 (ICP)	Method	Water	Barium	85-115	70-130	20
200.7 (ICP)	Method	Water	Beryllium	85-115	70-130	20
200.7 (ICP)	Method	Water	Boron	85-115	70-130	20
200.7 (ICP)	Method	Water	Cadmium	85-115	70-130	20
200.7 (ICP)	Method	Water	Calcium	85-115	70-130	20
200.7 (ICP)	Method	Water	Chromium	85-115	70-130	20
200.7 (ICP)	Method	Water	Cobalt	85-115	70-130	20
200.7 (ICP)	Method	Water	Copper	85-115	70-130	20
200.7 (ICP)	Method	Water	Iron	85-115	70-130	20
200.7 (ICP)	Method	Water	Magnesium	85-115	70-130	20
200.7 (ICP)	Method	Water	Manganese	85-115	70-130	20
200.7 (ICP)	Method	Water	Molybdenum	85-115	70-130	20
200.7 (ICP)	Method	Water	Nickel	85-115	70-130	20
200.7 (ICP)	Method	Water	Potassium	85-115	70-130	20

			CAS-KELSO METALS ANALYSES			
Method	**Prep Method**	**Matrix**	**Analyte**	**LCS Accuracy (% Rec.)**	**Matrix Spike (% Rec.)**	**Precision (RPD)**
200.7 (ICP)	Method	Water	Silver	85-115	70-130	20
200.7 (ICP)	Method	Water	Sodium	85-115	70-130	20
200.7 (ICP)	Method	Water	Tin	85-115	70-130	20
200.7 (ICP)	Method	Water	Vanadium	85-115	70-130	20
200.7 (ICP)	Method	Water	Zinc	85-115	70-130	20
200.8	Method	Soil/Sed.	Aluminum	85-115	70-130	30
200.8	Method	Soil/Sed.	Antimony	85-115	70-130	30
200.8	Method	Soil/Sed.	Arsenic	85-115	70-130	30
200.8	Method	Soil/Sed.	Barium	85-115	70-130	30
200.8	Method	Soil/Sed.	Beryllium	85-115	70-130	30
200.8	Method	Soil/Sed.	Cadmium	85-115	70-130	30
200.8	Method	Soil/Sed.	Chromium	85-115	70-130	30
200.8	Method	Soil/Sed.	Cobalt	85-115	70-130	30
200.8	Method	Soil/Sed.	Copper	85-115	70-130	30
200.8	Method	Soil/Sed.	Lead	85-115	70-130	30
200.8	Method	Soil/Sed.	Manganese	85-115	70-130	30
200.8	Method	Soil/Sed.	Molybdenum	85-115	70-130	30
200.8	Method	Soil/Sed.	Nickel	85-115	70-130	30
200.8	Method	Soil/Sed.	Selenium	85-115	70-130	30
200.8	Method	Soil/Sed.	Silver	85-115	70-130	30
200.8	Method	Soil/Sed.	Thallium	85-115	70-130	30
200.8	Method	Soil/Sed.	Vanadium	85-115	70-130	30
200.8	Method	Soil/Sed.	Zinc	85-115	70-130	30
200.8	Method	Water	Aluminum	85-115	70-130	20
200.8	Method	Water	Antimony	85-115	70-130	20
200.8	Method	Water	Arsenic	85-115	70-130	20
200.8	Method	Water	Barium	85-115	70-130	20
200.8	Method	Water	Beryllium	85-115	70-130	20
200.8	Method	Water	Cadmium	85-115	70-130	20
200.8	Method	Water	Chromium	85-115	70-130	20
200.8	Method	Water	Cobalt	85-115	70-130	20
200.8	Method	Water	Copper	85-115	70-130	20
200.8	Method	Water	Lead	85-115	70-130	20
200.8	Method	Water	Manganese	85-115	70-130	20
200.8	Method	Water	Molybdenum	85-115	70-130	20
200.8	Method	Water	Nickel	85-115	70-130	20
200.8	Method	Water	Selenium	85-115	70-130	20
200.8	Method	Water	Silver	85-115	70-130	20

			CAS-KELSO METALS ANALYSES			
Method	**Prep Method**	**Matrix**	**Analyte**	**LCS Accuracy (% Rec.)**	**Matrix Spike (% Rec.)**	**Precision (RPD)**
200.8	Method	Water	Thallium	85-115	70-130	20
200.8	Method	Water	Vanadium	85-115	70-130	20
200.8	Method	Water	Zinc	85-115	70-130	20
200.8	Red.Precip.	Seawater	Arsenic	71-124	50-147	20
200.8	Red.Precip.	Seawater	Beryllium	39-114	50-123	20
200.8	Red.Precip.	Seawater	Cadmium	80-114	65-114	20
200.8	Red.Precip.	Seawater	Chromium	78-118	50-130	20
200.8	Red.Precip.	Seawater	Cobalt	80-112	50-151	20
200.8	Red.Precip.	Seawater	Copper	63-128	50-120	20
200.8	Red.Precip.	Seawater	Lead	82-113	55-118	20
200.8	Red.Precip.	Seawater	Nickel	88-112	60-126	20
200.8	Red.Precip.	Seawater	Silver	80-110	67-103	20
200.8	Red.Precip.	Seawater	Thallium	79-110	63-111	20
200.8	Red.Precip.	Seawater	Zinc	79-133	50-133	20
200.8	3050B	Tissue	Aluminum	85-115	70-130	30
200.8	3050B	Tissue	Antimony	85-115	70-130	30
200.8	3050B	Tissue	Arsenic	85-115	70-130	30
200.8	3050B	Tissue	Barium	85-115	70-130	30
200.8	3050B	Tissue	Beryllium	85-115	70-130	30
200.8	3050B	Tissue	Cadmium	85-115	70-130	30
200.8	3050B	Tissue	Cobalt	85-115	70-130	30
200.8	3050B	Tissue	Copper	85-115	70-130	30
200.8	3050B	Tissue	Lead	85-115	70-130	30
200.8	3050B	Tissue	Manganese	85-115	70-130	30
200.8	3050B	Tissue	Molybdenum	85-115	70-130	30
200.8	3050B	Tissue	Nickel	85-115	70-130	30
200.8	3050B	Tissue	Silver	85-115	70-130	30
200.8	3050B	Tissue	Thallium	85-115	70-130	30
200.8	3050B	Tissue	Vanadium	85-115	70-130	30
200.8	3050B	Tissue	Zinc	85-115	70-130	30
200.9	Method	Soil	Arsenic	85-115	70-130	30
200.9	Method	Soil	Lead	85-115	70-130	30
200.9	Method	Soil	Selenium	85-115	70-130	30
200.9	Method	Soil	Thallium	85-115	70-130	30
200.9	Method	Water	Arsenic	85-115	70-130	20
200.9	Method	Water	Lead	85-115	70-130	20
245.1	Method	Water	Mercury	85-115	70-131	20
1631	Method	Water	Mercury	77-123	71-125	24

			CAS-KELSO METALS ANALYSES			
Method	**Prep Method**	**Matrix**	**Analyte**	**LCS Accuracy (% Rec.)**	**Matrix Spike (% Rec.)**	**Precision (RPD)**
200.9	Method	Water	Selenium	85-115	70-130	20
200.9	Method	Water	Thallium	85-115	70-130	20
6010B	3050B	Soil	Aluminum	63-148	10-215	30
6010B	3050B	Soil	Antimony	38-152	10-112	30
6010B	3050B	Soil	Arsenic	83-124	50-135	30
6010B	3050B	Soil	Barium	81-134	76-127	30
6010B	3050B	Soil	Beryllium	89-123	81-111	30
6010B	3050B	Soil	Boron	51-161	59-133	30
6010B	3050B	Soil	Cadmium	92-125	65-135	30
6010B	3050B	Soil	Calcium	75-136	75-125	30
6010B	3050B	Soil	Chromium	93-125	48-156	30
6010B	3050B	Soil	Cobalt	83-131	76-121	30
6010B	3050B	Soil	Copper	85-121	45-148	30
6010B	3050B	Soil	Iron	60-165	21-161	30
6010B	3050B	Soil	Lead	76-138	45-150	30
6010B	3050B	Soil	Magnesium	85-128	75-125	30
6010B	3050B	Soil	Manganese	87-129	37-167	30
6010B	3050B	Soil	Molybdenum	86-123	80-112	30
6010B	3050B	Soil	Nickel	92-125	72-126	30
6010B	3050B	Soil	Potassium	83-130	75-125	30
6010B	3050B	Soil	Selenium	67-159	67-125	30
6010B	3050B	Soil	Silver	89-120	48-141	30
6010B	3050B	Soil	Sodium	88-121	75-125	30
6010B	3050B	Soil	Thallium	32-187	22-160	30
6010B	3050B	Soil	Tin	Ref.	75-125	30
6010B	3050B	Soil	Vanadium	87-124	76-121	30
6010B	3050B	Soil	Zinc	89-125	31-160	30
6010B	CLP	Water	Aluminum	93-112	80-124	20
6010B	CLP	Water	Antimony	92-112	86-115	20
6010B	CLP	Water	Arsenic	92-113	79-121	20
6010B	CLP	Water	Barium	93-113	80-125	20
6010B	CLP	Water	Beryllium	92-113	88-114	20
6010B	CLP	Water	Boron	87-120	79-128	20
6010B	CLP	Water	Cadmium	94-115	71-143	20
6010B	CLP	Water	Calcium	93-112	75-125	20
6010B	CLP	Water	Chromium	94-114	89-117	20
6010B	CLP	Water	Cobalt	94-114	88-117	20

			CAS-KELSO METALS ANALYSES			
Method	**Prep Method**	**Matrix**	**Analyte**	**LCS Accuracy (% Rec.)**	**Matrix Spike (% Rec.)**	**Precision (RPD)**
6010B	CLP	Water	Copper	92-112	88-117	20
6010B	CLP	Water	Iron	93-113	68-135	20
6010B	CLP	Water	Lead	93-114	75-130	20
6010B	CLP	Water	Magnesium	91-110	75-125	20
6010B	CLP	Water	Manganese	94-113	85-122	20
6010B	CLP	Water	Molybdenum	94-115	91-116	20
6010B	CLP	Water	Nickel	92-117	87-121	20
6010B	CLP	Water	Potassium	89-116	75-125	20
6010B	CLP	Water	Selenium	91-113	82-118	20
6010B	CLP	Water	Silver	93-110	79-119	20
6010B	CLP	Water	Sodium	93-116	75-125	20
6010B	CLP	Water	Thallium	88-120	62-128	20
6010B	CLP	Water	Tin	80-120	75-125	20
6010B	CLP	Water	Vanadium	93-111	89-116	20
6010B	CLP	Water	Zinc	94-111	88-113	20
6010B	3050B	Tissue	Chromium	CRM	70-130	30
6020	3050B	Soil/Sed.	Aluminum	Ref.	75-125	20
6020	3050B	Soil/Sed.	Antimony	35-158	10-107	20
6020	3050B	Soil/Sed.	Arsenic	74-126	56-136	20
6020	3050B	Soil/Sed.	Barium	78-147	55-176	20
6020	3050B	Soil/Sed.	Beryllium	78-147	66-134	20
6020	3050B	Soil/Sed.	Boron	Ref.	75-125	20
6020	3050B	Soil/Sed.	Cadmium	77-133	68-136	20
6020	3050B	Soil/Sed.	Chromium	71-137	33-180	20
6020	3050B	Soil/Sed.	Cobalt	91-132	78-120	20
6020	3050B	Soil/Sed.	Copper	69-144	28-174	20
6020	3050B	Soil/Sed.	Lead	75-138	31-178	20
6020	3050B	Soil/Sed.	Manganese	Ref.	75-125	20
6020	3050B	Soil/Sed.	Molybdenum	73-142	53-143	20
6020	3050B	Soil/Sed.	Nickel	78-140	62-134	20
6020	3050B	Soil/Sed.	Selenium	80-140	66-122	20
6020	3050B	Soil/Sed.	Silver	78-128	61-133	20
6020	3050B	Soil/Sed.	Thallium	75-123	74-130	20
6020	3050B	Soil/Sed.	Uranium	Ref.	75-125	20
6020	3050B	Soil/Sed.	Vanadium	74-143	60-155	20
6020	3050B	Soil/Sed.	Zinc	78-140	33-161	20

			CAS-KELSO METALS ANALYSES			
Method	**Prep Method**	**Matrix**	**Analyte**	**LCS Accuracy (% Rec.)**	**Matrix Spike (% Rec.)**	**Precision (RPD)**
6020	CLP/3020A	Water	Aluminum	81-122	61-140	20
6020	CLP/3020A	Water	Antimony	90-111	59-135	20
6020	CLP/3020A	Water	Arsenic	88-112	74-126	20
6020	CLP/3020A	Water	Barium	92-110	84-120	20
6020	CLP/3020A	Water	Beryllium	79-124	66-128	20
6020	CLP/3020A	Water	Cadmium	90-111	84-113	20
6020	CLP/3020A	Water	Chromium	86-115	68-126	20
6020	CLP/3020A	Water	Cobalt	84-117	82-117	20
6020	CLP/3020A	Water	Copper	87-114	63-126	20
6020	CLP/3020A	Water	Lead	89-112	71-119	20
6020	CLP/3020A	Water	Manganese	84-120	69-134	20
6020	CLP/3020A	Water	Molybdenum	74-126	57-145	20
6020	CLP/3020A	Water	Nickel	87-114	74-119	20
6020	CLP/3020A	Water	Selenium	85-116	63-132	20
6020	CLP/3020A	Water	Silver	86-111	57-130	20
6020	CLP/3020A	Water	Thallium	87-114	68-125	20
6020	CLP/3020A	Water	Vanadium	83-116	76-124	20
6020	CLP/3020A	Water	Zinc	83-121	62-126	20
7000	3050B	Soil	Antimony	Ref.	75-125	20
7060A	3050B	Soil	Arsenic	76-126	45-135	30
7062	3050B	Soil	Arsenic	Ref.	75-125	20
7000	3050B	Soil	Copper	Ref.	75-125	20
7421	3050B	Soil	Lead	68-133	42-141	30
7471A	Method	Soil	Mercury	76-121	64-127	30
7740	3050B	Soil	Selenium	78-137	48-130	30
7742/*SM* 3114B	3050B	Soil	Selenium	62-147	64-131	20
7841	3050B	Soil	Thallium	Ref.	36-135	30
7000	CLP/3020A	Water	Antimony	75-124	56-123	20
7060A	CLP/3020A	Water	Arsenic	77-113	58-131	20
7062	CLP/3020A	Water	Arsenic	80-120	75-125	20
7000	CLP/3020A	Water	Copper	80-114	57-125	20
7421	CLP/3020A	Water	Lead	75-114	64-122	20
7470A	Method	Water	Mercury	84-117	78-122	20
7740	CLP/3020A	Water	Selenium	75-115	43-133	20
7742/*SM* 3114B	3010A	Water	Selenium	72-125	66-128	20
7841	CLP/3020A	Water	Thallium	87-115	53-132	20

			CAS-KELSO METALS ANALYSES			
Method	**Prep Method**	**Matrix**	**Analyte**	**LCS Accuracy (% Rec.)**	**Matrix Spike (% Rec.)**	**Precision (RPD)**
7471A	Method	Tissue	Mercury	CRM	60-130	30
7740	3050B	Tissue	Selenium	CRM	60-130	30

QUALITY ASSURANCE MANUAL

Columbia Analytical Services, Inc.

1317 South 13th Avenue
Kelso, Washington 98626
(360) 577-7222

Effective Date: March 1, 2008

Approved by:

Laboratory Director/Technical Director: _____
Jeff Christian

Quality Assurance Manager: _____
Lee Wolf

Technical Director - Metals: _____
Jeff Coronado

Technical Director - Inorganics: _____
Todd Poyfair

Technical Director - Organics: _____
Jeff Grindstaff

Technical Director - Microbiology: _____
Lynda Huckestein

DOCUMENT CONTROL

NUMBER: _____

Initials: _____ Date: _____

2.0 TABLE OF CONTENTS

Figures Page

Appendices Page

3.0 INTRODUCTION AND COMPANY QUALITY ASSURANCE POLICY

Columbia Analytical Services, Inc. (CAS) is an employee-owned professional analytical services laboratory which performs chemical and microbiological analyses on a wide variety of sample matrices, including drinking water, groundwater, surface water, wastewater, soil, sludge, sediment, tissue, industrial and hazardous waste, and other material.

It is a policy at CAS that there will be sufficient Quality Assurance (QA) activities conducted in the laboratory to ensure that all analytical data generated and processed will be scientifically sound, legally defensible, of known and documented quality, and will accurately reflect the material being tested. This goal is achieved by ensuring that adequate Quality Control (QC) procedures are used throughout the monitoring process, and by establishing a means to assess performance of these Quality Control and other QA activities. Policies and procedures are established in order to meet the quality objectives of clients, accrediting authorities, and certifying organizations. The Quality System is established to meet the requirements of The NELAC Institute (TNI) National Environmental Laboratory Accreditation Program (NELAP).

CAS maintains control of analytical results by adhering to written standard operating procedures (SOPs) and by observing sample custody requirements. All analytical results are calculated and reported in units consistent with project specifications to allow comparability of data.

We recognize that quality assurance requires a commitment to quality by everyone in the organization - individually, within each operating unit, and throughout the entire laboratory.

CAS is a network of laboratories. In addition to the Kelso, WA facility, to which this manual is applicable, CAS also operates laboratories in California, Florida, New York, Arizona, and Texas.

The information in this document has been organized according to the format described in *EPA Requirements for Quality Management Plans, EPA QA/R-2,* USEPA, 2001; and *EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5,* USEPA, 2001.

4.0 PROGRAM DESCRIPTION

The purpose of the QA program at CAS is to ensure that our clients are provided with analytical data that is scientifically sound, legally defensible, and of known and documented quality. The concept of Quality Assurance can be extended, and is expressed in the mission statement of CAS:

> "The mission of Columbia Analytical Services, Inc., is to provide high quality, cost-effective, and timely professional testing services to our customers. We recognize that our success as a company is based on our ability to maintain customer satisfaction. To do this requires constant attention to customer needs, maintenance of state-of-the-art testing capabilities and successful management of our most important asset - our people - in a way that encourages professional growth, personal development and company commitment."

In support of this mission, our QA program addresses all aspects of laboratory operations, including laboratory organization and personnel, standard operating procedures, sample management, sample and quality control data, calibration practices, standards traceability data, equipment maintenance records, method proficiency data (such as method detection limit studies and control charts), document control/storage and staff training records.

4.1 Facilities and Equipment

CAS features over 45,000 square feet of laboratory and administrative workspace. The laboratory has been designed and constructed to provide safeguards against cross-contamination of samples and is arranged according to work function, which enhances the efficiency of analytical operations. The ventilation system has been specially designed to meet the needs of the analyses performed in each work space. Also, CAS minimizes laboratory contamination sources by employing janitorial and maintenance staff to ensure that good housekeeping and facilities maintenance are performed. In addition, the segregated laboratory areas are designed for safe and efficient handling of a variety of sample types. These specialized areas (and access restrictions) include:

- Shipping and Receiving/Purchasing
- Sample Management Office, including controlled-access sample storage areas
- Inorganic/Metals Sample Preparation Laboratories (2)
- Inorganic/Metals “clean room” sample preparation laboratory
- ICP-AES Laboratory
- ICP-MS Laboratory
- AA Laboratory
- Water Chemistry & General Chemistry Laboratories (3)
- Semi-volatile Organics Sample Preparation Laboratory
- Gas Chromatography/High Performance Liquid Chromatography Laboratories (2)

- Gas Chromatography/Mass Spectrometry Laboratory
- Petroleum Hydrocarbon Laboratory
- Semi-volatile Organics Drinking Water Laboratories (2)
- Volatile Organics Laboratory
  - Separate sample preparation laboratory
  - Access by semi-volatile sample preparation staff only after removing lab coat and solvent-contaminated gloves, etc.
- Microbiology Laboratory
- Laboratory Deionized Water Systems (2)
- Laboratory Management, Client Service, Report Generation and Administration
- Data Archival, Data Review and support functions areas
- Information Technology (IT) and LIMS

In addition, the designated areas for sample receiving, refrigerated sample storage, dedicated sample container preparation and shipping provide for the efficient and safe handling of a variety of sample types. Figure 4-1 shows the facility floor plan. The laboratory is equipped with state-of-the-art analytical and administrative support equipment. The equipment and instrumentation are appropriate for the procedures in use. Appendix C lists the major equipment, illustrating the laboratory's overall capabilities and depth.

4.2 Technical Elements of the Quality Assurance Program

The Quality Assurance Program provides a platform on which technical operations are based. The program provides laboratory organization, procedures, and policies by which the laboratory operates. The necessary certifications and approvals administered by external agencies are maintained. This includes method approvals and audit administration. In addition, internal audits are performed to assess compliance with policies and procedures. Standard Operating Procedures (SOPs) are maintained for technical and administrative functions. A document control system is used for SOPs, as well as laboratory notebooks, and this QA Manual. A list of QA Program documents is provided in Appendix A.

Acceptable calibration procedures are defined in the SOP for each test procedure. Calibration procedures for other laboratory equipment (balances, thermometers, etc.) are also defined. Quality Control (QC) procedures are used to monitor the testing performed. Each analytical procedure has associated QC requirements to be achieved in order to demonstrate data quality. The use of method detection limit studies, control charting, and preventative maintenance procedures further ensure the quality of data produced. Proficiency Testing (PT) samples are used as an external means of monitoring the quality and proficiency of the laboratory. PT samples are obtained from qualified vendors and are performed on a regular basis. In addition to method proficiency, documentation of analyst training is performed to ensure proficiency and competency of laboratory analysts and technicians. Sample handling and custody procedures are defined in SOPs. Procedures are also in place to monitor the sample storage areas. The technical elements of the QA program are discussed in further detail in later sections of this QA manual.

4.3 Operational Assessments

There are a number of methods used to assess the laboratory and its daily operations. In addition to the routine quality control (QC) measurements to measure quality, the senior laboratory management examines a number of other indicators to assess the overall ability of the laboratory to successfully perform analyses for its clients. On-time performance, report quality, training, and Quality Assurance are a few of the items that are used to assess performance from an external perspective. A frequent, routine assessment must also be made of the laboratory's facilities and resources in anticipation of accepting an additional or increased workload.

CAS utilizes a number of different methods to ensure that adequate resources are available in anticipation of the demand for service. Regularly scheduled senior staff meetings, tracking of outstanding proposals and an accurate, current synopsis of incoming work all assist the senior staff in properly allocating resources to achieve the required results. All Requests for Proposal (RFP) documents are reviewed by the Project Chemist and appropriate managerial staff to identify any project specific requirements that differ from the standard practices of the laboratory. Any requirements that cannot be met are noted and communicated to the client, as well as requesting the client to provide any project specific Quality Assurance Plans (QAPPs) if available. A weekly status meeting is also conducted with the laboratory staff by the Client Services Manager to inform the staff of the status of incoming work, future projects, or project requirements.

4.4 Document Control

Procedures for control and maintenance of documents are described in the *SOP for Document Control (ADM-DOC_CTRL).* The procedures described in the SOP include distribution, tracking, filing, and copyrighting of CAS controlled documents. The requirements of the SOP apply to all standards preparation logbooks, instrument maintenance logbooks, run logbooks, standard operating procedures (SOPs), quality assurance manuals (QAMs), quality assurance project plans (QAPPs), Environmental Health & Safety (EHS) manuals, and other controlled CAS documents.

Each controlled copy of a controlled document will be released only after a document control number is assigned and the recipient is recorded on a document distribution list. Filing and distribution is performed by the Quality Assurance Manager, or designee, and ensure that only the most current version of the document is distributed and in use. A document control number is assigned to logbooks. Completed logbooks that are no longer in use are archived in a master logbook file.

CAS maintains a records system that ensures all laboratory records (including raw data, reports, and supporting records) are retained and available. The archiving system is described in the *SOP for Data Archiving (ADM-ARCH).*

4.5 Subcontracting

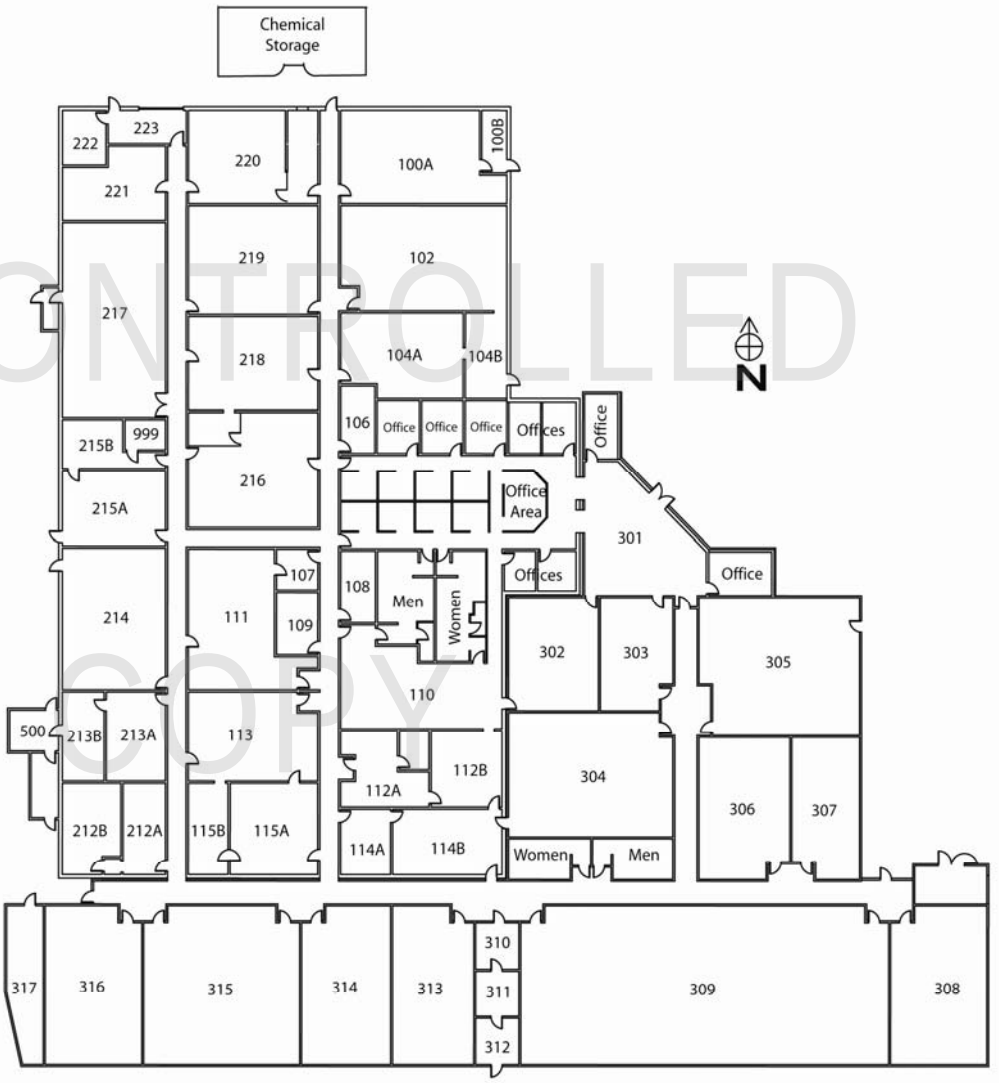
Analytical services are subcontracted when CAS/Kelso needs to balance workload or when the requested analyses are not performed by CAS/Kelso. Subcontracting is only done with the knowledge and approval of the client. Subcontracting to another CAS laboratory is preferred over external-laboratory subcontracting. Further, sub-contracting is done using capable and qualified laboratories. Established procedures are used to qualify external subcontract laboratories. These procedures are described in the *SOP for Qualification of Subcontract Laboratories Outside of CAS Network (ADM-SUBLAB).* The Corporate Quality Assurance staff is responsible for qualifying and oversight of subcontract laboratories.

4.6 Procurement

The quality level of reagents and materials (grade, traceability, etc.) required is specified in analytical SOPs. Department supervisors ensure that the proper materials are purchased. Inspection and verification of material ordered is performed at the time of receipt by receiving personnel. The receiving staff labels the material with the date received. Expiration dates are assigned (by the laboratory user) as appropriate for the material. Storage conditions and expiration dates are specified in the analytical SOP. The procedures for purchasing and procurement are described in the *SOP for Purchasing through CAS Purchasing Department in Kelso (SOP ADM-PUR).* Also, refer to section 10.4 for a discussion of reference materials.

Figure 4-1
CAS/Kelso Laboratory Floor Plan

Room #	
100A	Semivolatile GC Lab
100B	Electrical Room
102	Semivolatile GC Lab
104A	Petroleum Hydrocarbon Lab
104B	Petroleum Hydrocarbon Lab
106	Deionized Water System Room
107	Storage
108	Zero Headspace Extraction
109	Storage
110	Lunch Room
111	General Chemistry Lab
112A	Microbiology Lab
112B	Copy Center
113	Metals Lab
114A	Sample Preparation
114B	Sample Preparation
115A	Metals Lab
115B	Metals Lab
212A	Metals Lab
212B	Low Level Mercury Lab
213A	Sample Preparation
213B	Sample Preparation
500	Janitorial Room
214	General Chemistry Lab
215A	Drinking Water Lab
215B	Data Storage
999	Computer Room
216	Data Review Area
217	Sample Storage
218	Volatiles Lab
219	Semivolatile GC/MS Lab
220	Semivolatile GC/MS Lab
221	Drinking Water Lab
222	Purchasing
223	General Receiving
301	Lobby
302	Lunch Room
303	Conference Room
304	Sample Storage
305	Sample Receiving
306	Pharmaceutical A
307	Pharmaceutical B
308	Pharmaceutical C
309	Organics Extractions Lab
310	Communication Room
311	Electrical Room
312	Fire Room/Water System
313	Glass Room
314	Clean Room
315	Metals Digestion Room
316	Tissue Preparation
317	Mechanical



5.0 PROFESSIONAL CONDUCT AND ETHICAL PRACTICES

One of the most important aspects of the success of CAS is the emphasis placed on the integrity of the data provided and services performed. To promote product quality, employees are required to comply with certain standards of conduct and ethical practices. The following examples of CAS policy are representative of these standards, and are not intended to be limiting or all-inclusive:

- Under no circumstances is the willful act of fraudulent manipulation of analytical data condoned. Such acts are to be reported immediately to senior management for appropriate corrective action. Unless specifically required in writing by a client, alteration, deviation or omission of written contractual requirements is not permitted. Such changes must be in writing and approved by senior management.

- Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented, and appropriate remedies and punitive measures will be taken toward those individuals responsible. Employee discipline is progressive in its severity and each situation is handled individually in that the discipline is designed to fit the circumstances. Potential disciplinary actions may include a verbal warning, written warning, a second written notice (more severe and more strongly worded than a warning), suspension without pay, demotion, or termination.

- It is the responsibility of all CAS employees to safeguard sensitive company and client information. The nature of our business and the well being of our company and of our clients is dependent upon protecting and maintaining proprietary company/client information. All information, data, and reports (except that in the public domain) collected or assembled on behalf of a client is treated as confidential. Information may not be given to third parties without the consent of the client. Unauthorized release of confidential information about the company or its clients is taken seriously and is subject to formal disciplinary action.

All employees are required to sign and adhere to the requirements set forth in the CAS *Confidentiality and Conflicts of Interest Employee Agreement* and the CAS *Commitment to Excellence in Data Quality Policy.* All employees receive in-house ethics training and are periodically reminded of their data quality and ethical conduct responsibilities.

CAS makes every attempt to ensure that employees are free from any commercial, financial, or other undue pressures that might affect their quality of work. Related policies are described in the CAS Employee Handbook. This includes the CAS Ombudsman Program, the CAS Open Door Policy, and the use of flexible work hours. Operational assessments are regularly made to ensure that project planning is performed and that adequate resources are available during anticipated periods of increased workloads (Section 4.3). Procedures for subcontracting work are established, and within the CAS laboratory network additional capacity is typically available for subcontracting, if necessary.

6.0 ORGANIZATION AND RESPONSIBILITIES

The CAS/Kelso staff, consisting of approximately 110 employees, includes chemists, technicians and support personnel. They represent diverse educational backgrounds and experience, and provide the comprehensive skills that the laboratory requires. During seasonal workload increases, additional temporary employees may be hired to perform specific tasks.

CAS is committed to providing an environment that encourages excellence. Everyone within CAS shares responsibility for maintaining and improving the quality of our analytical services. The responsibilities of key personnel within the laboratory are described below. Table 6-1 lists the CAS/Kelso personnel assigned to these key positions. Managerial staff members are provided the authority and resources needed to perform their duties. An organizational chart of the laboratory, as well as the resumes of these key personnel, can be found in Appendix B.

- The role of the **Laboratory Director** is to provide technical, operational, and administrative leadership through planning, allocation and management of personnel and equipment resources. The Laboratory Director provides leadership and support for the QA program and is responsible for overall laboratory efficiency and the financial performance of the Kelso facility. The Laboratory Director has the authority to stop work in response to quality problems. The Laboratory Director also provides resources for implementation of the QA program, reviews and approves this QA Manual, reviews and approves standard operating procedures (SOPs), and provides support for business development by identifying and developing new markets through continuing support of the management of existing client activities.

- The responsibility of the **Quality Assurance Manager** (QAM) is to oversee implementation of the quality program and to coordinate QA activities within the laboratory. The QAM works with laboratory production units to establish effective quality control and assessment plans. The QAM has the authority to stop work in response to quality problems. The QAM is responsible for maintaining the QA Manual and performing an annual review of it; reviewing and approving SOPs and coordinating the annual review of each SOP; maintaining QA records such as metrological records, archived logbooks, PT sample results, etc.; document control; conducting PT sample studies; approving nonconformity and corrective action reports; maintaining the laboratory's certifications and approvals; performing internal QA audits; preparing QA activity reports; etc. The QAM reports directly to the Laboratory Director. The QAM also interacts with the CAS Quality Assurance Director. It is important to note that when evaluating data, the QAM does so in an objective manner and free of outside, or managerial, influence.

  The Chief Quality Officer (CQO) is responsible for the overall QA program at all the CAS laboratories. The CQO is responsible for ensuring that annual internal audits are performed at each CAS laboratory; maintaining a data base of information about state certifications and accreditation programs; writing laboratory-wide SOPs; maintaining a data base of CAS-approved subcontract laboratories; providing assistance to the laboratory QA staff and laboratory managers; preparing a quarterly QA activity report; etc.

- In the case of absence of the Laboratory Director or QA Manager, deputies are assigned to act in that role. Default deputies for these positions are the Client Services Manager or Organics Department Manager (for the Laboratory Director) and the CQO or Laboratory Director (for the QA Manager).

- The **Environmental Health and Safety Officer** (EH&S) is responsible for the administration of the laboratory health and safety policies. This includes the formulation and implementation of safety policies, the supervision of new-employee safety training, the review of accidents, incidents and prevention plans, the monitoring of hazardous waste disposal and the conducting of departmental safety inspections. The EH&S officer is also designated as the Chemical Hygiene Officer. The EH&S Officer has a dotted-line reporting responsibility to CAS' EH&S Director.
- The **Client Services and Sample Management Office Manager** is responsible for the Client Services Department (customer services/project chemists, and Electronic Data Deliverables group) and the sample management office/bottle preparation sections. The Client Services Department provides a complete interface with clients from initial project specification to final deliverables. The sample management office handles all the activities associated with receiving, storage, and disposal of samples. The Client Services Manager has the authority to stop subcontractor work in response to quality problems.
- The **Project Chemist** is a senior-level scientist assigned to each client to act as a technical liaison between the client and the laboratory. The project chemist is responsible for ensuring that the analyses performed by the laboratory meet all project, contract, and regulatory-specific requirements. This entails coordinating with the CAS laboratory and administrative staff to ensure that client-specific needs are understood, and that the services CAS provides are properly executed and satisfy the requirements of the client.
- The Analytical Laboratory is divided into operational units based upon specific disciplines. Each department is responsible for establishing, maintaining and documenting a quality control program based upon the unique requirements within the department. Each **Department Manager and Supervisor** has the responsibility to ensure that quality control functions are carried out as planned, and to guarantee the production of high quality data. Department managers and bench-level supervisors have the responsibility to monitor the day-to-day operations to ensure that productivity and data quality objectives are met. Each department manager has the authority to stop work in response to quality problems in their area. Analysts have the responsibility to carry out testing according to prescribed methods, SOPs, and quality control guidelines particular to the laboratory in which he/she is working.
- The **Sample Management Office** plays a key role in the laboratory QA program by maintaining documentation for all samples received by the laboratory, and by assisting in the archival of all laboratory results. The sample management office staff is also responsible for the proper disposal of samples after analysis.
- **Information Technology** (IT) staff are responsible for the administration of the Laboratory Information Management System (LIMS) and other necessary support services. Other functions of the IT staff include laboratory network maintenance, IT systems development and implementation, education of analytical staff in the use of scientific software, Electronic Data Deliverable (EDD) generation, and data back-up, archival and integrity operations.

Table 6-1
Summary of Technical Experience and Qualifications

Personnel	Years of Experience	Project Role
Jeff Christian, B.S.	29	Laboratory Director
Lee Wolf, B.S.	22	Quality Assurance Manager
Lynda Huckestein, B.S.	19	Client Services Manager Sample Management Office Manager
Jeff Coronado, B.S.	18	Metals Department Manager
Todd Poyfair, B.S.	16	General Chemistry & Extractions Department Manager
Jeff Grindstaff, B.S.	19	Organics Chromatography & Mass Spectrometry Department Manager
Loren Portwood, B.S.	17	Organics Drinking Water Department Manager
Eileen Arnold, B.A.	26	Environmental Health and Safety Officer
Ed Wilson, B.A.	34	CAS Information Technology Director
Gary Ward, M.S.	32	CAS Chief Quality Officer
Steve Vincent, B.S.	32	CAS President

7.0 INFORMATION MANAGEMENT

The generation, compilation, reporting, and archiving of electronic data is a critical component of laboratory operations. In order to generate data of known and acceptable quality, the quality assurance systems and quality control practices for electronic data systems must be complete and comprehensive and in keeping with the overall quality assurance objectives of the organization. CAS management provides the tools and resources to implement electronic data systems and establishes information technology standards and policies. Appendix C lists major automated data processing equipment.

7.1 Software Quality Assurance Plan

CAS has defined practices for assuring the quality of the computer software used throughout all laboratory operations to generate, compile, report, and store electronic data. These practices are described in the CAS Software Quality Assurance Plan (SQAP). The purpose of the SQAP is to describe the policies and practices for the procurement, configuration management, development, validation and verification, data security, maintenance, and use of computer software. The policies and practices described in the plan apply to purchased computer software as well as to internally developed computer software. Key components of configuration management plan are policies for controlling the software version that is in use in the laboratory.

7.2 IT Support

The local CAS Information Technology (IT) department is established to provide technical support for all computing systems. The IT department staff continually monitors the performance and output of operating systems. The IT department oversees routine system maintenance and data backups to ensure the integrity of all electronic data. A software inventory is maintained. Additional IT responsibilities are described in the SQAP.

In addition to the local IT department, CAS corporate IT provides support for network-wide systems. CAS also has personnel assigned to information management duties such as development and implementation of reporting systems; data acquisition, and Electronic Data Deliverable (EDD) generation.

7.3 Information Management Systems

CAS has various systems in place to address specific data management needs. The CAS Laboratory Information Management System (LIMS) is used to manage sample information and invoicing. Access is controlled by password. This system is used to establish and define sample identification, analysis specifications, and provide a means of sample tracking. This system is used during sample login to generate the internal Service Request. The Service

Request provides a summary of client information, sample information, required analyses, work instructions, deliverable requirements and other necessary information provided on the chain of custody. The LIMS also is the basis for valuable sample tracking mechanisms used throughout the laboratory. Laboratory analysts generate responsibility reports from the LIMS and perform internal chain of custody via the LIMS.

Where possible, instrument data acquired locally is immediately moved to a server (Microsoft Windows2003® domain). This provides a reliable, easily maintained, high-volume acquisition and storage system for electronic data files. With password entry, users may access the system from many available computer stations, improving efficiency and flexibility. The server is also used for data reporting, EDD generation, and administrative functions. Access to these systems is controlled by password. A standardized EDI (electronic data interchange) format is used as a reporting platform, providing functionality and flexibility for end users. With a common standardized communication platform, the EDI provides data reporting in a variety of hardcopy and electronic deliverable formats, including Staged Electronic Data Deliverable (SEDD) format.

7.4 Backup and Security

CAS laboratory data is either acquired directly to the centralized acquisition server or acquired locally and then transferred to the server. All data is eventually moved to the centralized data acquisition server for reporting and archiving. Differential backups are performed on all file server information once per day, Sunday through Thursday. Full backups are performed each Friday night. Tapes are physically stored in a locked media cabinet within a locked, temperature controlled computer room, with every other full backup also securely stored offsite.

Access to sample information and data is on a need-to-know basis. Access is restricted to the person's areas of responsibility. Passwords are required on all systems. No direct external, non-CAS access is allowed to any of our network systems.

The external e-mail system and Internet access is established via a single gateway to discourage unauthorized entry. CAS uses a closed system for company e-mail. Files, such as electronic deliverables, are sent through the external e-mail system only via a trusted agent. The external messaging system operates through a single secure gateway. Email attachments sent in and out of the gateway are subject to a virus scan. Because the Internet is not regulated, we use a limited access approach to provide a firewall for added security. Virus screening is performed continuously on all network systems.

8.0 SAMPLE MANAGEMENT

8.1 Sampling and Sample Preservation

The quality of analytical results is highly dependent upon the quality of the procedures used to collect, preserve and store samples. CAS recommends that clients follow sampling guidelines described in 40 CFR 136, 40 CFR 141, USEPA SW-846, and state-specific sampling guidelines, if applicable. Sampling factors that must be taken into account to insure accurate, defensible analytical results include:

- Amount of sample taken
- Type of container used
- Type of sample preservation
- Sample storage time
- Proper custodial documentation

CAS uses the sample preservation, container, and holding-time recommendations published in a number of documents. The primary documents of reference are: USEPA SW-846, Third Edition and Updates I, II, IIA, IIB, III, IV for hazardous waste samples; USEPA 600/4-79-020, 600/4-91-010, 600/4-82-057, 600/R-93/100, 600/4-88-039, 600/R-94-111, and Supplements; EPA 40CFR parts 136 and 141; and *Standard Methods for the Examination of Water and Wastewater* for water and wastewater samples (see Section 18 for complete citations). The container, preservation and holding time information for these references is summarized in Table 8-1 for soil, water, and drinking water. The current EPA CLP Statement of Work should be referred to for CLP procedures. Where allowed by project sampling and analysis protocols (such as Puget Sound Protocols) the holding time for sediment, soil, and tissue samples may be extended for a defined period when stored frozen at -20°C.

CAS routinely provides sample containers with appropriate preservatives for our clients. Containers are purchased as precleaned to a level 1 status, and conform to the requirements for samples established by the USEPA. Certificates of analysis for the sample containers are available to clients if requested. Reagent water used for sampling blanks (trip blanks, etc.) and chemical preservation reagents are tested by the laboratory to ensure that they are free of interferences and documented. Our sample kits typically consist of foam-lined, precleaned shipping coolers, (cleaned inside and out with appropriate cleaner, rinsed thoroughly and air-dried), specially prepared and labeled sample containers individually wrapped in protective material, (VOC vials are placed in a specially made, foam holder), chain-of-custody (COC) forms, and custody seals. Container labels and custody seals are provided for each container.

Figure 8-1 shows the chain-of-custody form routinely used at CAS and included with sample kits. For large sample container shipments, the containers may be shipped in their original boxes. Such shipments will consist of several boxes of labeled sample containers and sufficient materials (bubble wrap, COC forms, custody seals, shipping coolers, etc.) to allow the sampling personnel to process the sample containers and return them to CAS. The proper preservative is added to the sample containers prior to shipment, unless otherwise instructed by the client.

If any returning shipping cooler exhibits an odor or other abnormality after receipt and subsequent decontamination by laboratory personnel, a second, more vigorous decontamination process is employed. Containers exhibiting an odor or abnormality after the second decontamination process are promptly and properly discarded. CAS keeps client-specific shipping requirements on file and utilizes major transportation carriers to guarantee that sample shipping requirements (same-day, overnight, etc.) are met. CAS also provides courier service that makes regularly scheduled trips to the Greater Portland, Oregon Metropolitan area.

When CAS ships environmental samples to other laboratories for analysis each sample bottle is wrapped in protective material and placed in a plastic bag (preferably Ziploc®) to avoid any possible cross-contamination of samples during shipping. The sample management office (SMO) follows formalized procedures for maintaining the chain of custody of the sample(s) (*SOP for Chain of Custody for Sample Transfer between Laboratories* [SOP ADM-COC]), proper packaging and shipment, specification of proper methodology, etc. Blue or gel ice is the only temperature preservative used by CAS, unless otherwise specified by the client or receiving laboratory.

8.2 Sample Receipt and Handling

Standard Operating Procedures are established for the receiving of samples into the laboratory. These procedures ensure that samples are received and properly logged into the laboratory, and that all associated documentation, including chain of custody forms, is complete and consistent with the samples received. Complete documentation of all sample storage is maintained in order to preserve the integrity of the samples.

Once samples are delivered to the CAS sample management office (SMO), a Cooler Receipt and Preservation Check Form (CRF - See Figure 8-2 for an example) is used to assess the shipping cooler and its contents as received by the laboratory personnel. Verification of sample integrity includes the following activities:

- Assessment of custody seal presence/absence, location and signature;
- Temperature of sample containers upon receipt;
- Chain of custody documents properly used (entries in ink, signature present, etc.);
- Sample containers checked for integrity (broken, leaking, etc.);

- Sample is clearly marked and dated (bottle labels complete with required information);
- Appropriate containers (size, type) are received for the requested analyses;
- The minimum amount of sample material is provided for the analysis.
- Sample container labels and/or tags agree with chain of custody entries (identification, required analyses, etc.);
- Assessment of proper sample preservation (if inadequate, corrective action is employed); and
- VOC containers are inspected for the presence/absence of bubbles. (Assessment of proper preservation of VOC containers is performed by lab personnel).

Samples are logged into a Laboratory Information Management System (LIMS). Any anomalies or discrepancies observed during the initial assessment are recorded on the CRF and COC documents. Potential problems with a sample shipment are addressed by contacting the client and discussing the pertinent issues. When the Project Chemist and client have reached a satisfactory resolution, the login process may continue and analysis may begin. During the login process, each sample is given a unique laboratory code and a service request form is generated. The LIMS generates a Service Request that contains client information, sample descriptions, sample matrix information, required analyses, sample collection dates, analysis due dates and other pertinent information. The service request is reviewed by the appropriate Project Chemist for accuracy, completeness, and consistency of requested analyses and for client project objectives.

Samples are stored as per method requirements until they undergo analysis, unless otherwise specified, using various refrigerators or freezers, or designated secure areas. CAS has five walk-in cold storage units which house the majority of sample containers received at the laboratory. In addition, there are four additional refrigerators, including dedicated refrigerated storage of VOC samples. The dedicated storage areas for VOC samples are monitored using storage blanks, as described in the *SOP for VOA Storage Blanks (VOC-BLAN)*. CAS also has six sub-zero freezers capable of storing samples at -20° C primarily used for tissue and sediment samples requiring specialized storage conditions. The temperature of each sample storage unit is monitored daily and the data recorded in a bound logbook. Continuous-graph temperature recorders have also been placed in the walk-in refrigerators to provide a permanent record of the storage conditions to which samples are exposed.

CAS adheres to the method-prescribed or project-specified holding times for all analyses. The sampling date and time are entered into the LIMS system at the time of sample receipt and login. Analysts then monitor holding times by obtaining analysis-specific reports from the LIMS. These reports provide holding time information on all samples for the analysis, calculated from the sampling date and the holding time requirement. To document holding time compliance, the date and time analyzed is printed or written on the analytical raw data. For analyses with a holding time prescribed in hours it is essential that the sample collection time is provided, so holding time compliance can be demonstrated. If not, the sample collection time is assumed as the earliest in the day (i.e. the most conservative).

Unless other arrangements have been made in advance, upon completion of all analyses and submittal of the final report, aqueous samples and sample extracts are retained at ambient temperature for 30 days, soil samples are retained at ambient temperature for 60 days, and tissue samples are retained frozen for 3 months. Upon expiration of these time limits, the samples are either returned to the client or disposed of according to approved disposal practices. All samples are characterized according to hazardous/non-hazardous waste criteria and are segregated accordingly. All hazardous waste samples are disposed of according to formal procedures outlined in the *CAS Environmental Health and Safety Manual.* All waste produced at the laboratory, including the laboratory's own various hazardous waste streams, is treated in accordance with applicable local and Federal laws. Documentation is maintained for each sample from initial receipt through final disposal to ensure that an accurate history of the sample from "cradle to grave" is available.

8.3 Sample Custody

Sample custody transfer at the time of sample receipt is documented using chain-of-custody (COC) forms accompanying the samples. During sample receipt, it is also noted if custody seals were present. This is described in the *SOP for Sample Receiving (SMO-GEN)*. Figure 8-1 is a copy of the chain-of-custody form routinely used at CAS.

Facility security and access is important in maintaining the integrity of samples received at CAS/Kelso. Access to the laboratory facility is limited by use of locked exterior doors with a coded entry, except for the reception area and sample receiving doors, which are manned during business hours and locked at all other times. In addition, the sample storage area within the laboratory is a controlled access area with locked doors with a coded entry. The CAS facility is equipped with an alarm system and CAS employs a private security firm to provide nighttime and weekend security.

A barcoding system is used to document internal sample custody. Each person removing or returning samples from/to sample storage while performing analysis is required to document this custody transfer. The system uniquely identifies the sample container and provides an electronic record of the custody of each sample. For sample extracts and digestates the analyst documents custody of the sample extract or digestate by signing on the benchsheet, or custody record, that they have accepted custody. The procedures are described in the *SOP for Sample Tracking and Internal Chain of Custody (SMO-SCOC).*

8.4 Project Setup

The analytical method(s) to be used for sample analysis are chosen based on the client's requirements. Unless specified otherwise, the most recent versions of reference methods are used. For SW-846 methods, some projects may require the most recent *promulgated* version, and some projects may require the most recent *published* version. The Project Chemist will ensure that the correct method version is used. LIMS codes are chosen to identify the analysis method used for analysis. The Project Chemist ensures that the correct methods are selected for analysis, deliverable requirements are identified, and due dates are specified on the LIMS generated Service Request. To communicate and specify project-specific requirements, a Tier V form (Figure 8-3) is used and accompanies the service request form.

Table 8-1
Sample Preservation and Holding Times

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	MAXIMUM HOLDING TIME
Bacterial Tests				
Coliform, Colilert (Standard Methods)	W, DW	P, Bottle or Bag	Cool, 4°C, 0.008% $Na_2S_2O_3$[d]	6-24 hours[e]
Coliform, Fecal and Total (Standard Methods)	W, DW	P,G	Cool, 4°C, 0.008% $Na_2S_2O_3$[d]	6-24 hours[e]
Fecal Streptococci (SM 9230B)	W	P,G	Cool, 4°C, 0.008% $Na_2S_2O_3$[d]	6-24 hours[e]
Inorganic Tests				
Acidity (SM 2310B)	W	P,G	Cool, 4°C	14 days[EPA]
Alkalinity (SM 2320B)	W, DW	P,G	Cool, 4°C	14 days[EPA]
Ammonia (SM 4500NH3)	W, DW	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Biochemical Oxygen Demand (SM 5210B)	W	P,G	Cool, 4°C	48 hours
Bromate (EPA 300.1)	W, DW	P,G	50mg/L EDA, cool to 4°C	28 days
Bromide (EPA 300.1)	W, DW	P,G	None Required	28 days
Chemical Oxygen Demand (SM 5220C)	W	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Chloride (EPA 300.0)	W, DW	P,G	None Required	28 days
Chloride (EPA 9056)	W	P,G	Cool, 4°C	Analyze immediately
Chlorine, Total Residual (SM 4500Cl F)	W, DW	P,G	None Required	24 hours
Chlorite (EPA 300.1)	W, DW	P,G	50mg/L EDA, cool to 4°C	14 days
Chlorophyll-A (SM 11200H)	W	G Amber	Cool, 4°C	Analyze immediately
Chromium VI (EPA 7196A)	W	P,G	Cool, 4°C	24 hours
Color (SM 2120B)	W, DW	P,G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination (EPA 335.4, 9010, 9012) (SM 4500CN E,G)	W, DW	P,G	Cool, 4°C, NaOH to pH>12, plus 0.6 g Ascorbic Acid	14 days
Cyanide, Weak Acid Dissociable (SM 4500CN I)	W	P,G	Cool, 4°C, NaOH to pH >12	14 days
Ferrous Iron (CAS SOP)	W, DW	G Amber	Cool, 4°C	24 hours
Fluoride (EPA 300.0)	W, DW	P,G	None Required	28 days
Fluoride (EPA 9056)	W	P,G	Cool, 4°C	Analyze immediately
Hardness (SM 2340C)	W, DW	P,G	HNO_3 to pH<2	6 months
Hydrogen Ion (pH) (SM 4500H B)	W, DW	P,G	None Required	Analyze immediately
Kjeldahl and Organic Nitrogen (ASTM D3590-89)	W	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days

Table 8-1 (continued)
Sample Preservation and Holding Times[a]

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	MAXIMUM HOLDING TIME
Nitrate (EPA 300.0)	W, DW	P,G	Cool, 4°C	48 hours
Nitrate (EPA 353.2)	W, DW	P,G	Cool, 4°C, H_2SO_4 to pH<2	48 hours
Nitrate (EPA 9056)	W	P,G	Cool, 4°C	Analyze immediately
Nitrate-Nitrite (EPA 353.2)	W, DW	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Nitrite (EPA 300.0)	W, DW	P,G	Cool, 4°C	48 hours
Nitrite (EPA 353.2)	W, DW	P,G	Cool, 4°C, H_2SO_4 to pH<2	48 hours
Nitrite (EPA 9056)	W	P,G	Cool, 4°C	Analyze immediately
Orthophosphate (EPA 365.3)	W, DW	P,G	Cool, 4°C	Analyze immediately
Oxygen, Dissolved (Probe) (SM 4500O G)	W, DW	G, Bottle and Top	None Required	Analyze immediately
Oxygen, Dissolved (Winkler)	W, DW	G, Bottle and Top	Fix on Site and Store in Dark	8 hours
Perchlorate (EPA 314.0)	W, DW	P,G	Protect from temp. extremes	28 days
Phenolics, Total (EPA 420.1)	W	G Only	Cool, 4°C, H_2SO_4 to pH<2	28 days
Phosphorus, Total (EPA 365.3)	W	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Residue, Total (EPA 160.3 & SM 2540B)	W	P,G	Cool, 4°C	7 days
Residue, Filterable (TDS) (SM 2540C)	W	P,G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS) (SM 2540D)	W	P,G	Cool, 4°C	7 days
Residue, Settleable (SM 2540F)	W	P,G	Cool, 4°C	48 hours
Residue, Volatile (EPA 160.4)	W	P,G	Cool, 4°C	7 days
Silica (SM 4500SiO2 C)	W	P Only	Cool, 4°C	28 days
Specific Conductance (EPA 120.1 & SM 2510B)	W, DW	P,G	Cool, 4°C	28 days
Sulfate (EPA 300.0)	W, DW	P,G	Cool, 4°C	28 days
Sulfate (EPA 9056)	W	P,G	Cool, 4°C	Analyze immediately
Sulfide (SM 4500S2 F)	W	P,G	Cool, 4°C, Add Zinc Acetate plus Sodium Hydroxide to pH>9	7 days
Sulfite (SM 4500SO3 B)	W	P,G	None Required	24 hours
Surfactants (MBAS) (SM 5540C)	W	P,G	Cool, 4°C	48 hours
Tannin and Lignin (SM 5550B)	W	P,G	Cool, 4°C	28 days
Turbidity (EPA 180.1)	W, DW	P,G	Cool, 4°C	48 hours

Table 8-1 (continued)
Sample Preservation and Holding Times[a]

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	MAXIMUM HOLDING TIME
Metals				
Metals, except CrVI and Mercury	W, DW	P,G	HNO_3 to pH<2	6 months
(EPA 200.7, 200.8, 200.9, 6010, 6020)	S	G, Teflon-Lined Cap	Cool, 4°C	6 months
Chromium VI (EPA 7195/7191)	W	P,G	Cool, 4°C	24 hours
Mercury	W	P,G	HNO_3 to pH<2	28 days
(EPA 245.1, 7470, 7471, 1631E)	S	P,G	Cool, 4°C	28 days
Organic Tests				
Oil and Grease, Hexane Extractable Material (EPA 1664)	W	G, Teflon-Lined Cap	Cool, 4°C, H_2SO_4 to pH<2	28 days
Organic Carbon, Total (EPA 415.1, 9060 & SM 5310C)	W	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Organic Halogens, Total (EPA 9020)	W	G, Teflon-Lined Cap	Cool, 4°C, H_2SO_4 to pH<2, No headspace	28 days
Organic Halogens, Adsorbable (EPA 1650B)	W	G, Teflon-Lined Cap	Cool, 4°C, HNO_3 to pH<2	6 months
Petroleum Hydrocarbons, Total (EPA 8015)	W	G, Teflon-Lined Cap	Cool, 4°C, HCl or H_2SO_4 to pH<2	7 days until extraction; 40 days after extraction
	S	G, Teflon-Lined Cap	Cool, 4°C	14 days until extraction; 40 days after extraction

Table 8-1 (continued)
Sample Preservation and Holding Times[a]

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	MAXIMUM HOLDING TIME
Volatile Organics				
Petroleum Hydrocarbons, Volatile (Gasoline-Range Organics) (EPA 8015)	W	G, Teflon-Lined Septum Cap	Cool, 4°C, HCl to pH<2 No Headspace	14 days
	S	G, Teflon-Lined Cap	Cool, 4°C Minimize Headspace	14 days
Purgeable Halocarbons (EPA 624, 8021, 8260)	W	G, Teflon-Lined Septum Cap, No Headspace	**No Residual Chlorine Present**: HCl to pH<2, Cool, 4°C, No Headspace **Residual Chlorine Present**: 10% $Na_2S_2O_3$, HCl to pH<2, Cool, 4°C	14 days
	S	G, Teflon-Lined Cap	Cool, 4°C, Minimize Headspace	14 days
	S	Method 5035	Encore, Freeze at -20°C Methanol, Cool, 4°C Sodium Bisulfate Cool, 4°C	7 days 48 hrs to prepare from Encore, 14 days after preparation. 48 hrs to prepare from Encore, 14 days after preparation.
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE) (EPA 624, 8021, 8260)	W	G, Teflon-Lined Septum Cap, No Headspace	**No Residual Chlorine Present**: HCl to pH<2, Cool, 4°C, No Headspace **Residual Chlorine Present**: 10% $Na_2S_2O_3$, HCl to pH<2, Cool 4°C	14 days
	S	G, Teflon-Lined Cap	Cool, 4°C, Minimize Headspace	14 days
	S	Method 5035	Encore, Freeze at -20°C Methanol, Cool, 4°C Sodium Bisulfate Cool, 4°C	7 days 48 hrs to prepare from Encore, 14 days after preparation. 48 hrs to prepare from Encore, 14 days after preparation.
Acrolein, Acrylonitrile, Acetonitrile (EPA 624, 8260)	W	G, Teflon-Lined Septum Cap	Adjust pH to 4-5, Cool, 4°C, No Headspace	14 days
EDB and DBCP (EPA 8260)	W,S	G, Teflon-Lined Cap	Cool, 4°C, 3 mg $Na_2S_2O_3$, No Headspace	28 days

Table 8-1 (continued)
Sample Preservation and Holding Times[a]

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	MAXIMUM HOLDING TIME
Semivolatile Organics				
Petroleum Hydrocarbons, Extractable (Diesel-Range Organics) (EPA 8015)	W,S	G, Teflon-Lined Cap	Cool, 4°C	7 days until extraction;[f] 40 days after extraction
Alcohols and Glycols (EPA 8015)	W,S	G, Teflon-Lined Cap	Cool, 4°C[g]	7 days until extraction;[f] 40 days after extraction
Acid Extractable Semivolatile Organics (EPA 625, 8270)	W,S	G, Teflon-Lined Cap	Cool, 4°C[g]	7 days until extraction;[f] 40 days after extraction
Base/Neutral Extractable Semivolatile Organics (EPA 625, 8270)	W,S	G, Teflon-Lined Cap	Cool, 4°C[g]	7 days until extraction;[f] 40 days after extraction
Polynuclear Aromatic Hydrocarbons (EPA 625, 8270, 8310)	W,S	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark[g]	7 days until extraction;[f] 40 days after extraction
Organochlorine Pesticides and PCBs (EPA 608, 8081)	W,S	G, Teflon-Lined Cap	Cool, 4°C	7 days until extraction;[f] 40 days after extraction
Organophosphorus Pesticides (EPA 8141)	W,S	G, Teflon-Lined Cap	Cool, 4°C[g]	7 days until extraction;[f] 40 days after extraction
Nitrogen- and Phosphorus-Containing Pesticides (EPA 8141)	W,S	G, Teflon-Lined Cap	Cool, 4°C[g]	7 days until extraction;[f] 40 days after extraction
Chlorinated Herbicides (EPA 8151)	W,S	G, Teflon-Lined Cap	Cool, 4°C[g]	7 days until extraction;[f] 40 days after extraction
Organotins (CAS SOP)	W,S	G, Teflon-Lined Cap	Cool, 4°C	7 days until extraction;[f] 40 days after extraction
Chlorinated Phenolics (EPA 1653A)	W	G, Teflon-Lined Cap	H_2SO_4 to pH<2, Cool, 4°C[g]	30 days until extraction; 30 days after extraction
Resin and Fatty Acids (NCASI 85.02)	W	G, Teflon-Lined Cap	NaOH to pH $\geq$10, Cool, 4°C[g]	30 days until extraction; 30 days after extraction

Table 8-1 (continued)
Sample Preservation and Holding Times[a]

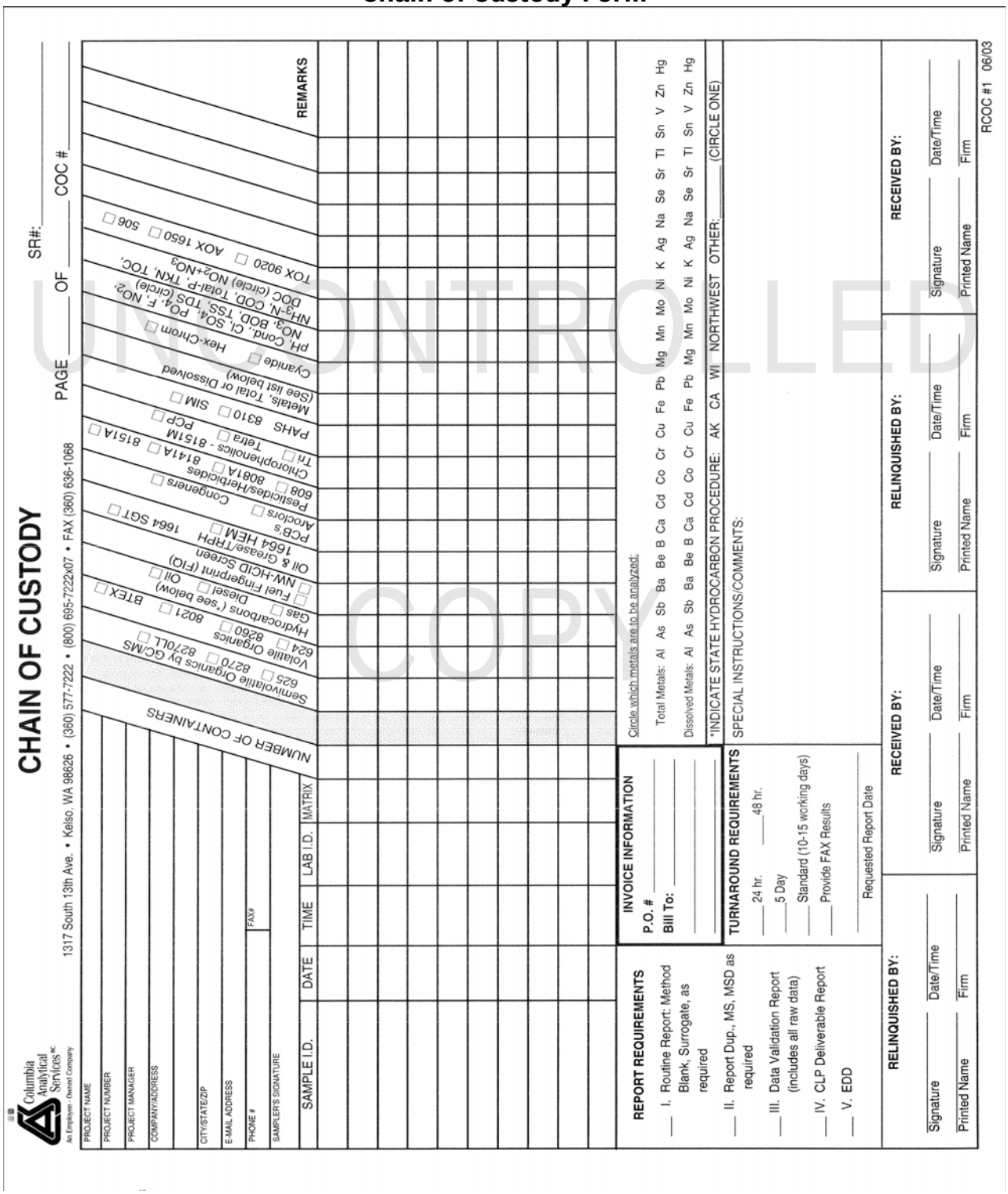
DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	MAXIMUM HOLDING TIME
Drinking Water Organics				
Purgeable Organics (EPA 524.2)	DW	G, Teflon-Lined Septum Cap	Ascorbic Acid, HCl to pH≤2, Cool, 4°C, No Headspace	14 days
EDB, DBCP, and TCP (EPA 504.1)	DW	G, Teflon-Lined Septum Cap	Cool, 4°C, 3 mg $Na_2S_2O_3$, No Headspace	14 days
Carbamates, Carbamoyloximes (EPA 531.1)	DW	G, Amber, Teflon-Lined Cap	1.8 mL monochloroacetic acid to pH<3; 80 mg/L $Na_2S_2O_3$ if Res.Cl.; Cool, 4°C	28 days
Chlorinated Herbicides (EPA 515.4)	DW	G, Amber, Teflon-Lined Cap	If Res.Cl, 2mg/4omL NaS; Cool, <6°C	14 days until extraction; 21 days after extraction
Chlorinated Pesticides (EPA 508.1, 525.2)	DW	G, Amber, Teflon-Lined Cap	50 mg/L NaS, HCl to pH≤ 2; Cool, 4°C	14 days until extraction; 30 days after extraction
Diquat and Paraquat (EPA 549.2)	DW	G, Amber, Teflon-Lined Cap	100 mg/L $Na_2S_2O_3$ if Res.Cl., Cool, 4°C,	7days until extraction; 21 days after extraction
Endothall (EPA 548.1)	DW	G, Amber, Teflon-Lined Cap	Cool, 4°C	7 days until extraction; 14 days after extraction
Glyphosate (EPA 547)	DW	G, Amber, Teflon-Lined Cap	100 mg/L $Na_2S_2O_3$, Cool, 4°C	14 days
Haloacetic Acids (EPA 552.2)	DW	G, Amber, Teflon-Lined Cap	100 mg/L NH_4Cl, Cool, 4°C	14 days until extraction; 7 days after extraction
Semivolatile Organics (EPA 525.2)	DW	G, Amber, Teflon-Lined Cap	50 mg/L NaS, HCl to pH≤ 2; Cool, 4°C	14 days until extraction; 30 days after extraction
Toxicity Characteristic Leaching Procedure (TCLP)				
Mercury (EPA 1311/7470)	HW	P,G	Sample: Cool, 4°C TCLP extract: HNO_3 to pH<2	28 days until extraction; 28 days after extraction
Metals, except Mercury (EPA 1311/6010)	HW	P,G	Sample: Cool, 4°C TCLP extract: HNO_3 to pH<2	180 days until extraction; 180 days after extraction
Volatile Organics (EPA 1311/8260)	HW	G, Teflon-Lined Cap	Sample: Cool, 4°C Minimize Headspace TCLP extract: Cool, 4°C, HCl to pH<2, No Headspace	14 days until extraction; 14 days after extraction

Table 8-1 (continued)
Sample Preservation and Holding Times[a]

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	MAXIMUM HOLDING TIME
Toxicity Characteristic Leaching Procedure (TCLP)				
Semivolatile Organics (EPA 1311/8270)	HW	G, Teflon-Lined Cap	Sample: Cool, 4°C, Store in Dark[g] TCLP extract: Cool, 4°C, Store in Dark[g]	14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction
Organochlorine Pesticides (EPA 1311/8081)	HW	G, Teflon-Lined Cap	Sample: Cool, 4°C TCLP extract: Cool, 4°C	14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction
Chlorinated Herbicides (EPA 1311/8151)	HW	G, Teflon-Lined Cap	Sample: Cool, 4°C TCLP extract: Cool, 4°C	14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction

a For EPA SW-846 methods the method number is listed generically, without specific revision suffixes.
b DW = Drinking Water, W = Water; S = Soil or Sediment; HW = Hazardous Waste
c P = Polyethylene; G = Glass
d For chlorinated water samples
e The maximum holding time is dependent upon the geographical proximity of sample source to the laboratory.
f Fourteen days until extraction for soil, sediment, and sludge samples.
g If the water sample contains residual chlorine, 10% sodium thiosulfate is used to dechlorinate.

Figure 8-1
Chain of Custody Form



CHAIN OF CUSTODY

Columbia Analytical Services, Inc.
An Employee - Owned Company

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222x07 • FAX (360) 636-1068

SR#: _____ PAGE _____ OF _____ COC # _____

PROJECT NAME
PROJECT NUMBER
PROJECT MANAGER
COMPANY/ADDRESS
CITY/STATE/ZIP
E-MAIL ADDRESS
PHONE # FAX#
SAMPLER'S SIGNATURE

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐ 8021 ☐ BTEX ☐	Hydrocarbons ("see below) Gas ☐ Diesel ☐ Oil ☐	Fuel Fingerprint (FIO) NW-HCID Screen ☐	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐	Pesticides/Herbicides Congeners ☐ 608 ☐ 8081A ☐	Chlorophenolics - 8151M 8141A ☐ 8151A ☐	Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals, Total or Dissolved (See list below)	Cyanide ☐	Hex-Chrom ☐	pH, Cond., Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS (circle) NH3-N, COD, Total-P, TKN, TOC, DOC (circle) NO2+NO3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	REMARKS

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
___ III. Data Validation Report (includes all raw data)
___ IV. CLP Deliverable Report
___ V. EDD

INVOICE INFORMATION

P.O. # _____
Bill To: _____

TURNAROUND REQUIREMENTS

___24 hr. ___48 hr.
___5 Day
___Standard (10-15 working days)
___Provide FAX Results
___Requested Report Date

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: _____ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature _____ Date/Time _____	Signature _____ Date/Time _____	Signature _____ Date/Time _____	Signature _____ Date/Time _____
Printed Name _____ Firm _____	Printed Name _____ Firm _____	Printed Name _____ Firm _____	Printed Name _____ Firm _____

RCOC #1 06/03

Figure 8-2

Columbia Analytical Services, Inc. PC_____
Cooler Receipt and Preservation Form

Client / Project:_____ Service Request *K08*_____

Received:_____ Opened:_____ By:_____

1. Samples were received via? ***US Mail*** ***Fed Ex*** ***UPS*** ***DHL*** ***GH*** ***GS*** ***PDX*** ***Courier*** ***Hand Delivered***
2. Samples were received in: (circle) ***Cooler*** ***Box*** ***Envelope*** ***Other***_____ ***NA***
3. Were custody seals on coolers? NA Y N If yes, how many and where?_____
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N
4. Is shipper's air-bill filed? If not, record air-bill number:_____ NA Y N
5. **Temperature of cooler(s) upon receipt (°C):** _____ _____ _____ _____
   Temperature Blank (°C): _____ _____ _____ _____
6. If applicable, list Chain of Custody Numbers: _____ _____ _____ _____
7. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
8. Packing material used. ***Inserts*** ***Bubble Wrap*** ***Gel Packs*** ***Wet Ice*** ***Sleeves*** ***Other***_____
9. **Did all bottles arrive in good condition (unbroken)?** *Indicate in the table below.* NA Y N
10. Were all sample labels complete (i.e analysis, preservation, etc.)? Y N
11. Did all sample labels and tags agree with custody papers? *Indicate in the table below* Y N
12. **Were the correct types of bottles used for the tests indicated?** NA Y N
13. Were all of the preserved bottles received at the lab with the appropriate pH? *Indicate in the table below* NA Y N
14. Were VOA vials and 1631 Mercury bottles checked for absence of air bubbles? *Indicate in the table below.* NA Y N
15. **Are CWA Microbiology samples received with >1/2 the 24hr. hold time remaining from collection?** NA Y N
16. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broken	pH	Reagent	Volume added	Reagent Lot Number	Initials

*Additional Notes, Discrepancies, & Resolutions:*_____

Figure 8-3
Tier V Form

Client :

Project Chemist :

Project Name :

Service Request :

Project Number :

SMO LimsTemplate ID :

Project Description :

QAPP/SOW Information :

Reporting

Tier Level :

PDF:

Report to :

In result field use :

EDD :

Flagging Requirements :

Other Requirements :

Sample Considerations

Sample Limitations :

Sample Prep/Analysis :

Non-Standard Holdtimes :

Historical Data :

Comments :

9.0 ANALYTICAL PROCEDURES

CAS employs methods and analytical procedures from a variety of sources. The primary method references are: USEPA SW-846, Third Edition and Updates I, II, IIA, IIB, III, IVA, IVB, and online updates for hazardous waste samples, and USEPA 600/4-79-020, 600/4-91-010, 600/4-82-057, 600/R-93/100, 600/4-88-039, 600/R-94-111, and Supplements; and *Standard Methods for the Examination of Water and Wastewater* for water and wastewater samples. Complete citations for these references can be found in Section 18.0. Other published procedures, such as state-specific methods, program-specific methods (such as Puget Sound Protocols), or in-house methods may be used. Several factors are involved with the selection of analytical methods to be used in the laboratory. These include the method detection limit, the concentration of the analyte being measured, method selectivity, accuracy and precision of the method, the type of sample being analyzed, and the regulatory compliance objectives. The implementation of methods by CAS is described in SOPs specific to each method. A list of SOPs and NELAP-accredited methods are given in Appendix E. Further details are described below.

9.1 Standard Operating Procedures (SOPs) and Laboratory Notebooks.

CAS maintains SOPs for use in both technical and administrative functions. SOPs are written following standardized format and content requirements. Each SOP is reviewed and approved by a minimum of two managers (the Laboratory Director and/or Department Manager and the Quality Assurance Manager). All SOPs undergo a documented annual review to make sure current practices are described. The QA Manager maintains a comprehensive list of current SOPs. The document control process ensures that only the most currently prepared version of an SOP is being used. The QA Manual, QAPPs, SOPs, standards preparation logbooks, maintenance logbooks, et al., are controlled documents. The procedures for document control are described in the *SOP for Document Control* (ADM-DOC_CTRL). In addition to SOPs, each laboratory department maintains a current file, accessible to all laboratory staff, of the current methodology used to perform analyses. Laboratory notebook entries are standardized following the guidelines in the *SOP for Making Entries into Logbooks and onto Benchsheets* (ADM-DATANTRY). Entries made into laboratory notebooks are reviewed and approved by the appropriate supervisor at a regular interval.

9.2 Deviation from Standard Operating Procedures

When a customer requests a modification to an SOP (such as a change in reporting limit, addition or deletion of target analyte(s), etc.), the project chemist handling that project must discuss the proposed deviation with the department manager in charge of the analysis and obtain their approval to accept the project. The project chemist is responsible for documenting the approved or allowed deviation from the SOP by placing a detailed description of the deviation attached to the quotation or in the project file and also providing an appropriate comment on the service request when the samples are received.

For circumstances when a deviation or departure from company policies or procedures involving any non-technical function is found necessary, approval must be obtained from the appropriate supervisor, manager, the laboratory director, or other level of authority. Frequent departure from policy is not encouraged. However, if frequent departure from any policy is noted, the laboratory director will address the possible need for a change in policy.

9.3 Modified Procedures

CAS strives to perform published methods as described in the referenced documents. If there is a material deviation from the published method, the method is cited as a "Modified" method in the analytical report. Modifications to the published methods are listed in the standard operating procedure. Standard operating procedures are available to analysts and are also available to our clients for review, especially those for "Modified" methods. Client approval is obtained for the use of "Modified" methods prior to the performance of the analysis.

9.4 Analytical Batch

The basic unit for analytical quality control is the analytical batch. The definition that CAS has adopted for the analytical batch is listed below. The overriding principle for describing an analytical batch is that all the samples in a batch, both field samples and quality control samples, are to be handled exactly the same way, and all of the data from each analysis is to be manipulated in exactly the same manner. The minimum requirements of an analytical batch are:

1) The number of (field) samples in a batch is not to exceed 20.

2) All (field) samples in a batch are of the same matrix.

3) The QC samples to be processed with the (field) samples include:

   a) Method Blank (a.k.a. Laboratory Reagent Blank)

      Function: Determination of laboratory contamination.

   b) Laboratory Control Sample (a.k.a. Laboratory Fortified Blank)

      Function: Assessment of method performance

   c) Matrix Spiked (field) Sample (a.k.a. Laboratory Fortified Sample Matrix)*

      Function: Assessment of matrix bias

   d) Duplicate Matrix Spiked (field) Sample or Duplicate (field) Sample (a.k.a. Laboratory Duplicate)*

      Function: Assessment of batch precision

   * A sample identified as a field blank, an equipment blank, or a trip blank is not to be matrix spiked or duplicated.

4) A single lot of reagents is used to process the batch of samples.

5) Each operation within the analysis is performed by a single analyst, technician, chemist, or by a team of analysts/technicians/chemists.

6) Samples are analyzed in a continuous manner over a timeframe not to exceed 24-hours.

7) (Field) samples are assigned to batches commencing at the time that sample processing begins. For example: for analysis of metals, sample processing begins when the samples are digested. For analysis of organic constituents, it begins when the samples are extracted.

8) The QC samples are to be analyzed in conjunction with the associated field samples prepared with them. However, for tests which have a separate sample preparation step that defines a batch (digestion, extraction, etc.), the QC samples in the batch do not require analysis each time a field sample within the preparation batch is analyzed (multiple instrument sequences to analyze all field samples in the batch need not include re-analyses of the QC samples).

9) The batch is to be assigned a unique identification number that can be used to correlate the QC samples with the field samples.

10) Batch QC refers to the QC samples that are analyzed in a batch of (field) samples.

11) Project-specific requirements may be exceptions. If project, program, or method requirements are more stringent than these laboratory minimum requirements, then the project, program, or method requirements will take precedence. However, if the project, program, or method requirements are less stringent than these laboratory minimum requirements, these laboratory minimum requirements will take precedence.

9.5 Specialized Procedures

CAS not only strives to provide results that are scientifically sound, legally defensible, and of known and documented quality; but also strives to provide the best solution to analytical challenges. Procedures using specialized instrumentation and methodology have been developed to improve sensitivity (provide lower detection limits), selectivity (minimize interferences while maintaining sensitivity), and overall data quality for low concentration applications. Examples are trace-level Mercury and methylmercury analyses, reductive precipitation metals analysis, specialized GC/MS analyses, LC/MS analyses, and ultra-low level organics analyses (including PAHs, pesticides and PCBs).

9.6 Sample Cleanup

CAS commonly employs several cleanup procedures to minimize known common interferences prior to analysis. EPA methods for cleanup of sample extracts for organics analysis are routinely used to minimize or eliminate interferences that may adversely affect sample results and data usability.

10.0 CALIBRATION PROCEDURES AND FREQUENCY

All equipment and instruments used at CAS are operated, maintained and calibrated according to the manufacturer's guidelines and recommendations, as well as to criteria set forth in the applicable analytical methodology. Operation and calibration are performed by personnel who have been properly trained in these procedures. Documentation of calibration information is maintained in appropriate reference files. Brief descriptions of the calibration procedures for our major laboratory equipment and instruments are described below. Calibration verification is performed according to the applicable analytical methodology. Calibration verification procedures and criteria are listed in laboratory Standard Operating Procedures. Documentation of calibration verification is maintained in appropriate reference files.
Records are maintained to provide traceability of reference materials.

Equipment which has been subjected to overloading or mishandling, or has been shown by verification or otherwise to be defective; is taken out of service until it has been repaired. The equipment is placed back in service only after verifying by calibration that the equipment performs satisfactorily. An evaluation of the effect of this defect on previous calibrations or tests is made and documented appropriately.

10.1 Temperature Control Devices

Temperatures are monitored and recorded for all of the temperature-regulating support equipment such as sample refrigerators, freezers, and standards refrigerators. Bound record books are kept which contain daily-recorded temperatures, identification and location of equipment, acceptance criteria and the initials of the technician who performed the checks. The procedure for performing these measurements is provided in the *SOP for Support Equipment Monitoring and Calibration (SOP ADM-SEMC).* The SOP also includes the use of acceptance criteria and correction factors.

Where the operating temperature is specified as a test condition (such as ovens, incubators, evaporators) the temperature is recorded on the raw data. All thermometers are identified according to serial number, and the calibration of these thermometers is checked annually against a National Institute of Standards and Technology (NIST) certified thermometer. The NIST thermometer is recertified by a professional metrology organization on an annual basis.

10.2 Analytical Balances

The calibration of each analytical balance is checked by the user each day of use with three Class S or S-1 weights, which assess the accuracy of the balance at low, mid-level and high levels bracketing the working range. Records are kept which contain the recorded measurements, identification of the balance, acceptance criteria, and the initials of user who performed the check. The procedure for performing these measurements and use of acceptance criteria is described in the SOP ADM-SEMC. The weights are recertified using NIST traceable standards by a professional metrology organization on an annual basis.

As needed, the balances are recalibrated using the manufacturers recommended operating procedures. Analytical balances are serviced on a semi-annual basis by a professional metrology organization. New certificates of calibration for each balance are issued to the laboratory on a semi-annual basis.

10.3 Water Purification Systems

CAS uses two independent water purification systems is designed to produce deionized water meeting method specifications. One system consists of a series of pumps, filters, and resin beds designed to yield deionized water meeting the specifications of ASTM Type II water, and *Standard Methods for the Examination of Water and Wastewater* (SM1080, 20th Ed.) *High Quality* water. Activated carbon filters are also in series with the demineralizers to produce "organic-free" water. A second system consists of pumps, filters, and treatment components designed to yield deionized water meeting the specifications of ASTM Type I water, and *Standard Methods for the Examination of Water and Wastewater* (SM1080, 20th Ed.) *High Quality* water. Following a written SOP, the status of each system is monitored continuously for conductivity and resistivity with an on-line meter and indicator light, and readings recorded daily in a bound record book. The meter accuracy is verified annually. Deionizers are rotated and replaced on a regular schedule. Microbiology water is checked at a point downstream of the purification system at a tap in the laboratory, and monitoring documented.

10.4 Source and Preparation of Standard Reference Materials

All analytical measurements generated at CAS are performed using materials and/or processes that are traceable to a reference material. Metrology equipment (analytical balances, thermometers, etc.) is calibrated using reference materials traceable to the National Institute of Standards and Technology (NIST). These primary reference materials are themselves recertified on an annual basis. All sampling containers provided to the client by the laboratory are purchased as precleaned (Level 1) containers, with certificates of analysis available for each bottle type. This information is provided to the client when requested.

Consumable reference materials routinely purchased by the laboratories (e.g., analytical standards) are purchased from nationally recognized, reputable vendors. All vendors have fulfilled the requirements for ISO 9001 certification and/or are accredited by A_2LA. CAS relies on a primary vendor for the majority of its analytical supplies. Consumable primary stock standards are obtained from certified commercial sources or from sources referenced in a specific method. Supelco, Ultra Scientific, AccuStandard, Chem Services, Inc., Aldrich Chemical Co., Baker, Spex, etc. are examples of the vendors used. Reference material information is recorded in the appropriate logbook(s) and materials are stored under conditions that provide maximum protection against deterioration and contamination. The logbook entry includes such information as an assigned logbook identification code, the source of the material (i.e. vendor identification), solvent (if applicable) and concentration of analyte(s), reference to the certificate of analysis and an assigned expiration date. The date that the standard is received in the laboratory is marked on the container. When the reference material is used for the first time, the date of usage and the initials of the analyst are also recorded on the container.

Stock solutions and calibration standard solutions are prepared fresh as often as necessary according to their stability. All standard solutions are properly labeled as to analyte concentration, solvent, date, preparer, and expiration date; these entries are also recorded in the appropriate notebook(s) following the *SOP for Making Entries into Logbooks and onto Benchsheets* (SOP No. ADM-DATANTRY). Prior to sample analysis, all calibration reference materials are verified with a second, independent source of the material (see section 11.3.5).

10.5 Inductively Coupled Plasma-Atomic Emission Spectrograph (ICP-AES)

Each emission line on the ICP is calibrated daily against a blank and against standards. Analyses of calibration standards, initial and continuing calibration verification standards, and inter-element interference check samples are carried out as specified in the applicable method SOP and analytical method (i.e. EPA 200.7, 6010B, 6010C, CLP SOW, etc.).

10.6 Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)

Each element of interest is calibrated for using a blank and a single standard. Prior to calibration, a short-term stability check is performed on the system. Following calibration, an independent check standard is analyzed, and a continuing calibration verification standard (CCV) is analyzed with every ten samples.

10.7 Atomic Absorption Spectrophotometers (AAS)

These instruments are calibrated daily using a minimum of four standards and a blank. Calibration is validated using reference standards, and is verified at a minimum frequency of once every ten samples. Initial calibration points cannot be “dropped” from the resulting calibration curve.

10.8 GC/MS Systems

All GC/MS instruments are calibrated at a minimum of five different concentration levels for the analytes of interest (unless specified otherwise) using procedures outlined in Standard Operating Procedures and/or appropriate USEPA method citations. All reference materials used for this function are vendor-certified standards. Calibration verification is performed at method-specified intervals following the procedures in the SOP and reference method. Compounds selected as system performance check compounds (SPCCs) must show a method-specified response factor in order for the calibration to be considered valid. Calibration check compounds (CCCs) must also meet method specifications for percent difference from the multipoint calibration. For isotope dilution procedures, the internal standard response(s) and labeled compound recovery must meet method criteria. Method-specific instrument tuning is regularly checked using bromofluorobenzene (BFB) for volatile organic chemical (VOC) analysis, or decafluorotriphenylphosphine (DFTPP) for semi-volatile analysis. Mass spectral peaks for the tuning compounds must conform both in mass numbers and in relative intensity criteria before analyses can proceed. Calibration policies for organics chromatographic analyses are described in the *SOP for Calibration of Instruments for Organics Chromatographic Analyses (SOP SOC-CAL).*

10.9 Gas Chromatographs and High Performance Liquid Chromatographs

Calibration and standardization follow SOP guidelines and/or appropriate USEPA method citations. All GC and HPLC instruments are calibrated at a minimum of five different concentration levels for the analytes of interest (unless specified otherwise). The lowest standard is equivalent to the method reporting limit; additional standards define the working range of the GC or LC detector. Results are used to establish response factors (or calibration curves) and retention-time windows for each analyte. Calibration is verified at a minimum frequency of once every ten samples, unless otherwise specified by the reference method. *SOP for Calibration of Instruments for Organics Chromatographic Analyses (SOP SOC-CAL).*

10.10 LC/MS Systems

Calibration and tuning procedures are included in analytical SOPs written specifically for these tests. In general, multiple concentration levels for the analytes of interest are used to generate calibration curves. All reference materials used for this function are vendor-certified standards. Calibration and tuning verification is performed at SOP-defined intervals. Any other system performance checks are described in the applicable SOP. Calibration policies for organics chromatographic analyses are described in the *SOP for Calibration of Instruments for Organics Chromatographic Analyses (SOP SOC-CAL).*

10.11 UV-Visible Spectrophotometer (manual colorimetric analyses)

Routine calibrations for colorimetric and turbidimetric analyses involve generating a 5-point calibration curve including a blank. Initial calibration points cannot be "dropped" from the resulting calibration curve. Correlation coefficients must meet method or SOP specifications before analysis can proceed. Independent calibration verification standards (ICVs) are analyzed with each batch of samples. Continuing calibration is verified at a minimum frequency of once every ten samples. Typical UV-Visible spectrophotometric methods at CAS include total phenolics, phosphates, surfactants and tannin-lignin.

10.12 Flow Injection Analyzer (automated colorimetric analysis)

A minimum of six standards and a blank are used to calibrate the instrument for cyanide analysis. A blank and (minimum of) five standards are used to calibrate the instrument for all other automated chemistries. Initial calibration points cannot be "dropped" from the resulting calibration curve. Standard CAS acceptance limits are used to evaluate the calibration curve prior to sample analysis.

10.13 Ion Chromatographs

Calibration of the ion chromatograph (IC) involves generating a calibration curve with the method-specified number of points (or more). Initial calibration points cannot be "dropped" from the resulting calibration curve. A correlation coefficient of $\geq$ 0.995 for the curve is required before analysis can proceed. Quality Control (QC) samples that are routinely analyzed include blanks and laboratory control samples. The target analytes typically determined by the IC include nitrate, nitrite, chloride, fluoride, sulfate and drinking water

inorganic disinfection byproducts. Calibration verification is performed at method-specified intervals following the procedures in the SOP and reference method.

10.14 Turbidimeter

Calibration of the turbidimeter requires analysis of three Nephelometric Turbidity Unit (NTU) formazin standards. Quality Control samples that are routinely analyzed include blanks, Analytical Products Group® QC samples (or equivalent) and duplicates.

10.15 Ion-selective electrode

The method-prescribed numbers of standards are used to calibrate the electrodes before analysis. The slope of the curve must be within acceptance limits before analysis can proceed. Quality Control samples that are routinely analyzed include blanks, LCSs and duplicates.

10.16 Pipets

The calibration of pipets and autopipettors used to make critical-volume measurements is verified following the *SOP for Checking Pipet Calibration*. Both accuracy and precision verifications are performed, at intervals applicable to the pipet and use. The results of all calibration verifications are recorded in bound logbooks.

10.17 Other Instruments

Calibration for the total organic carbon (TOC), total organic halogen (TOX), and other instruments is performed following manufacturer's recommendations and applicable SOPs.

11.0 QUALITY CONTROL

A primary focus of Columbia Analytical Services Quality Assurance (QA) Program is to ensure the accuracy, precision and comparability of all analytical results. Prior to using a procedure for the analysis of field samples, acceptable method performance is established by performing demonstration of capability analyses and performance characteristics are established by performing method detection limit studies and assessing accuracy and precision according to the reference method. CAS has established Quality Control (QC) objectives for precision and accuracy that are used to determine the acceptability of the data that is generated. These QC limits are either specified in the methodology or are statistically derived based on the laboratory's actual historical data obtained from the various QC measurements for each analytical method. The Quality Control objectives are defined below.

11.1 Quality Control Objectives

11.1.2 Demonstration of Capability - Where required by mandatory test method, regulation, or accreditation protocols, a demonstration of capability (DOC) is made prior to using any test method. This demonstration is made following regulatory, accreditation, or method specified procedures. In general, this demonstration does not test the performance of the method in real world samples, but in the applicable clean matrix free of target analytes and interferences.

A quality control reference material or quality control sample is obtained. The analyte(s) is (are) diluted in a volume of clean matrix (for analytes which do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples). Where specified, the method-required concentration levels are used. Four aliquots are prepared and analyzed according to the test procedure. The mean recovery and standard deviations are calculated and compared to the corresponding acceptance criteria for precision and accuracy in the test method or laboratory-generated acceptance criteria (if there are not established mandatory criteria). All parameters must meet the acceptance criteria. Where spike levels are not specified, actual Laboratory Control Sample results or MDL study results may be used to meet this requirement, provided acceptance criteria is met.

11.1.3 Accuracy - Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory-fortified blanks, standard reference materials, and standard solutions. In addition, laboratory-fortified (i.e. matrix-spiked) samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery (% REC.) of the measured value, relative to the true or expected value. If a measurement process produces results whose mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or

caused by an artifact of the measurement system (e.g., contamination). CAS utilizes several quality control measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement

11.1.4 Precision - Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling and in laboratory analysis. The American Society of Testing and Materials (ASTM) recognizes two levels of precision: repeatability - the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions, and reproducibility - the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material.

"Within-batch" precision is measured using replicate sample or QC analyses and is expressed as the relative percent difference (RPD) between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

11.1.5 Control Limits - The control limits for accuracy and precision originate from two different sources: For analyses having enough QC data, control limits are calculated at the 99% confidence limits. For analyses not having enough QC data, or where the method is prescriptive, control limits are taken from the method on which the procedure is based. If the method does not have stated control limits, then control limits are assigned method-default or reasonable values. Control limits are updated periodically when new statistical limits are generated for the appropriate surrogate, laboratory control sample, and matrix spike compounds (typically once a year) or when method prescribed limits change. The updated limits are reviewed by the Quality Assurance Manager. The new control limits replace the previous limits and data is assessed using the new values. The current acceptance limits for accuracy and precision are available from the laboratory and on the accompanying CD-ROM. For inorganics, the precision limit values listed are for laboratory duplicates. For organics, the precision limit values listed are for duplicate laboratory control samples or duplicate matrix spike analyses.

11.1.6 Representativeness - Representativeness is the degree to which the field sample, being properly preserved, free of contamination, and analyzed within holding time, represents the overall sample site or material. This can be extended to the sample itself, in that representativeness is the degree to which the subsample that is analyzed represents the entire field sample submitted for analysis. CAS has sample handling procedures to ensure that the sample used for analysis is representative of the entire sample. These include the *SOP for Subsampling and Compositing of Samples* and the *SOP for Tissue Sample Preparation*. Further, analytical SOPs specify appropriate sample handling and sample sizes to further ensure the sample aliquot that is analyzed is representative in entire sample.

11.1.7 Comparability – Comparability expresses the confidence with which one data set can be compared to another and is directly affected by data quality (accuracy and precision) and sample handling (sampling, preservation, etc). Only data of known quality can be compared. The objective is to generate data of known quality with the highest level of comparability, completeness, and usability. This is achieved by employing the quality controls listed below and standard operating procedures for the handling and analysis of all samples. Data is reported in units specified by the client and using CAS or project-specified data qualifiers.

11.2 Method Detection Limits and Method Reporting Limits

Method Detection Limits (MDL) for methods performed at CAS/Kelso are determined annually, and may change slightly from year to year. The MDLs are determined by following the *SOP for the Determination of Method Detection Limits and Limits of Detection,* which is based on the procedure in 40 CFR Part 136, Appendix B. As required by NELAP and DoD protocols, the validity of MDLs is verified using MDL verification samples. The Method Reporting Limit (MRL) is the lowest amount of an analyte in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated analytical conditions (i.e. the lower limit of quantitation). Therefore, analyses are calibrated to the MRL, or lower. To take into account day-to-day fluctuations in instrument sensitivity, analyst performance, and other factors, the MRL is established at three times the MDL (or greater). The current MDLs and MRLs are available from the laboratory.

11.3 Quality Control Procedures

The specific types, frequencies, and processes for quality control sample analysis are described in detail in method-specific standard operating procedures and listed below. These sample types and frequencies have been adopted for each method and a definition of each type of QC sample is provided below. In addition, a number of other quality control processes that may impact analytical results are also described below.

11.3.1 Method Blank (a.k.a. Laboratory Reagent Blank)

The method blank is an analyte-free matrix (water, soil, etc.) subjected to the entire analytical process. When analyte-free soil is not available, anhydrous sodium sulfate, organic-free sand, or an acceptable substitute is used. The method blank is analyzed to demonstrate that the analytical system itself does not introduce contamination. The method blank results should be below the Method Reporting Limit (MRL) or, if required for DoD projects, < ½ MRL for the analyte(s) being tested. Otherwise, corrective action must be taken. A method blank is included with the analysis of every sample preparation batch, every 20 samples, or as stated in the method, whichever is more frequent.

11.3.2 Calibration Blanks

For some methods, calibration blanks are prepared along with calibration standards in order to create a calibration curve. Calibration blanks are free of the analyte of interest and, where applicable, provide the zero point of the calibration curve. Additional project-specific requirements may also apply to calibration blanks.

11.3.3 Continuing Calibration Blanks

Continuing calibration blanks (CCBs) are solutions of either analyte-free water, reagent, or solvent that are analyzed in order to verify the system is contamination-free when CCV standards are analyzed. The frequency of CCB analysis is either once every ten samples or as indicated in the method, whichever is greater. Additional project-specific requirements may also apply to continuing calibration blanks.

11.3.4 Calibration Standards

Calibration standards are solutions of known concentration prepared from primary standard or stock standard materials. Calibration standards are used to calibrate the instrument response with respect to analyte concentration. Standards are analyzed in accordance with the requirements stated in the particular method being used.

11.3.5 Initial (or Independent) Calibration Verification Standards

Initial (or independent) calibration verification standards (ICVs) are standards that are analyzed *after* calibration with newly prepared standard(s) but *prior to* sample analysis, in order to verify the validity and accuracy of the standards used in the calibration. Once it is determined that there is no reference material defect or systematic error in preparation of the calibration standard(s), standards are considered valid and may be used for subsequent calibrations and quantitative determinations (as expiration dates and methods allow). The ICV standards are prepared from materials obtained from a source independent of that used for preparing the calibration standards ("second-source"). ICVs are also analyzed in accordance with method-specific requirements.

11.3.6 Continuing Calibration Verification Standards

Continuing calibration verification standards (CCVs) are midrange standards that are analyzed in order to verify that the calibration of the analytical system is still acceptable. The frequency of CCV analysis is either once every ten samples, or as indicated in the method.

11.3.7 Internal Standards

Internal standards are known amounts of specific compounds that are added to each sample prior to instrument analysis. Internal standards are generally used for GC/MS and ICP-MS procedures to correct sample results that have been affected by changes in instrument conditions or changes caused by matrix effects. The requirements for evaluation of internal standards are specified in each method and SOP.

11.3.8 Surrogates

Surrogates are organic compounds which are similar in chemical composition and chromatographic behavior to the analytes of interest, but which are not normally found in environmental samples. Depending on the analytical method, one or more of these compounds is added to method blanks, calibration and check standards, and samples (including duplicates, matrix spike samples, duplicate matrix spike samples and laboratory control samples) prior to extraction and analysis in order to monitor the method performance on each sample. The percent recovery is calculated for each surrogate, and the recovery is a measurement of the overall method performance.

Recovery (%) = (M/T) x 100

Where: M = The measured concentration of analyte,
T = The theoretical concentration of analyte added.

11.3.9 Laboratory Control Samples (a.k.a. Laboratory Fortified Blanks)

The laboratory control sample (LCS) is an aliquot of analyte-free water or analyte-free solid (or anhydrous sodium sulfate or equivalent) to which known amounts of the method analyte(s) is (are) added. A reference material of known matrix type, containing certified amounts of target analytes, may also be used as an LCS. An LCS is prepared and analyzed at a minimum frequency of one LCS per 20 samples, with every analytical batch or as stated in the method, whichever is more frequent. The LCS sample is prepared and analyzed in exactly the same manner as the field samples. The percent recovery of the target analytes in the LCS is compared to established control limits and assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements at the required reporting limit. Comparison of batch-to-batch LCS analyses enables the laboratory to evaluate batch-to-batch precision and accuracy.

Recovery (%) = (M/T) x 100

Where: M = The measured concentration of analyte,
T = The theoretical concentration of analyte added.

11.3.10 Matrix Spikes (a.k.a. Laboratory Fortified Sample Matrix)

Matrix spiked samples are aliquots of samples to which a known amount of the target analyte (or analytes) is(are) added. The samples are then prepared and analyzed in the same analytical batch, and in exactly the same manner as are routine samples. For the appropriate methods, matrix spiked samples are prepared and analyzed and at a minimum frequency of one spiked sample (and one duplicate spiked sample, if appropriate) per twenty samples. The spike recovery measures the effects of interferences caused by the sample matrix and reflects the accuracy of the method for the particular matrix in question. Spike recoveries are calculated as follows:

$$Recovery\ (\%) = (S - A) \times 100 \div T$$

Where: S = The observed concentration of analyte in the spiked sample,
A = The analyte concentration in the original sample, and
T = The theoretical concentration of analyte added to the spiked sample.

11.3.11 Laboratory Duplicates and Duplicate Matrix Spikes

Duplicates are additional replicates of samples that are subjected to the same preparation and analytical scheme as the original sample. Depending on the method of analysis, either a duplicate analysis (and/or a matrix spiked sample) or a matrix spiked sample and duplicate matrix spiked sample (MS/DMS) are analyzed. The relative percent difference between duplicate analyses or between an MS and DMS is a measure of the precision for a given method and analytical batch. The relative percent difference (RPD) for these analyses is calculated as follows:

$$Relative\ Percent\ Difference\ (RPD) = (S1 - S2) \times 100 \div S_{ave}$$

Where S1 and S2 = The observed concentrations of analyte in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike, and

S_{ave} = The average of observed analyte concentrations in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike.

Depending on the method of analysis, either duplicates (and/or matrix spikes) or MS/DMS analyses are performed at a minimum frequency of one set per 20 samples. If an insufficient quantity of sample is available to perform a laboratory duplicate or duplicate matrix spikes, duplicate LCSs will be prepared and analyzed.

11.3.12 Interference Check Samples

An interference check sample (ICS) is a solution containing both interfering and analyte elements of known concentration that can be analyzed to verify background and

interelement correction factors in metals analyses. The ICS is prepared to contain known concentrations (method or program specific) of elements that will provide an adequate test of the correction factors. The ICS is analyzed at the beginning and end of an analytical run or at a method-specified frequency. Results must meet method criteria and any project-specific criteria.

11.3.13 Post Digestion Spikes

Post digestion spikes are samples prepared for metals analyses that have an analyte spike added to determine if matrix effects may be a factor in the results. The spike addition should produce a method-specified minimum concentration above the method reporting limit. A post digestion spike is analyzed with each batch of samples and recovery criteria are specified for each method.

11.3.14 Control Charting

The generation of control charts is routinely performed at CAS. Surrogate, Matrix Spike and LCS recoveries are all monitored and charted. In addition, the laboratory also monitors the Relative Percent Difference (RPD) measurement of precision. Control charts are available to each individual laboratory unit to monitor the data generated in its facility using control charts that have been programmed to identify various trends in the analytical results. If trends in the data are perceived, various means of corrective action may then be employed in order to prevent future problems with the analytical system(s). Finally, data quality reports using control charts are generated for specific clients and projects pursuant to contract requirements. The control charting procedure is described in the SOP for *Control Charting Quality Control Data* (ADM-CHRT).

11.3.15 Glassware Washing

Glassware washing and maintenance play a crucial role in the daily operation of a laboratory. The glassware used at CAS undergoes a rigorous cleansing procedure prior to every usage. A number of SOPs have been generated that outline the various procedures used at CAS; each is specific to the end-use of the equipment as well as to the overall analytical requirements of the project. In addition, other equipment that may be routinely used at the laboratory is also cleaned following instructions in the appropriate SOP.

12.0 DATA REDUCTION, VALIDATION, AND REPORTING

CAS reports the analytical data produced in its laboratories to the client via the certified analytical report (CAR). This report includes a transmittal letter, a case narrative, client project information, specific test results, quality control data, chain of custody information, and any other project-specific support documentation. The following procedures describe our data reduction, validation and reporting procedures.

12.1 Data Reduction and Review

Results are generated by the analyst who performs the analysis and works up the data. All data is initially reviewed and processed by analysts using appropriate methods (e.g., chromatographic software, instrument printouts, hand calculation, etc.). Equations used for calculation of results are found in the applicable analytical SOPs. The resulting data set is either manually entered (e.g., titrimetric or microbiological data) into an electronic report form or is electronically transferred into the report from the software used to process the original data set (e.g., chromatographic software). Once the complete data set has been transferred into the proper electronic report form(s), it is then printed. The resulting hardcopy version of the electronic report is then reviewed by the analyst for accuracy. Once the primary analyst has checked the data for accuracy and acceptability, the hardcopy is forwarded to the supervisor or second qualified analyst, who reviews the data for errors. Where calculations are not performed using a validated software system, the reviewer rechecks a minimum of 10% of the calculations. When the entire data set has been found to be acceptable, a final copy of the report is printed and signed by the laboratory supervisor, departmental manager or designated laboratory staff. The entire data package is then placed into the appropriate service request file, and an electronic copy of the final data package is forwarded to the appropriate personnel for archival. Data review procedures are described in the *SOP for Laboratory Data Review Process.*

Policies and procedures for manual editing of data are established. The analyst making the change must initial and date the edited data entry, without obliteration of the original entry. The policies and procedures are described in the *SOP for Making Entries into Logbooks and onto Benchsheets* (SOP ADM-DATANTRY).

Policies and procedures for electronic manual integration of chromatographic data are established. The analyst performing the integration must document the integration change by printing both the "before" and "after" integrations and including them in the raw data records. The policies and procedures are described in the *SOP for Manual Integration of Chromatographic Peaks* (SOP ADM-INT).

12.2 Confirmation Analysis

12.2.1 Gas Chromatographic and Liquid Chromatographic Analyses

For gas chromatographic (GC) and liquid chromatographic (LC) analyses, all positive results are confirmed by a second column, a second detector, a second wavelength (HPLC/UV), or by GC/MS analysis, unless exempted by one of the following situations:

- The analyte of interest produces a chromatogram containing multiple peaks exhibiting a characteristic pattern, which matches appropriate standards. This is limited to petroleum hydrocarbon analyses (e.g., gasoline and diesel) and does not include polychlorinated biphenyls.

- The sample meets all of the following requirements:

    1. All samples (liquid or solid) come from the same source (e.g., groundwater samples from the same well) for continuous monitoring. Samples of the same matrix from the same site, but from different sources (e.g., different sampling locations) are not exempt.

    2. All analytes have been previously analyzed in sample(s) from the same source (within the last year), identified and confirmed by a second column or by GC/MS. The chromatogram is largely unchanged from the one for which confirmation was carried out. The documents indicating previous confirmation must be available for review.

12.2.2 Confirmation Data

Confirmation data will be provided as specified in the method. Identification criteria for GC, LC or GC/MS methods are summarized below:

- GC and LC Methods

    1. The analyte must fall within plus or minus three times the standard deviation (established for the analyte/column) of the retention time of the daily midpoint standard in order to be qualitatively identified. The retention-time windows will be established and documented, as specified in the appropriate Standard Operating Procedure (SOP).

    2. When sample results are confirmed by two dissimilar columns or detectors, the agreement between quantitative results must be evaluated. The relative percent difference between the two results is calculated and evaluated against SOP and/or method criteria.

- GC/MS Methods - Two criteria are used to verify identification:

    1. Elution of the analyte in the sample will occur at the same relative retention time (RRT) as that of the analyte in the standard.

    2. The mass spectrum of the analyte in the sample must, in the opinion of a qualified analyst or the department manager, correspond to the spectrum of the analyte in the standard or the current GC/MS reference library.

12.3 Data Review and Validation

The integrity of the data generated is assessed through the evaluation of the sample results, calibrations, and QC samples (method blanks, laboratory control samples, sample duplicates, matrix spikes, trip blanks, etc.). A brief description of the evaluation of these analyses is described below, with details listed in applicable SOPs. The criteria for evaluation of QC samples are listed within each method-specific SOP. Other data evaluation measures may include (as necessary) a check of the accuracy check of the QC standards and a check of the system sensitivity. Data transcriptions and calculations are also reviewed.

Note: Within the scope of this document, all possible data assessment requirements for various project protocols cannot be included in the listing below. This listing gives a general description of data evaluation practices used in the laboratory in compliance with NELAP Quality Systems requirements. Additional requirements exist for certain programs, such as projects under the DoD QSM protocols, AFCEE QAPP protocols, and project-specific QAPPs.

- Method Calibration – Following the analysis of calibration blanks and standards according to the applicable SOP the calibration correlation coefficient, average response factor, etc. is calculated and compared to specified criteria. If the calibration meets criteria analysis may continue. If the calibration fails, any problems are isolated and corrected and the calibration standards reanalyzed. Following calibration and analysis of the independent calibration verification standard(s) the percent difference for the ICV is calculated. If the percent difference is within the specified limits the calibration is complete. If not, the problem associated with the calibration and/or ICV are isolated and corrected and verification and/or calibration is repeated.

- Continuing Calibration Verification (CCV) – Following the analysis of the CCV standard the percent difference is calculated and compared to specified criteria. If the CCV meets the criteria analysis may continue. If the CCV fails, routine corrective action is performed and documented and a 2nd CCV is analyzed. If this CCV meets criteria, analysis may continue, including any reanalysis of samples that were associated with a failing CCV. If the routine corrective action failed to produce an immediate CCV within criteria, then either acceptable performance is demonstrated (after additional corrective action) with two consecutive calibration verifications, or a new initial calibration is performed. For DoD projects, the concentration of these two consecutive must be varied as required by the DoD QSM, Version 3.

- Method Blank – Results for the method blank are calculated as performed for samples. If results are less than the MRL (<½ MRL for DoD projects), the blank may be reported. If not, associated sample results are evaluated to determine the impact of the blank result. If possible, the source of the contamination is determined. If the contamination has affected sample results the blank and samples are reanalyzed. If positive blank results are reported, the blank (and sample) results are flagged with an appropriate flag, qualifier, or footnote.

- Sample Results (Inorganic) – Following sample analysis and calculations (including any dilutions made due to the sample matrix) it is verified that the result is within the calibration range. If not, the sample is diluted and analyzed to bring the result into calibration range. For sample and sample duplicate analyzed for precision, the calculated RPD is compared to the specified limits. The sample and duplicate are reanalyzed if the criteria are exceeded. The samples may require re-preparation and reanalysis. For metals, additional measures described in the applicable SOP may be taken to further evaluate results (dilution tests and/or post-digestion spikes). Results are reported when within the calibration range, or as estimates when outside the calibration range. When dilutions are performed the MRL is elevated accordingly and qualified. The MRL must meet project requirements.

- Sample Results (Organic) – For GC/MS analyses, it is verified that the analysis was within the prescribed tune window. If not, the sample is reanalyzed. Following sample analysis and calculations (including any dilutions made due to the sample matrix) peak integrations, retention times, and spectra are evaluated to confirm qualitative identification. Internal standard responses and surrogate recoveries are evaluated against specified criteria. If internal standard response does not meet criteria, the sample is diluted and reanalyzed. It is verified that the result is within the calibration range. If not, the sample is diluted and analyzed to bring the result into calibration range. For GC and HPLC tests, results from confirmation analysis are evaluated to confirm positive results and to determine the reported value. If obvious matrix interferences are present, additional cleanup of the sample using appropriate procedures may be necessary and the sample is reanalyzed. Results are reported when within the calibration range, or as estimates when outside the calibration range. When dilutions are performed the MRL is elevated accordingly and qualified. The MRL must meet project requirements.

- Surrogate Results (Organic) – Following sample analysis and calculations the percent recovery of each surrogate is compared to specified control limits. If recoveries are acceptable and other sample evaluation is complete, the results are reported. If recoveries do not fall within control limits, the sample matrix is evaluated. When matrix interferences are present or documented, the results are reported with a qualifier that matrix interferences are present. If no matrix interferences are present and there is no cause for the outlier, the sample is reprepared and reanalyzed. However, if the recovery is above the upper control limit with non-detected target analytes, the sample may be reported. All surrogate recovery outliers are appropriately qualified on the report.

- Duplicate Sample and/or Duplicate Matrix Spike Results – The RPD is calculated and compared to the specified control limits. If the RPD is within the control limits the result is reported. If not, an evaluation of the sample is made to verify that a homogenous sample was used. Despite the use of homogenizing procedures prior to sample preparation or analysis, the sample may not be homogenous or duplicate sample containers may not have been sample consistently. If non-homogenous, the result is reported with a qualifier about the homogeneity of the sample. Also, the results are compared to the MRL. If the results are less than five times the MRL, the results are reported with a qualifier that the high RPD is due to the results being near the MRL. If the sample is homogenous and results above five times the MRL, the samples and duplicates are reanalyzed. If re-analysis also produces out-of-control results, the results are reported with an appropriate qualifier.

- Laboratory Control Sample Results – Following analysis of the LCS the percent recovery is calculated and compared to specified control limits. If the recovery is within control limits, the analysis is in control and results may be reported. If not, this indicates that the analysis is not in control. The source of the problem is identified and, depending on the source of the problem, the LCS and the associated batch is reanalyzed or re-prepared and reanalyzed.

- Matrix Spike Results – Following analysis of the MS the percent recovery is calculated and compared to specified control limits. If the recovery is within control limits the results may be reported. If not, and the LCS is within control limits, this indicates that the matrix potentially biases analyte recovery. It is verified that the spike level is at least five times the background level. If not, the results are reported with a qualifier that the background level is too high for accurate recovery determination. If matrix interferences are present or results indicate a potential problem with sample preparation, steps may be taken to improve results; such as performing any additional cleanups, dilution and reanalysis, or re-preparation and reanalysis. Results that do not meet acceptance limits are reported with an appropriate qualifier.

12.4 Data Reporting

When an analyst determines that a data package has met the data quality objectives (and/or any client-specific data quality objectives) of the method and has qualified any anomalies in a clear, acceptable fashion, the data package is reviewed by a trained chemist. Prior to release of the report to the client, the project chemist reviews and approves the entire report for completeness and to ensure that any and all client-specified objectives were successfully achieved. The original raw data, along with a copy of the final report, is filed in project files by service request number for archiving. CAS maintains control of analytical results by adhering to standard operating procedures and by observing sample custody requirements. All data are calculated and reported in units consistent with project specifications, to enable easy comparison of data from report to report.

To the extent possible, samples shall be reported only if all QC measures are acceptable. If a QC measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s). The *SOP for Data Reporting and Report Generation* addresses the flagging and qualification of data. The CAS-defined data qualifiers, state-specific data qualifiers, or project-defined data qualifiers are used depending on project requirements. A case narrative may be written by the project chemist to explain problems with a specific analysis or sample, etc.

For subcontracted analyses, the Project Chemist verifies that the report received from the subcontractor is complete. This includes checking that the correct analyses were performed, the analyses were performed for each sample as requested, a report is provided for each analysis, and the report is signed. The Project Chemist accepts the report if all verification items are complete. Acceptance is demonstrated by forwarding the report to the CAS client.

12.5 Documentation

CAS maintains a records system which ensures that all laboratory records of analysis data retained and available. Analysis data is retained for 5 years from the report date unless contractual terms or regulations specify a longer retention time. The archiving system is described in the *SOP for Data Archiving*.

12.5.1 Documentation and Archiving of Sample Analysis Data

The archiving system includes the following items for each set of analyses performed:

- Benchsheets describing sample preparation (if appropriate) and analysis;
- Instrument parameters (or reference to the data acquisition method);
- Sample analysis sequence;
- Instrument printouts, including chromatograms and peak integration reports for all samples, standards, blanks, spikes and reruns;
- Logbook ID number for the appropriate standards;
- Copies of report sheets submitted to the work request file; and
- Copies of Nonconformity and Corrective Action Reports, if necessary.

Individual sets of analyses are identified by analysis date and service request number. Since many analyses are performed with computer-based data systems, the final sample concentrations can be automatically calculated. If additional calculations are needed, they are written on the integration report or securely stapled to the chromatogram, if done on a separate sheet.

For organics analysis, data applicable to all analyses within the batch, such as GCMS tunes, CCVs, batch QC, and analysis sequences; are kept using a separate documentation system. This system is used to archive data on a batch-specific basis and is segregated according to the date of analysis. This system also includes results for the most recent calibration curves, as well as method validation results.

12.6 Deliverables

In order to meet individual project needs, CAS provides several levels of analytical reports. Standard specifications for each level of deliverable are described in Table 12-1. Variations may be provided based on client or project specifications. This includes (but is not limited to) to following specialized deliverables:

- ADEC – Alaska Department of Conservation specified data package
- ACOE/HTRW – Army Corps of Engineers specified data package and reporting requirements (HTRW, CERP, FUDS, etc.)
- AFCEE – Air Force Center for Environmental Excellence project-specific reporting

When requested, CAS provides Electronic Data Deliverables (EDDs) in the format specified by client need or project specification. CAS is capable of generating EDDs with many different formats and specifications. The EDD is prepared by report production staff using the electronic version of the laboratory report to minimize transcription errors. User guides and EDD specification outlines are used in preparing the EDD. The EDD is reviewed and compared to the hard-copy report for accuracy.

Table 12-1
Descriptions of CAS Standard Data Deliverables

Tier I. Routine Certified Analytical Report (CAR) includes the following:

1. Transmittal letter
2. Sample analytical results
3. Method blank results
4. Surrogate recovery results and acceptance criteria for applicable organic methods
5. Chain of custody documents
6. Dates of sample preparation and analysis for all tests

Tier II and IIA. In addition to the Tier I Deliverables, this CAR includes the following:

1. Matrix spike result(s) with calculated recovery and including associated acceptance criteria
2. Duplicate or duplicate matrix spike result(s) (as appropriate to method), with calculated relative percent difference
3. Tier IIA also includes Laboratory Control Sample (LCS) result(s) with calculated recovery and including associated acceptance criteria

Tier III. Data Validation Package. In addition to the Tier II Deliverables, this CAR includes the following:

1. Case narrative
2. Calibration records and results of initial and continuing calibration verification standards, with calculated recoveries
3. Results of laboratory control sample (LCS) or Quality Control check sample, with calculated recovery and/or associated acceptance limit criteria
4. Results of calibration blanks or solvent blanks (as appropriate to method)
5. Summary forms for associated QC and calibration parameters
6. Copies of all raw data, including extraction/preparation bench sheets, chromatograms, and instrument printouts. For GC/MS, this includes tuning criteria and mass spectra of all positive hits. Results and spectra of TIC compounds will be included upon request.

Tier IV. CLP-Level Data Validation Package.

A complete Data Validation Package containing all sample results, quality control and calibration results, and raw data necessary to fulfill all deliverable requirements of an EPA Contract Laboratory Program (CLP) data package.

13.0 PERFORMANCE AND SYSTEM AUDITS

Quality audits are an essential part of CAS/Kelso's quality assurance program. There are two types of audits used at the facility: System Audits are conducted to qualitatively evaluate the operational details of the QA program, while Performance Audits are conducted by analyzing proficiency testing samples in order to quantitatively evaluate the outputs of the various measurement systems.

13.1 System Audits

The system audit examines the presence and appropriateness of laboratory systems. External system audits of CAS/Kelso are conducted regularly by various regulatory agencies and clients. Table 13-1 summarizes some of the major programs in which CAS/Kelso participates. Programs and certifications are added as required. Additionally, internal system audits of CAS/Kelso are conducted regularly under the direction of the Quality Assurance Manager. The internal audit procedures are described in the *SOP for Internal Audits*. The internal audits are performed as follows:

- Comprehensive lab-wide system audit – performed annually. This audit is conducted such that systems, technical operations, hardcopy data, and electronic data are assessed.
- Hardcopy report audits – minimum of 3 per quarter.
- Electronic audit trail reviews – each applicable instrument per quarter.

All audit findings, and corrective actions are documented. The results of each audit are reported to the Laboratory Director and Department Managers for review. Any deficiencies identified are summarized in the audit report. Managers must respond with corrective actions correcting the deficiency within a defined timeframe. Should problems impacting data quality be found during an internal audit, any client whose data is adversely impacted will be given written notification within the corrective action period (if not already provided).

Electronic data audits may be performed in conjunction with hardcopy data audits. The electronic audits focus on organic chromatographic data and include an examination of audit trails, peak integrations, calibration practices and files, GCMS tuning data, peak response data, use of appropriate files, and other components of the analysis. The audit also verifies that the electronic data supports the hardcopy reported data.

Additional internal audits or data evaluations may be performed as needed to address any potential data integrity issues that may arise.

13.2 Performance Audits

CAS/Kelso also participates in the analysis of interlaboratory proficiency testing (PT) samples. Participation in PT studies is performed on a regular basis and is designed to evaluate all analytical areas of the laboratory. CAS routinely participates in the following studies:

- Water Pollution (WP) and additional water parameters, 2 per year.
- Water Supply (WS) PT studies, 2 per year.
- Hazardous Waste/Soil PT studies, 2 per year.
- Underground Storage Tank PT studies, 2 per year.
- Microbiology (WS and WP) PT studies, 2 per year.
- Other studies as required for specific certifications, accreditations, or validations.

PT samples are processed by entering them into the LIMS system as samples (assigned Service Request, due date, testing requirements, etc.) and are processed the same as field samples. The laboratory sections handle samples the same as field samples, performing the analyses following method requirements and performing data review. The laboratory sections submit results to the QA Manager for subsequent reporting to the appropriate agencies or study provider. Results of the performance evaluation samples and audits are reviewed by the Quality Assurance Manager, Laboratory Director, the laboratory staff, and the CAS Quality Assurance Director. For any results outside acceptance criteria, the analysis data is reviewed to identify a possible cause for the deficiency, and corrective action is taken and documented.

Table 13-1
Current CAS Performance and System Audit Programs

Federal and National Programs

- The TNI (The NELAC Institute) National Environmental Laboratory Accreditation Program (NELAP) Accredited Drinking Water, Non-Potable Water, Solid & Hazardous Waste, and Biological Tissue Laboratory
- Naval Facilities Engineering Service Center
  Validated Laboratory for NFESC Parameters
- U.S. Air Force, Air Force Center for Environmental Excellence (AFCEE)
  Approved Laboratory for AFCEE Projects
- U.S. Army Corps of Engineers
  Approved Laboratory for USACE Projects
- U.S. EPA Region 8
  Approved Drinking Water Laboratory

State and Local Programs

- State of Alaska, Department of Environmental Conservation
  UST Laboratory, Lab I.D. UST040
- State of Arizona, Department of Health Services
  License No. AZ0339
- State of Arkansas, Department of Environmental Quality
  Certified Environmental Laboratory, Lab I.D. 88-0637
- State of California, Department of Health Services, Environmental Laboratory Accreditation Program
  Certification No. 2286
- State of Colorado, Department of Public Health and Environment
  Certified Drinking Water Laboratory
- State of Florida, Department of Health
  Primary NELAP Accreditation No. E87412
- State of Georgia, Department of Natural Resources
  Certified Drinking Water Laboratory
- State of Hawaii, Department of Health
  Certified Drinking Water Laboratory
- State of Idaho, Department of Health and Welfare
  Certified Drinking Water Laboratory
- State of Indiana, Department of Health
  Certified Drinking Water Laboratory, Lab I.D. C-WA-01
- State of Louisiana, Department of Environmental Quality
  Accredited Environmental Laboratory, Lab I.D. 3016
- State of Louisiana, Department of Health and Hospitals
  Accredited Drinking Water Laboratory, Lab I.D. LA080001
- State of Maine, Department of Human Services
  Certified Environmental Laboratory, Lab I.D. WA0035
- State of Michigan, Department of Environmental Quality
  Certified Drinking Water Laboratory, Lab I.D. 9949

Table 13-1 (continued)

State and Local Programs (continued)

- State of Minnesota, Department of Health
  Certified Environmental Laboratory, Lab I.D. 053-999-368
- State of Montana, Department of Health and Environmental Sciences
  Certified Drinking Water Laboratory, Lab I.D. 0047
- State of Nevada, Division of Environmental Protection
  Certified Drinking Water Laboratory, Lab I.D. WA35
- State of New Jersey, Department of Environmental Protection
  Accredited Environmental Laboratory, Lab I.D. WA005
- State of New Mexico, Environment Department
  Certified Drinking Water Laboratory
- State of North Carolina, Department of Environment and Natural Resources
  Certified Environmental Laboratory, Lab I.D. 605
- State of Oklahoma, Department of Environmental Quality
  General Water Quality/Sludge Testing, Lab I.D. 9801
- State of Oregon, ORELAP Laboratory Accreditation Program
  Accredited Environmental Laboratory, Lab I.D. WA200001
- State of Pennsylvania Department of Environmental Protection
  Registered Environmental Laboratory
- State of South Carolina, Department of Health and Environmental Control
  Certified Environmental Laboratory, Lab I.D. 61002
- State of Utah, Department of Health, Division of Laboratory Services
  Accredited Environmental Laboratory
- State of Washington, Department of Ecology, Environmental Laboratory Accreditation Program
  Accreditation No. C1203
- State of Wisconsin, Department of Natural Resources
  Accredited Environmental Laboratory, Lab I.D. 998386840

14.0 PREVENTIVE MAINTENANCE

Preventive maintenance is a crucial element of the Quality Assurance program. Instruments at CAS (e.g., ICP/MS and ICP systems, GC/MS systems, atomic absorption spectrometers, analytical balances, gas and liquid chromatographs, etc.) are maintained under commercial service contracts or by qualified, in-house personnel. All instruments are operated and maintained according to the instrument operating manuals. All routine and special maintenance activities pertaining to the instruments are recorded in instrument maintenance logbooks. The maintenance logbooks used at CAS contain extensive information about the instruments used at the laboratory.

An initial demonstration of analytical control is required on every instrument used at CAS before it maybe used for sample analysis. If an instrument is modified or repaired, a return to analytical control is required before subsequent sample analyses can occur. When an instrument is acquired at the laboratory, the following information is noted in a bound maintenance notebook specifically associated with the new equipment:

- The equipment's serial number;
- Date the equipment was received;
- Date the equipment was placed into service;
- Condition of equipment when received (new, used, reconditioned, etc.); and
- Prior history of damage, malfunction, modification or repair (if known).

Equipment records also include a copy of the manufacturer's manual(s) and dates and results of calibrations.

Preventive maintenance procedures, frequencies, etc. are available for each instrument used at CAS. They may be found in the various SOPs for routine methods performed on an instrument and may also be found in the operating or maintenance manuals provided with the equipment at the time of purchase.

Responsibility for ensuring that routine maintenance is performed lies with the section supervisor. The supervisor may perform the maintenance or assign the maintenance task to a qualified bench level analyst who routinely operates the equipment. In the case of non-routine repair of capital equipment, the section supervisor is responsible for providing the repair, either by performing the repair themselves with manufacturer guidance or by acquiring on-site manufacturer repair. Each laboratory section maintains a critical parts inventory. The parts inventories include the items needed to perform the preventive maintenance procedures listed in Appendix D.

This inventory or “parts list” also includes the items needed to perform any other routine maintenance and certain in-house non-routine repairs such as gas chromatography/mass spectrometry jet separators and electron multipliers and ICP/MS nebulizer. When performing maintenance on an instrument (whether preventive or corrective), additional information about the problem, attempted repairs, etc. is also recorded in the notebook. Typical logbook entries include the following information:

- Details and symptoms of the problem;
- Repairs and/or maintenance performed;
- Description and/or part number of replaced parts;
- Source(s) of the replaced parts;
- Analyst's signature and date; and
- Demonstration of return to analytical control.

See the table in Appendix D for a list of preventive maintenance activities and frequency for each instrument.

15.0 CORRECTIVE ACTION

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s). Failure to meet established analytical controls, such as the quality control objectives outlined in Section 11, prompts corrective action. In general, corrective action may take several forms and may involve a review of the calculations, a check of the instrument maintenance and operation, a review of analytical technique and methodology, and reanalysis of quality control and field samples. If a potential problem develops that cannot be solved directly by the responsible analyst, the supervisor, team leader, the department manager, and/or the Quality Assurance Manager may examine and pursue alternative solutions. In addition, the appropriate project chemist may be notified in order to ascertain if contact with the client is necessary.

In the event that analyses produce nonconformances with data or results, the problem and the corresponding corrective actions taken are documented on Nonconformity and Corrective Action Reports (See Figure 15-1) following the requirements in the SOP for Corrective Action (SOP No. ADM-CA). This form is utilized to document corrective actions in response to out-of-control situations. The Quality Assurance Manager reviews each problem, ensuring that appropriate corrective action has been taken by the appropriate personnel. The Nonconformity and Corrective Action Report (NCAR) is filed in the associated service request file and a copy is kept by the Quality Assurance Manager. The Quality Assurance Manager periodically reviews all NCARs looking for chronic, systematic problems that need more in-depth investigation and alternative corrective action consideration. In addition, the appropriate project chemist is promptly notified of any problems in order to inform the client and proceed with any action the client may want to initiate.

In addition to internal communication of data issues, the laboratory also maintains a system for dealing with customer complaints. The person who initially receives the feedback (typically the project chemist) is responsible for documenting the complaint. If the project chemist is unable to satisfy the customer, the complaint is brought to the attention of the Client Services Manager, Laboratory Director, or QA Manager for final resolution. The complaint and resolution are documented. The procedure is described in the *SOP for Handling Customer Feedback* (ADM-FDBK).

Corrective action due to a performance audit or a check sample problem is initiated by the Quality Assurance Manager; the affected laboratory supervisors and managers are promptly informed of performance audit results requiring corrective action.

Figure 15-1

Columbia Analytical Services, Inc.

Nonconformity and Corrective Action Report

NONCONFORMITY

NCAR No. _____

PROCEDURE (SOP or METHOD): EVENT DATE: _____

EVENT: ☐ Missed Holding Time ☐ QC Failure ☐ Lab Error (spilled sample, spiking error, etc.)
☐ Method Blank Contamination ☐ Login Error ☐ Project Management Error
☐ Equipment Failure ☐ Unacceptable PT Sample Result
☐ SOP Deviation ☐ Other (describe):

SAMPLES / PROJECTS / CUSTOMERS / SYSTEMS AFFECTED

DETAILED DESCRIPTION

ORIGINATOR: _____ DATE: _____

PROJECT MANAGER(S): _____ NOTIFIED BY: _____ DATE: _____

CORRECTIVE ACTION AND OUTCOME

Re-establishment of conformity must be demonstrated and documented. Describe the steps that were taken, or are planned to be taken, to correct the particular Nonconformity and prevent its reoccurrence. Include Project Manager instructions here.

Is the data to be flagged in the Analytical Report with an appropriate qualifier? ☐ **No** ☐ **Yes**

APPROVAL AND NOTIFICATION

Supervisor Verification and Approval of Corrective Action _____ Date: _____
Comments:

QA PM Verification and Approval of Corrective Action _____ Date: _____
Comments:

Customer Notified by ☐ Telephone ☐ Fax ☐ E-mail ☐ Narrative ☐ Not notified

Project Manager Verification and Approval of Corrective Action _____ Date: _____
Comments:

(Attach record or cite reference where record is located.)

Original: QA PM
NCAR 2007.doc 9/11/2007

Page 1 of 1

Photocopies: Supervisor and Customer File
File Name: NCAR 2007

16.0 QUALITY ASSURANCE REPORTS

Quality assurance requires an active, ongoing commitment by CAS personnel at all levels of the organization. Communication and feedback mechanisms are designed so that analysts, supervisors and managers are aware of QA issues in the laboratory. Analysts performing routine testing are responsible for generating a data quality report with every analytical batch processed. This report contains explicit documentation of the various controls used during the analysis. This report also allows the analyst to provide appropriate notes and/or a case narrative if problems were encountered with the analyses. A Non-Conformity and Corrective Action Report (NCAR) (see Section 15.0) may also be attached to the data prior to review. Supervisors or qualified analysts review all of the completed analytical batches to ensure that all QC criteria have been examined and any deficiencies noted and corrected if possible.

It is the responsibility of each laboratory unit to provide the project chemist with a final report of the data, accompanied by signature approval. Footnotes and/or narrative notes must accompany any data package if problems were encountered that require further explanation to the client. Each data package is submitted to the appropriate project chemist, who in turn reviews the entire collection of analytical data for completeness. The project chemist must also review the entire body of data to ensure that any and all client-specified objectives were successfully achieved. A case narrative may be written by the project chemist to explain any unusual problems with a specific analysis or sample, etc.

The Quality Assurance Manager (QAM) provides overview support to the project chemists as required (e.g., contractually specified, etc.). The QAM is also responsible for the oversight of all internal and external audits, for all proficiency testing sample and analysis programs, and for all laboratory certification/accreditation responsibilities. The QAM provides the Laboratory Director with quarterly reports that summarize the various QA/QC activities that occurred during the previous quarter. The report addresses such topics as the following:

- Status, schedule, and results of internal and external audits;
- Status, schedule, and results of internal and external proficiency testing studies;
- Status of certifications, accreditations, and approvals;
- Status of QA Manual and SOP review and revision;
- Status of MDLs studies;
- Discussion of QC problems in the laboratory;
- Discussion of corrective action program issues;
- Status of staff training and qualification; and
- Other topics as appropriate.

Any operational or quality assurance problems noted by the Laboratory Director are then addressed during the senior staff operations meetings with all appropriate department managers. The Laboratory Director also performs al documented management review annually of the quality and management systems to identify any necessary changes or improvements to the quality system or quality assurance policies.

17.0 PERSONNEL TRAINING

Technical position descriptions are available for all employees, regardless of position or level of seniority. These documents are maintained by the Human Resources personnel and are available for review. In order to assess the technical capabilities and qualifications of a potential employee, all candidates for employment at CAS are evaluated, in part, against the appropriate technical description.

Training begins the first day of employment at CAS when the company policies are presented and discussed. Safety and QA/QC requirements are integral parts of all technical SOPs and, consequently, are integral parts of all training processes at CAS. Safety training begins with the reading of the *Environmental Health and Safety Manual.* Employees are also required to attend periodic safety meetings where additional safety training may be performed by the Environmental, Health and Safety Officer. Employees are responsible for complying with the requirements of the QA Manual and QA/QC requirements associated with their function(s).

Each employee participates in Ethics training, which is part of the CAS Improper Practices Prevention Program. CAS also encourages its personnel to continue to learn and develop new skills that will enhance their performance and value to the Company. Ongoing training occurs for all employees through a variety of mechanisms. The "CAS University" education system, external and internal technical seminars and training courses, and laboratory-specific training exercises are all used to provide employees with professional growth opportunities.

A training plan is developed for each Standard Operating Procedure. The training plan includes a description of the step-by-step process for training an employee and for initial demonstration of proficiency. Where the analyst performs the entire procedure, a generic training plan may be used. In cases where work cells are used, a training plan specific to the work cell is established.

17.1 Initial Demonstration of Capability (IDOC)

Training in analytical procedures typically begins with the reading of the Standard Operating Procedure (SOP) for the method. Hands-on training begins with the observation of an experienced analyst performing the method, followed by the trainee performing the method under close supervision, and culminating with independent performance of the method on quality control samples. Successful completion of the applicable Demonstration of Capability analysis qualifies the analyst to perform the method independently. Demonstration of Capability is performed by one of the following:

- Successful completion of an Initial Precision and Recovery (IPR) study (required where mandated by the method).

- Analysis of 4 consecutive Laboratory Control Samples, with acceptable accuracy and precision. (For use of this option, LCSs must be from "second-source" standard materials independent of the calibration standards materials.).

- Where spiking is not possible but QC standards are used ("non-spiked" Laboratory Control Samples), analysis of 4 consecutive Laboratory Control Samples with acceptable accuracy and precision.

- Where one of the three above is not possible, special requirements are as follows:
  - Total Settleable Solids: Successful single-blind PT sample analysis and duplicate results with RPD<10%.
  - Color: Four consecutive prepared LCSs with acceptable accuracy and precision of <10% RSD.
  - Physical Tests (Grain size, Corrosivity to Steel, etc.): Supervisor acknowledgement of training and approval.

A flowchart identifying the Demonstration of Proficiency requirements is given in Figure 17-1. The flowchart identifies allowed approaches to assessing Demonstration of Capability when a 4-replicate study is not mandated by the method, when spiking is not an option, or when QC samples are not readily available.

17.2 Continuing Demonstration of Proficiency

A periodic demonstration of proficiency is required to maintain continuing qualification. Continuing Demonstration of Proficiency is required each year, and may be performed one of the following ways:

- Successful performance on external (independent) single-blind PT sample analyses using the test method, or a similar test method using the same technology.

- Performing Initial Demonstration of Capability as described above, with acceptable levels of precision and accuracy.

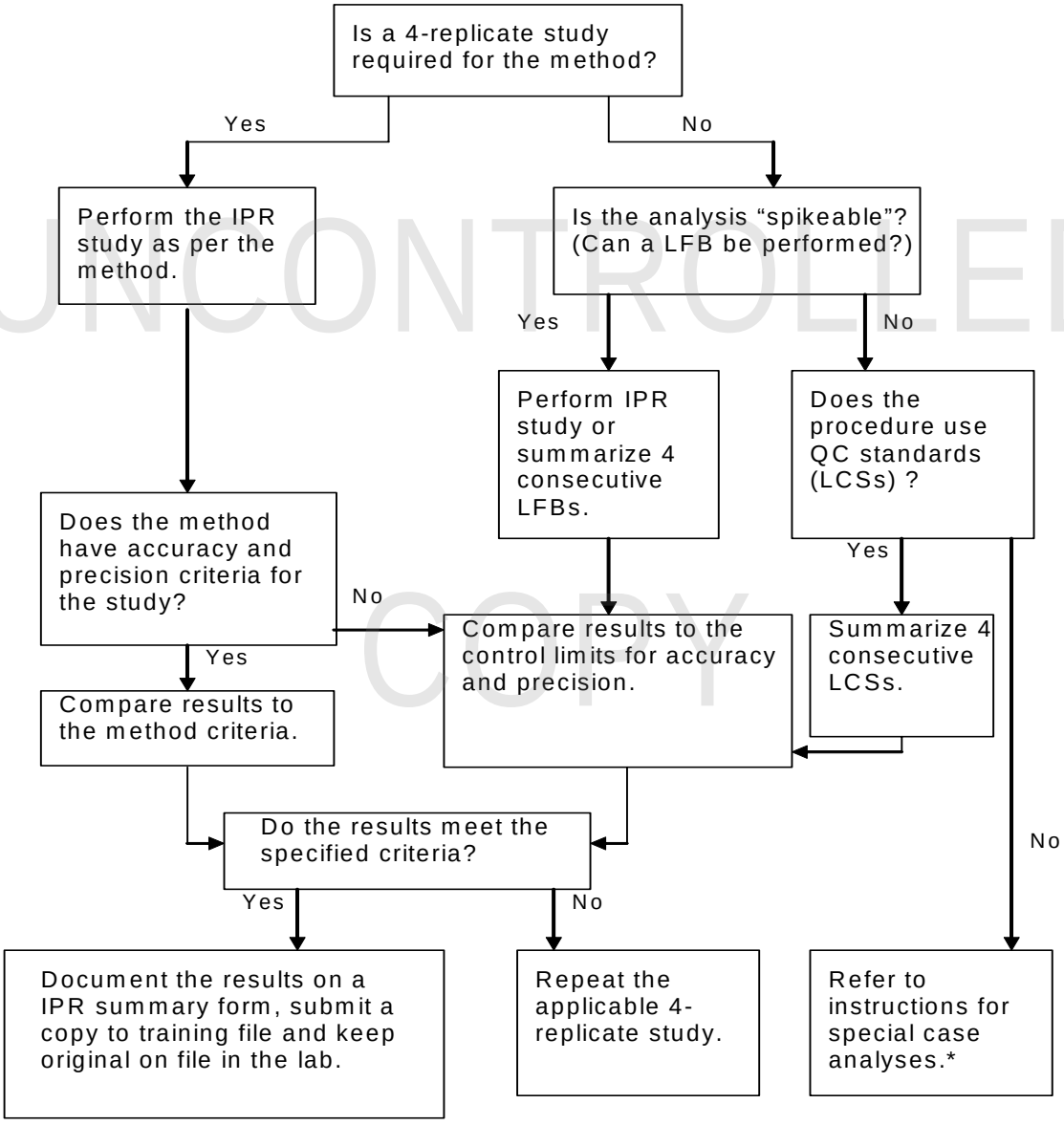
- Analysis of at least 4 consecutive LCSs with acceptable levels of accuracy and precision from in-control analytical batches.

- For methods for which PT samples are not available and a spiked analysis (LFB, MDL, etc.) is not possible, analysis of field samples that have been analyzed by another analyst with statistically indistinguishable results.

17.3 Documentation of Training

Records are maintained to indicate the employee has the necessary training, education, and experience to perform their functions. Information of previously acquired skills and abilities for a new employee is maintained in Human Resources personnel files and CAS resumes. A database is used to record the various technical skills and training acquired while employed by CAS. Information includes the employee's name, a description of the skill including the appropriate method and SOP reference, the mechanism used to document proficiency, and the date the training was completed. General procedures for documenting technical training are described in the *SOP for Documentation of Training (SOP No. ADM-TRANDOC).*

Figure 17-1
Initial Demonstration of Capability Requirements[a]



[a] For IDOC IPR or LFB studies, "second-source" reference materials are used, as per NELAP requirements
*Total Settleable Solids: Successful PT sample analysis and duplicate results with RPD<10%.
*Color: Four consecutive prepared LCSs with acceptable accuracy and precision of <10% RSD.
* Physical Tests (Grain size, Corrosivity to Steel, etc.): Supervisor acknowledgement of training and approval.

18.0 REFERENCES FOR ANALYTICAL PROCEDURES

The analytical methods used at CAS generally depend upon the end-use of the data. Since most of our work involves the analysis of environmental samples for regulatory purposes, specified federal and/or state testing methodologies are used and followed closely. Typical methods used at CAS are taken from the following references:

- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, (September 1986) and Updates I (July 1992), II (September 1994), IIA (August 1993), IIB (January 1995), III (December 1996), Final Update IV (February 2007), and updates posted online at http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm. See Chapters 1, 2, 3, and 4.

- *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, (Revised March 1983).

- *Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA/600/R-93/100 (August 1993).

- *Methods for the Determination of Metals in Environmental Samples*, EPA/600/4-91/010 (June 1991) and Supplements.

- *Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater*, EPA 600/4-82-057 (July 1982) and 40 CFR Part 136, Appendix A.

- *Methods for the Determination of Organic Compounds in Drinking Water*, EPA/600/4-88/039 (December 1988) and Supplements.

- *Standard Methods for the Examination of Water and Wastewater*, 18th Edition (1992); 19th Edition (1995), 20th Edition (1998). See Introduction in Part 1000.

- 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act.

- 40 CFR Part 141, National Primary Drinking Water Regulations.

- *Analytical Methods for Petroleum Hydrocarbons*, ECY 97-602, Washington State Department of Ecology, June 1997.

- State-specific total petroleum hydrocarbon methods for the analysis of samples for gasoline, diesel, and other petroleum hydrocarbon products (Alaska, Arizona, California, Oregon, Washington, Wisconsin, etc.).

- Annual Book of ASTM Standards, Part 31, Water.

- EPA Contract Laboratory Program, Statement of Work for Organic Analysis, SOW Nos. OLM03.1, OLM03.2, OLM04.2, and OLM04.3.

- EPA Contract Laboratory Program, Statement of Work for Inorganic Analysis, SOW No. ILM04.0, ILM04.1, and ILM05.2.

- *U. S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA-540/R-94/012 (February 1993).

- *U. S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA-540/R-94/013 (February 1994).

- National Institute for Occupational Safety and Health (NIOSH) *Manual of Analytical Methods*, Third Edition (August 1987); Fourth Edition (August 1994).

- *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound*, for USEPA and USACE (March 1986), with revisions through April 1997.

- WDOE 83-13, *Chemical Testing Methods for Complying with the State of Washington Dangerous Waste Regulations* (March 1982) and as Revised (July 1983 and April 1991).

- *Identification and Listing of Hazardous Waste,* California Code of Regulations, Title 22, Division 4.5, Chapter 11.

- *Analytical Methods for the Determination of Pollutants in Pulp and Paper Industry Wastewater*, EPA 821-R-93-017 (October 1993).

- *Analytical Methods for the Determination of Pollutants in Pharmaceutical Manufacturing Industry Wastewaters*, EPA 821-B-98-016 (July 1998).

- National Council of the Pulp and Paper Industry for Air and Stream Improvement (NCASI).

- *Good Automated Laboratory Practices, Principles and Guidance to Regulations For Ensuring Data Integrity In Automated Laboratory Operations*, EPA 2185 (August 1995).

- *Manual for the Certification of Laboratories Analyzing Drinking Water*, 4th Edition, EPA 815-B-97-001 (March 1997).

- National Environmental Laboratory Accreditation Program (NELAP), 2003 Quality Standards.

- *Department of Defense Quality Systems Manual for Environmental Laboratories*, Final Version 3 (January 2006).

APPENDIX A

LIST of QA PROGRAM DOCUMENTS

Quality Assurance Manual	1/30/08
Software Quality Assurance Plan	7/11/05
CAS-Kelso Certifications/Accreditations	Cert_kel.xls
Columbia Analytical Services MDL Tracking Spreadsheet	Mdl_list.xls
Technical Training Summary Database	TrainDat.mdb
Approved Signatories List	AppSignatories.pdf
Personnel resumes/qualifications	HR Department
Personnel Job Descriptions	HR Department
Quality Control Acceptance Criteria	Qclimits.xls
Master Logbook of Laboratory Logbooks	Masterlog-001

ADMINISTRATIVE STANDARD OPERATING PROCEDURES

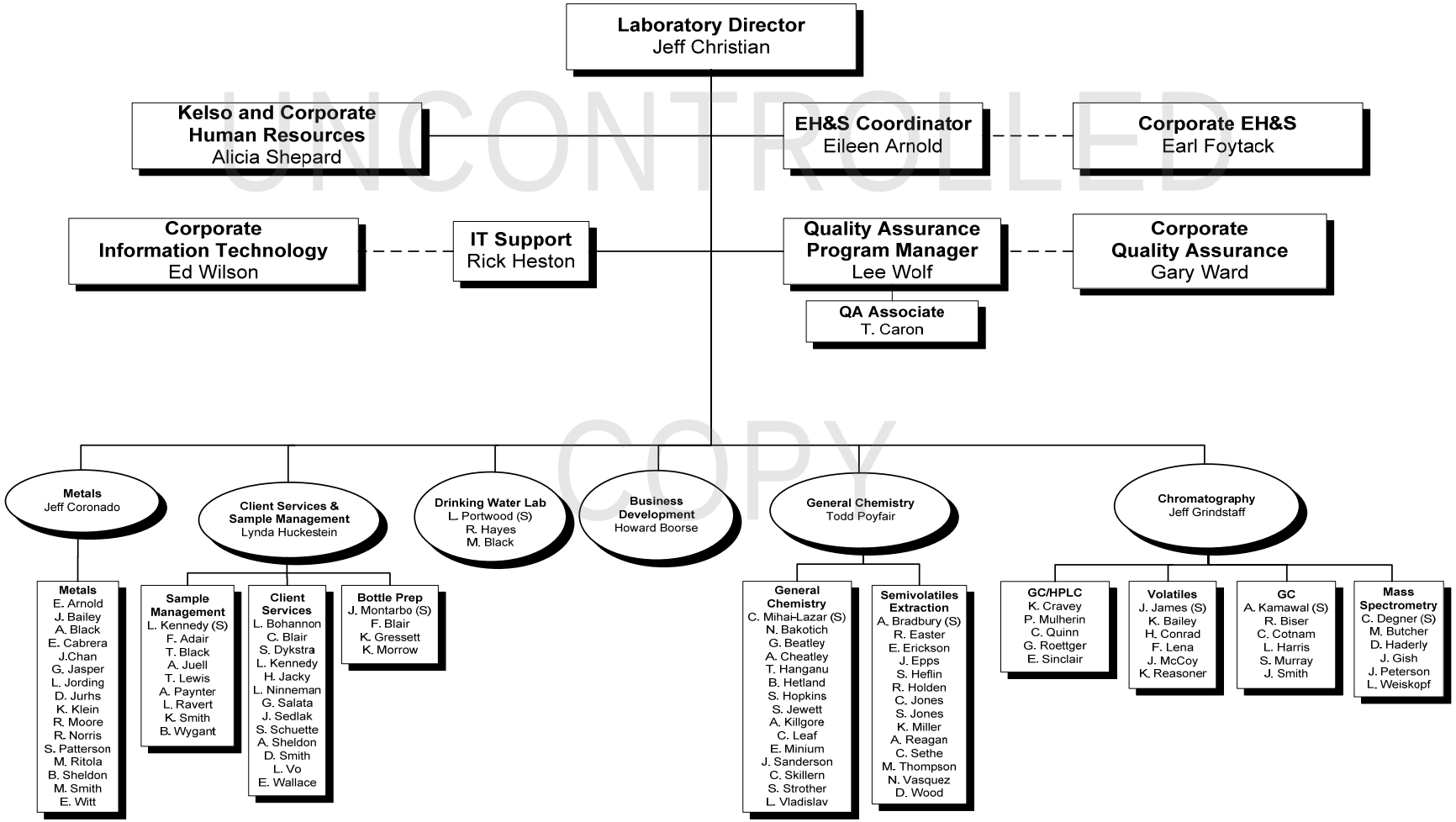
ADMINISTRATIVE - CORPORATE	**FILE NAME**
CHECKING NEW LOTS OF CHEMICALS FOR CONTAMINATION	**ADM-CTMN**
CONTROL LIMITS	**ADM-CTRL_LIM**
CORRECTIVE ACTION	**ADM-CA**
DATA RECALL	**ADM-DATARECALL**
HANDLING CUSTOMER FEEDBACK	**ADM-FDBK**
DETERMINATION OF METHOD DETECTION LIMITS AND LODS	**ADM-MDL**
DOCUMENT CONTROL	**ADM-DOCCTRL**
DOCUMENTATION OF TRAINING	**ADM-TRANDOC**
ELECTRONIC DATA AUDITING	**ADM-E_DATAAUDIT**
ESTIMATION OF UNCERTAINTY OF MEASUREMENTS	**ADM-UNCERT**
MAKING ENTRIES INTO LOGBOOKS AND ONTO BENCHSHEETS	**ADM-DATANTRY**
MANAGERIAL REVIEW OF THE LABORATORY'S QUALITY SYSTEM	**ADM-MGMTRVW**
MANUAL INTEGRATION OF CHROMATOGRAPHIC PEAKS	**ADM-INT**
PREPARATION OF ELECTRONIC DATA FOR ORGANIC ANALYSES ELECTRONIC DATA AUDITS	**ADM-EDATA**
PREPARATION OF STANDARD OPERATING PROCEDURES	**ADM-SOP**
PROFICIENCY TESTING SAMPLE ANALYSIS	**ADM-PTS**
PURCHASING THROUGH CAS PURCHASING DEPARTMENT IN KELSO	**ADM-PUR**
QUALIFICATION OF SUBCONTRACT LABORATORIES OUTSIDE OF CAS NETWORK	**ADM-SUBLAB**
SIGNIFICANT FIGURES	**ADM-SIGFIG**

ADMINISTRATIVE – LOCAL LABORATORY	**FILE NAME**
ARMY CORPS OF ENGINEERS HTRW PROJECT MANAGEMENT	**ADM-HTRW**
CHECKING PIPETTE CALIBRATION	**ADM-CPIP**
CONTINGENCY PLAN FOR LABORATORY EQUIPMENT FAILURE	**ADM-ECP**
CONTROL CHARTING QUALITY CONTROL DATA	**ADM-CHRT**
DATA ARCHIVING	**ADM-ARCH**
DATA REPORTING AND REPORT GENERATION	**ADM-RG**
DEPARTMENT OF DEFENSE PROJECTS LABORATORY PRACTICES AND PROJECT MANAGEMENT	**ADM-DOD**
ELECTRONIC DATA BACKUP AND ARCHIVING	**ADM-EBACKUP**
INTERNAL QUALITY ASSURANCE AUDITS	**ADM-IAUD**
LABORATORY BALANCE MONITORING AND CALIBRATION	**ADM-BAL**
LABORATORY DATA REVIEW PROCESS	**ADM-DREV**
METHOD DETECTION LIMIT DOCUMENTATION AND CONTROL	**ADM-MDLC**
PROJECT MANAGEMENT	**ADM-PCM**
REAGENT LOGIN AND TRACKING	**ADM-RLT**
SUPPORT EQUIPMENT MONITORING AND CALIBRATION	**ADM-SEMC**
SAMPLE MANAGEMENT SOPS	**FILE NAME**
BOTTLE ORDER PREPARATION AND SHIPPING	SMO-BORD
FOREIGN SOILS HANDLING TREATMENT	SMO-FSHT
SAMPLE DISPOSAL	SMO-SDIS
SAMPLE RECEIVING	SMO-GEN
SAMPLE TRACKING AND LABORATORY CHAIN OF CUSTODY	SMO-SCOC
TECHNICAL STANDARD OPERATING PROCEDURES	
SOP TABLE OF CONTENTS	SOPLIST.XLS

APPENDIX B

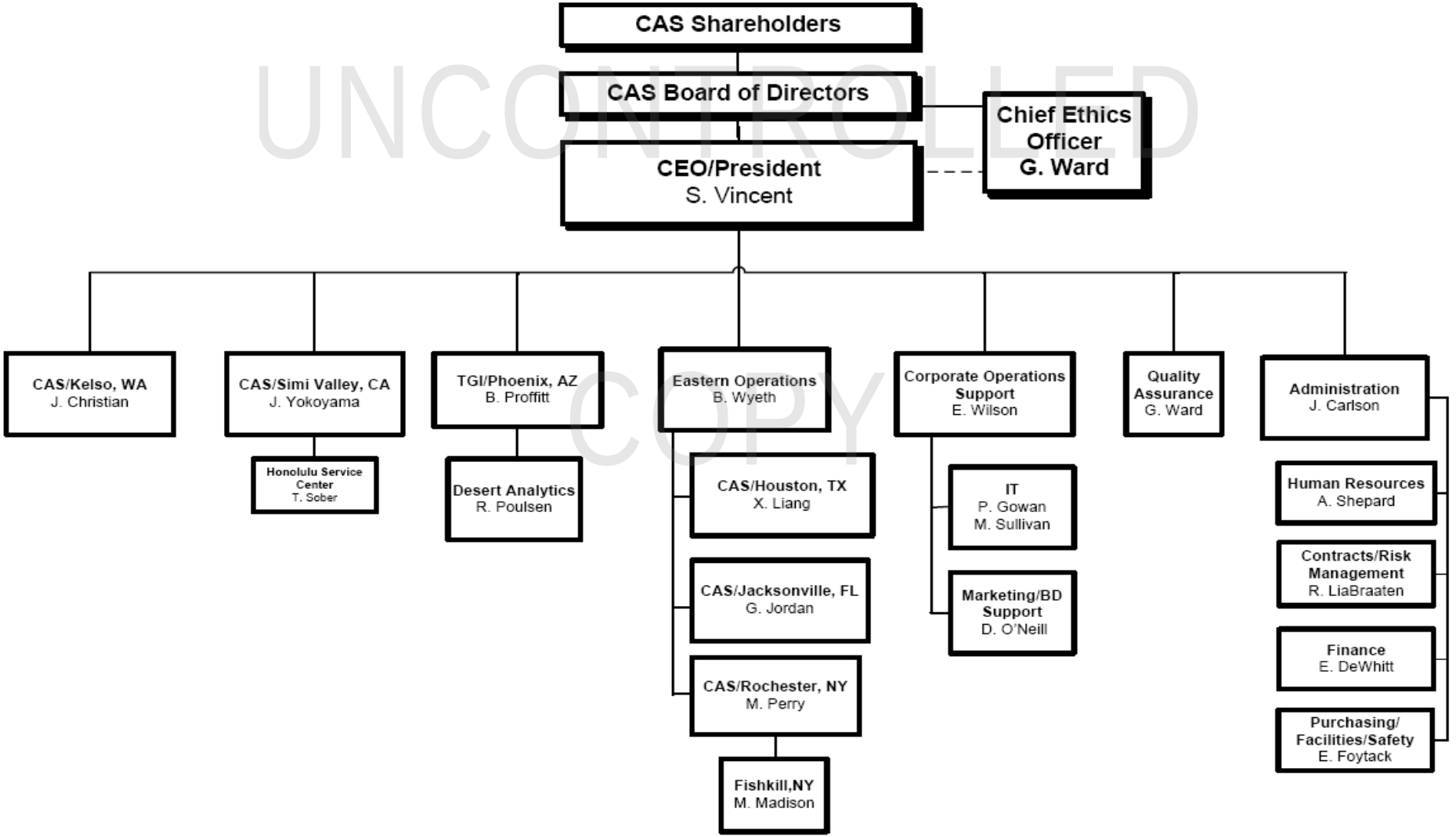
ORGANIZATIONAL CHARTS and RESUMES OF KEY PERSONNEL

Environmental and General Testing Division
Columbia Analytical Services, Inc.
Kelso, Washington Laboratory Organization



Revised 3/1/08

Columbia Analytical Services, Inc.
Laboratory Division Organization



JEFFREY D. CHRISTIAN

1989 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

VICE PRESIDENT/NW REGIONAL DIRECTOR – 1996 to Present

Responsibilities

Responsible for all phases of laboratory operations at the Kelso (WA) and Redding (CA) facilities, including project planning, budgeting, and quality assurance. Primary duties include the direct management of the Kelso laboratory (i.e. serves as the Kelso Laboratory Director, 1993-present). Also responsible for additional duties acquired as a member of the Columbia Analytical Services Holdings, Inc., Board of Directors.

Experience

Laboratory Director, Kelso Laboratory, *Columbia Analytical Services, Inc., Kelso, Washington,* 1993-1995. Responsible for all phases of laboratory operations, including project planning, budgeting, and quality assurance.

Operations Manager, Kelso Laboratory, *Columbia Analytical Services, Inc., Kelso, Washington,* 1992-1993. Responsibilities included directing the daily operation of the Kelso laboratory. Other responsibilities and duties included functioning as a technical consultant to clients, providing assistance in developing and planning analytical schemes to match client objectives, and writing and developing analytical procedures/methods. Also, served as Project Manager for State of Alaska Department of Environmental Conservation contract and Coordinator for EPA Special Analytical Services (SAS) contracts.

Project Chemist and Manager, Metals Analysis Laboratory, *Columbia Analytical Services, Kelso, Washington,* 1989-1992. Responsible for directing the daily operation of the Metals Laboratory, including the sample preparation, AAS, ICP-OES, and ICP-MS Laboratories.

Scientist, *Weyerhaeuser Technology Center, Federal Way, Washington,* 1986-1989. Responsibilities included supervising atomic spectroscopy laboratory which included flame and furnace AAS, ICP-OES, and sample preparation capabilities to handle a wide variety of sample types. Interfaced with internal and external clients to provide technical support. Wrote and developed analytical procedures/methods.

Lead Technician, Metals Lab, *Weyerhaeuser Technology Center, Federal Way, Washington,* 1981-1986. Responsibilities included primary ICP and AAS analyst for EPA-CLP contract work. Extensive experience in wide variety of environmental and product-related testing.

Research Assistant, *ITT Rayonier, Olympic Research Division, Shelton, Washington,* 1978-1981. Responsibilities included performing water quality tests, product-related analytical tests, corrosion tests (i.e., potentiometric polarization techniques), and operated pilot equipment specific to the pulp and paper industry.

Education

B.S., Chemistry, *Evergreen State College, Olympia, Washington,* 1993.
ICP/MS Training Course, *VG-Elemental,* 1992.
Coursework, *Pacific Lutheran University, Tacoma, Washington.* 1988-1989.
Coursework, *Tacoma Community College, Tacoma, Washington.* 1970-1971, 1988-1989.
Perkin-Elmer Advanced Furnace, *Norwalk, Connecticut,* 1986.
CERTIFICATION, Chemistry, *L.H. Bates Technical, Tacoma, Washington,* 1978.
Coursework, *Central Washington University, Ellensburg, Washington.* 1969-1970.

Publications/ Presentations

On request.

LEE E. WOLF

1988 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

TECHNICAL MANAGER IV, KELSO QUALITY ASSURANCE MANAGER – 2002 to Present

Responsibilities

Responsible for the overall coordination of the laboratory QA program, and for ensuring that established quality objectives are met. Responsible for Quality Assurance function, including the Quality Assurance Manual, certifications, documenting SOPs, and maintaining performance evaluation records. Oversee balance calibration and sample storage temperature control. Maintain certifications/accreditations for regulatory agencies and client certifications or approval programs. Act as primary point of contact during laboratory audits. Provides audit responses and initiates any changes in procedures resulting from an audit. Coordinate the analysis of performance evaluation samples required for certification/accreditation programs. Report and review results for these analyses. Conduct internal audits and make recommendations for corrective action.

Experience

Scientist IV, Kelso Quality Assurance Manager, *Columbia Analytical Services, Inc., Kelso, Washington,* 1996-2002. Duties primarily as listed above.

Project Chemist/Principal Organic Scientist, *Columbia Analytical Services, Inc., Kelso, Washington,* 1994-1996. Responsibilities included GC and GC/MS method development and special projects coordination. Acts as technical advisor to the GC and GC/MS laboratories and GC/MS interpretation specialist and CLP organics specialist. Also responsible for Project Chemist functions, including management and coordination of projects for clients, identifying client needs, and preparation of data reports.

Semi-VOA Department Manager, *Columbia Analytical Services,* 1988-1994. Responsibilities included overall management of the Semi-VOA department. Oversee the operation of Semi-VOA GC/MS, data review and reporting and related QA/QC function. Also responsible for supervision of staff, including training, scheduling, and other personnel issues. Beginning in 1992, increased responsibilities to include Project Chemist functions for organics EPA-SAS and other clients. This involved scheduling projects for clients, identifying client needs, and preparing data reports.

GC/MS Chemist, *U.S. Testing Co., Richland, Washington,* 1985-1988. Responsibilities included GC and GC/MS analysis of water and soil samples for volatiles and Semi-VOA by EPA protocol, including Methods 8240, 8270 and CLP. Coordinated extraction and GC-GC/MS areas to manage sample/data flow through the lab. Experience also with pesticide/PCB analysis by EPA Methods 8080 and CLP. Responsible for development of analysis methods for non-routine pesticides and herbicides and performed HPLC analysis.

Laboratory Assistant, *Eastern Washington University, Cheney, Washington,* 1985. Responsibilities included supervision and instruction of organic chemistry labs. Experience with GC and IR operation. Responsible for lab safety.

Chemist Assistant, *Spokane County Air Pollution Control Authority, Spokane, Washington,* 1984. Responsibilities included gathering and analyzing air samples for CO content using IR equipment.

Education

Documenting Your Quality System, *A2LA Short Course, Las Vegas, Nevada,* 1998.
Internal Laboratory Audits, *A2LA Short Course, Las Vegas, Nevada,* 1998.
Mass Spectra Interpretation, *ACS Short Course, Denver, Colorado,* 1992.
BS, Chemistry, Minor in Geology, *Eastern Washington University, Cheney, Washington,* 1985.

Publications/ Presentations

On Request.

Affiliations

American Chemical Society.

LYNDA A. HUCKESTEIN

1989 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

CLIENT SERVICES MANAGER IV – 1998 to Present

Responsibilities

Management of the Client Services Departments: Project Management, Electronic Data Deliverables and Report Generation, and Sample Management. Personally responsible for approximately 1.5 million dollars of client work annually performing technical project management and client service. Provides technical and regulatory interpretation assistance as-well-as project organization to work received by the laboratory.

Documentation of Demonstration of Capabilities is available for review.

Experience

Project Chemist, *Columbia Analytical Service, Inc., Kelso, Washington,* 1992-1998. Primary responsibilities included technical project management and client service in areas of pulp & paper, marine services, mining, and DOD. Also responsible for providing technical and regulatory interpretation assistance as-well-as project organization to work received by the laboratory

Project Chemist and Department Manager, General Chemistry Laboratory, *Columbia Analytical Services, Inc.,* 1989-1992. Responsible for management of the General Chemistry laboratory for routine wastewater, bioassay, and microbiological analyses. Also responsible for supervision of staff, data review, and reporting.

Analyst III, *Columbia Analytical Services, Inc., Kelso, Washington,* 1989. Primary responsibilities included coliform testing, total recoverable petroleum hydrocarbon extractions and analysis, BODs, ammonias, and TKN, in addition to miscellaneous wet chemistry analyses.

Microbiologist/Chemist, *Coffey Laboratories, Portland, Oregon,* 1983. Coliform analysis; water chemistry.

Laboratory Assistant, *Oregon State University, Corvallis, Oregon,* 1983. Wheat spike dissection and tissue culture.

Education

BS, Microbiology, *Oregon State University, Corvallis, Oregon,* 1983.

JEFFREY A. CORONADO

1989 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

TECHNICAL MANAGER IV, METALS DEPARTMENT MANAGER – 2001 to Present

Responsibilities

Primary responsibilities include management of the Metals laboratory department. Responsible for training oversight, data review, report accuracy and timeliness QA/QC implementation, tracking department workload, and scheduling and performance of the Metals department. Also responsible for departmental budgets, method development efforts, and resource allocation.

Documentation of Demonstration of Capabilities is available for review.

Experience

Metals Department Manager, *Columbia Analytical Services, Inc., Kelso, Washington,* 1992-2001. Responsibilities included management of all aspects of the metal laboratory operation, including personnel training and evaluation, review of all metals data, and report generation. Also responsible for client service on a number of ongoing CAS accounts. Technical duties include primary analytical responsibility for trace level metals analysis by ICP/MS. Analyses range from routine water and soil analysis, to marine tissues, as well as industrial applications such as ultra-trace QA/QC work for various semiconductor clients. Also responsible for a number of specialized sample preparation techniques including trace metals in seawater by reductive precipitation, and arsenic and selenium speciation by ion-exchange chromatography. Developed methodology for performing mercury analysis at low part per trillion levels by cold vapor atomic fluorescence..

Supervisor, GFAA Laboratory, *Columbia Analytical Services, Inc., Kelso, Washington,* 1989-1992. Responsibilities included supervision of metals analysis by graphite furnace atomic absorption following SW-846 and EPA CLP methodologies. Duties include workload scheduling, data review, instrument maintenance, personnel training and evaluation.

Education

Field Immunoassay Training Course, *EnSys Inc*., 1995.
Winter Conference on Plasma Spectrochemistry, *San Diego, California*, 1994.
ICP-MS Training Course, *VG-Elemental*, 1992.
BS, Chemistry, *Western Washington University, Bellingham, Washington,* 1988.
BA, Business Administration, *Western Washington University, Bellingham, Washington,* 1985.

JEFFREY A. GRINDSTAFF

1991 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

TECHNICAL MANAGER III, CHROMATOGRAPHY AND MASS SPECTROMETRY LABORATORIES – 1997 to Present

Responsibilities

Primary responsibilities include management of the GC/MS SemiVoa and VOA laboratory departments. Responsible for training oversight, data review, report accuracy and timeliness QA/QC implementation, tracking department workload, and scheduling and performance of the GC/MS departments. Also responsible for departmental budgets, method development efforts, and resource allocation. Also performs GC/MS maintenance and troubleshooting.

Documentation of Demonstration of Capabilities is available for review.

Experience

Manager, GC/MS VOA Laboratory, *Columbia Analytical Services, Inc., Kelso, Washington,* 1994-1997. Responsible for supervision of GC/MS VOA staff, method development, training, data review, tracking department workload, scheduling analyses, and general maintenance and troubleshooting of GC/MS systems.

Scientist III, GC/MS VOA Laboratory, *Columbia Analytical Services, Inc., Kelso, Washington,* 1991-1994. Responsibilities included scheduling workload, data review, instrument maintenance and troubleshooting, and personnel training and evaluation. Also responsible for supervision of extraction personnel and instrument analysts. Additional supervisory duties included report generation and data review for GC analyses. Responsibilities also included project management and customer service.

Chemist, *Enseco-CRL, Ventura, California,* 1990-1991. Established GC/MS department including inventory maintenance, preparation of state certification data packages, method development, SOPs, and extended data programs. Performed daily maintenance and troubleshooting of GC and GC/MS instrumentation. Scheduled and performed routine and non-routine VOA analyses.

GC/MS Chemist, VOA Laboratory *Coast-to-Coast Analytical Service, San Luis Obispo, California,* 1990-1991. Responsible for standard preparation for VOA analyses and instrument calibration, tuning, and maintenance. Also implemented and further developed EPA methods for quantitative analysis of pesticides and priority pollutants..

Education

Mass Selective Detector Maintenance, *Hewlett-Packard Education Center,* 1993.
Interpretation of Mass Spectra I, *Hewlett-Packard Analytical Education Center,* 1992.
B.S., Chemistry, *California Polytechnic State University, San Luis Obispo, California,* 1989.
A.A., Liberal Arts, *Allan Hancock College, Santa Maria, California.* 1986

Publications/ Presentations

Alternate Method to Lower Detection Limits to Satisfy Regulatory Action Levels for Volatiles in Groundwater, with David Edelman, Kairas Parvez, and Paul Laymon. TAPPI National Meeting, Orlando, Florida. 1996

Affiliations

American Chemical Society. 1989

TODD N. POYFAIR

1991 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

TECHNICAL MANAGER III, INORGANICS & EXTRACTIONS LABORATORIES – 2001 to Present

Responsibilities

Primary responsibilities include management of the GC, HPLC, and General Chemistry laboratory departments. Responsible for training oversight, data review, report accuracy and timeliness QA/QC implementation, tracking department workload, and scheduling and performance of the these departments. Also responsible for departmental budgets, method development efforts, and resource allocation.

Documentation of Demonstration of Capabilities is available for review.

Experience

Supervisor/Manager, General Chemistry Department, *Columbia Analytical Services, Inc., Kelso, Washington,* 1995-2001. Responsibilities included supervision, management, and training of General Chemistry staff. Also responsible for workload coordination, data review, reporting, and instrument maintenance within the General Chemistry department.

Project Chemist, Client Services Group, *Columbia Analytical Services, Inc., Kelso, Washington,* 1993-1995. Responsibilities included technical project management and customer service. Responsible for meeting the clients' needs of timely and appropriate analyses, and to acted as liaison for all client-related activities within CAS.

Scientist II, General Chemistry Laboratory, *Columbia Analytical Services, Inc., Kelso, Washington,* 1992-1993. Responsibilities included the review and summarization of pH, alkalinity, conductivity, turbidity, hardness, and CODs.

Scientist I, **General Chemistry Laboratory,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1992. Responsibilities included analysis of Total Organic Halogens, Chemical Oxygen Demand, Sulfides, Ammonia, TKN, Nitrate/Nitrite by Lachat, and Cyanide.

Analyst III, **General Chemistry Laboratory,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1991-1992. Responsibilities included analysis of pH, Conductivity, Alkalinity, Turbidity, and Oil and Grease.

Education

BS, Chemistry, *Portland State University, Portland, Oregon,* 1991.
BA, German, *Portland State University, Portland, Oregon,* 1990.
COURSEWORK, *Brigham Young University, Provo, Utah.* 1982-1983 & 1985-1986.

LOREN E. PORTWOOD

1992 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

SCIENTIST IV, DRINKING WATER LABORATORY MANAGER– 2008 to Present

Responsibilities

Responsible for the overall operation and supervision of the Organic Drinking Water department, including oversight of UCMR2 analyses. Perform analyses and conduct data review. Perform method development. Work with project management of drinking water accounts. Development of Standard Operating Procedures for drinking water methods. Operation of Varian GC/MS, Agilent GC/ECD and Agilent HPLC.

Documentation of Demonstration of Capabilities is available for review.

Experience

Scientist IV, Drinking Water Laboratory, *Columbia Analytical Services, Inc., Kelso, Washington,* 2002-2008. Plan, conduct, and, as lead analyst, supervise analyses using advanced instrumentation such as HPLC with post column derivatization, GC/MS, and GC/ECD. Responsible for data interpretation, QC, and data reporting. Also responsible for preparation of SOPs; handling routine and advanced maintenance and troubleshooting of instrumentation; and assisting in the training of staff department analysts. Assists the department manager and/or other senior scientists in setting up more complex procedures.

Technical Manager I, Petroleum Hydrocarbon Laboratory Supervisor, Primary responsibilities included oversight of the PHC laboratory, including initiating new processes and staff development and training. Responsible for CAS QA compliance, routine system checks. Technical mentor to PHC staff. Also duties listed below under Scientist II and Scientist III.

Scientist III, Petroleum Hydrocarbon Laboratory, Columbia Analytical Services, Inc., Kelso, Washington, 1997-1998. Duties primarily as listed below.

Scientist II, **Petroleum Hydrocarbon Laboratory,** Columbia Analytical Services, Inc., Kelso, Washington, 1996-1997. Duties primarily as listed below, and including HPLC methods 8310, 8315, and 8330.

Scientist I, Petroleum Hydrocarbon Laboratory, Columbia Analytical Services, Inc., Kelso, Washington, 1993-1996. Primary responsibilities included the analysis, reporting, and archiving of water, soil, and product samples for semi-volatile petroleum hydrocarbons. Methods of analysis include EPA method 8015 and various state modifications thereof (OR, WA, CA, AK). Additional responsibilities include sample preparation, instrument maintenance, and assistance with other departmental analyses.

Bench Chemist I, Organic Extractions Laboratory, Columbia Analytical Services, Inc., Kelso, Washington, 1992-1993. Primary responsibilities included performing a wide range of organics extractions and cleanups for water, soil, and oil to be analyzed in the GC, GC/MS, and PHC laboratories.

Chemist, Treclen Laboratories, Spokane, Washington, 1990-1992. Primary responsibilities included inorganic water and soil testing by EPA methods. Developed testing which was accredited by the EPA, including metal digestions, phosphates, and TSS/ TDS.

Education

BS, Chemistry, Emphasis in Biochemistry, *Whitworth College, Spokane, Washington,* 1990.
Several vendor chromatography, GC, HPLC, and Quality training courses, 1993-2002.

EILEEN M. ARNOLD

1987 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

SCIENTIST IV, METALS LABORATORY, KELSO HEALTH AND SAFTEY OFFICER – 1994 to Present

Responsibilities

Duties include the operation and maintenance of the Inductively Coupled Argon Plasma (ICAP) Emission Spectrometer. This involves digestion, instrumental analysis, and report generation for environmental samples using approved EPA techniques. Health and Safety Officer responsibilities included development and implementation of the Kelso Health and Safety program, including accident investigation and incident review, maintenance of all safety related equipment and documents, and performance of monthly safety audits.

Documentation of Demonstration of Capabilities is available for review.

Experience

Project Chemist, Client Services Group, Kelso Health and Safety Officer, *Columbia Analytical Services, Inc., Kelso, Washington,* 1992-1994. Duties included technical project management and customer service. Responsible for meeting the clients' needs of timely and appropriate analyses, and to act as liaison for all client-related activities within Columbia Analytical Services, Inc. Health and Safety Officer responsibilities included development and implementation of the Kelso Health and Safety program, including accident investigation and incident review, maintenance of all safety related equipment and documents, and performance of monthly safety audits.

Scientist IV, Metals Laboratory, Health and Safety Officer, *Columbia Analytical Services, Inc., Kelso, Washington, 1987-1992.* Duties include the operation and maintenance of the Inductively Coupled Argon Plasma (ICAP) Emission Spectrometer. This involves digestion, instrumental analysis, and report generation for environmental samples using approved EPA techniques. Health and Safety Officer responsibilities included development and implementation of the Kelso Health and Safety program, including accident investigation and incident review, maintenance of all safety related equipment and documents, and performance of monthly safety audits.

Chemist, *Dow Corning Corporation, Springfield, Oregon,* 1986-1987. Responsibilities included ICP and atomic absorption work in silicon manufacturing. Methods development for ICP analysis of minor impurities found in silicon.

Chemist, *Ametek, Inc., Harleysville, Pennsylvania,* 1982-1985. Responsibilities included product research and development chemist involved in production of thin-film semiconductors for use as solar cells. Work involved AA and SEM techniques.

Chemist, *Janbridge, Inc., Philadelphia, Pennsylvania,* 1978-1982. Responsibilities included maintaining electroplating process lines through wet chemical analysis techniques, and performed Quality Assurance testing on printed circuit boards.

Education

BA, Chemistry, *Immaculata College, Immaculata, Pennsylvania,* 1977.

Affiliations

American Chemical Society, Member since 1987.

ED WILSON

1999 TO PRESENT

Columbia Analytical Services, Inc. 1317 South 13th Avenue Kelso, WA 98626 (360)577-7222

Current Position

DIRECTOR OF IT AND MARKETING – 2007 to Present

Responsibilities

Responsible for planning and implementing the CAS IT and marketing strategies.

Documentation of Demonstration of Capabilities is available for review.

Experience

Laboratory Director/Southwest Regional Manager, *Columbia Analytical Service, Inc., Canoga Park, California,* Responsible for the Canoga Park Laboratory and provides oversight of the Simi Valley, CA and Phoenix, AZ laboratories. Participates in strategic planning activities as part of the Senior Management Team of Columbia Analytical Services, Inc. 2002-2007.

Laboratory Director, *Columbia Analytical Service, Inc., Redding, California*, 1999-2002. Continued as Laboratory Director of the Redding Laboratory for Columbia Analytical Services, diversifying the laboratory into non-CH2M Hill clients.

Laboratory Director, *CH2M HILL, Redding, California*, 1998 -1999. Responsible for the operation of $3.5mm laboratory operation employing more than 40 people. Duties include P/L responsibility, and maintaining systems to ensure quality and client satisfaction. The laboratory specialized in Federal Program and Industrial Package work.

LIMS implementation, *CH2M Hill, Montgomery, Alabama,* 1997-1998. Participated as a member of the LIMS Implementation team.

Laboratory Director, *Columbia Analytical Services, Canoga Park, California,* 1996-1997. Responsible for the Southern California operation; this includes the main lab, mobile laboratories and Southern California sales. Also participates in strategic planning activities within the Southwest Division of Columbia Analytical Services, Inc.

Laboratory Director, *PACE, Camarillo, California*, 1995. Responsible for operation of the Camarillo and Fountain Valley laboratories, and the Phoenix and San Luis Obispo service centers. Also responsible for the planning, sales, marketing and financial management of the region. The laboratory specialized in Air Toxics, Sediment and Tissue analysis, and Drinking Water Analyses.

Vice President Operations, *ATI – San Diego,* 1993-1995. Responsible for ATI's eight fixed based laboratories (Anchorage, Seattle, Portland, San Diego, Phoenix, Albuquerque, Fort Collins, and Pensacola) and the nine mobile laboratories. He managed the startup of the Anchorage laboratory from writing the business plan, hiring a manager, oversight of the design and construction and staff selection through the successful startup. He served as Program Director on high profile projects such as ATI's $1M Jacobs/Navy/MCAS-Yuma mobile laboratory project. He developed and implemented systems for Variable Labor Management, Revenue and PBT Forecasting, Capacity Utilization measurement, Performance Ranking/Management Staff Planning, Job Classification, and Salary Administration. Principal role was to provide direction and advice to managers and to balance workloads and resolve resource conflicts across the network.

President, *BC Analytical*, 1980-1993. Developed a high quality, profitable well-diversified laboratory. Working with the Brown and Caldwell Consulting organization he built up the Southern California laboratories from a strong municipal wastewater business base bringing in key industrial and federal marketplace accounts. He was responsible for business development, long-range planning, budgeting staffing decisions, and overall operations for the region. He oversaw the acquisition of the PJB Laboratory from Jacobs Engineering, managed the design and construction of two laboratories - a 10,000 square-foot facility and Anaheim in 1988 and a 22,000 sq. ft. in Glendale in 1989.

Chemist, *Los Angeles Sanitation Districts, Los Angeles, California,* 1973-1980. Developed a thorough understanding of environmental chemistry, Wastewater Treatment technologies and plant operations.

Education

Accounting course work, *University of California in Los Angeles extension*, 1992.
Human Resources course work, *University of California in Los Angeles extension*, 1991.
Environmental Engineering course work, *California State University, Long Beach, California*, 1974-1976.
Post Graduate Coursework, Biochemistry, *California State University, Long Beach, California*, 1972-1976.
BA, Chemistry, *Southern Connecticut State College, New Haven, Connecticut*, 1972.

Affiliations

California State University, Long Beach, Member Curriculum Advisory Council
Society of American Military Engineers
Sierra Club

GARY K. WARD

2001 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

VICE PRESIDENT, CHIEF QUALITY, SAFETY, AND ETHICS OFFICER – 2001 to Present

Responsibilities

Responsibilities include directing and managing the overall corporate-wide quality systems, ethics and safety programs for all CAS facilities, as well as strategic planning, marketing, business development, and information technology. Responsible for all interaction and liaison with government entities involving quality, technical and operational issues.

Experience

Deputy Director, Laboratory Standards, *Intertek Testing Services, Houston, Texas,* 1998-2001. Responsibilities included professional standards/quality assurance for 240 laboratories in 93 countries, involving laboratory tests ranging from petroleum products and environmental samples to toys, textiles, and building products. Resolution of issues with a variety of governments, agiences, and companies with particular focus on interactions with the US EPA. Was previously responsible for all operations of over 100 labs in the Americas, ranging from Canada to South America, including duties to improve quality, raise profits and revenues, and implement a LIMS.

Director, Technical Operations, *Environmental Health Laboratories, South Bend, Indiana,* 1995-1998. Responsibilities included operations and quality assurance of the laboratory. Directed, administered and coordinated activities of the lab in accordance with goals and objectives of the company. Responsible for the R&D program, laboratory throughput and financial performance, and implementation of the new LIMS system.

Executive Scientist, *Quanterra (Enseco), Arvada, Colorado,* 1987-1995. Responsibilities included providing expertise and experience in laboratory analysis and operations to the entire laboratory system. Duties included implementation of network-wide LIMS as well as coordination of the Technology, QA, IS, and Operations groups. As Director of Technology and Quality Assurance was responsible for management of the R&D program, Quality Assurance program, and Environment, Health and Safety program throughout the Enseco lab system. Direct reports were all QA managers, safety managers, and chief scientists from each of the 13 laboratories.

Deputy Branch Chief, *U.S. Environmental Protection Agency,* 1983-1987. Responsibilities included providing expertise to entire Superfund program ranging from lab analytical services to sampling. Duties involved managing the CLP program as well as the Superfund R&D program. As CLP National Program Manager was responsible for development and implementation of CLP analytical protocols, administration of contracts for over 100 laboratories throughout the country, and liasion with contract divisions, other EPA programs, and enforcement. Responsible for development and implementation of disk deliverables, automated contract screening, as well as writing new protocols for specific methods such as ICP/MS and for EPA methods such as included in SW846, 3rd Edition. Duties also included coordination of the annual CLP conferences.

Education

MS, Chemical Oceanography, *RSMAS, University of Miami, Miami, Florida,* 1973.
BS, Chemistry, *Loyola University, Los Angeles, California,* 1970.

Publications, Presentations. And Affiliations

Mr. Ward has a number of publications and presentations, and is affiliated with several professional organizations. For a list of these, please contact CAS.

STEPHEN W. VINCENT

1986 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

PRESIDENT, CAS HOLDINGS INC. – 1986 to Present

Responsibilities

Responsible for the overall growth and profitability of the CAS laboratory network. This includes establishing and implementing long-range objectives, plans, and policies, and representing the company with its major customers, technical community, and the public.

Experience

Laboratory Manager, *Weyerhaeuser Company, Federal Way, Washington,* 1979-1986. Responsibilities involved all phases of technical and administrative management. This included management of organic, inorganic, and microbiological analyses and management of capital; an annual operating budget of approximately $2 million; management of thirty staff members; contract procurement, and project management. Projects included an EPA Inorganic CLP contract; an EPA acid rain deposition contract; a contract with the Fish and Wildlife Service to measure trace organic contaminants in animal tissues; and others.

Analytical Chemist, *Weyerhaeuser Company, Longview, Washington,* 1975-1979. Responsibilities: Method development, routine analysis and supervision for the Weyerhaeuser Multi-Region Support Lab. Responsible for setting up a company-wide laboratory audit, round robin, and quality assurance program.

Education

Market Strategy for Technology Based Companies, *Executives Program, Stanford University.* 1994.

Advanced Technical Management Program, *University of California at Los Angeles, Department of Business, Engineering and Management,* 1991.

Completion of Coursework for MS, Pulp and Paper Technology, *University of Washington, Seattle, Washington,* 1984.

Post Graduate Coursework, Engineering and Management, *University of California at Los Angeles, Graduate School of Engineering and Applied Science, Los Angeles, California,* 1981.

BS, Oceanography, *University of Washington, Seattle, Washington,* 1974.

Publications/ Presentations

Mr. Vincent has a number of publications and presentations. For a list of these publications and presentations, please contact CAS.

Affiliations

American Chemical Society.
Technical Association of the Pulp and Paper Industry.

APPENDIX C

MAJOR ANALYTICAL EQUIPMENT

GENERAL CHEMISTRY/WATER CHEMISTRY LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balances (9):			
Precisa and Mettler models	1988-2000	MM	15
Autoclave - Market Forge Sterilmatic	1988	LM	5
Autotitrator – Thermo Orion 500	2007	LM	3
Calorimeters (2):			
Parr 1241 EA Adiabatic	1987	LM	4
Parr 6300 Isoparabolic	2005	LM	4
Centrifuge - Damon/IEC Model K	1992	LM	15
Colony Counter - Quebec Darkfield	1988	LM	4
Conductivity Meters (2):			
YSI Model 3200	2004	LM	4
VWR	2001	LM	4
Digestion Systems (5):			
COD (4)	1987, 1989	LM	5
Kjeldahl, Lachat 46-place (1)	1999	LM	3
Dissolved Oxygen Meter - YSI Model 58 (3)	1987, 1988, 1991	LM	5
Distillation apparatus (Midi) - Easy Still (2)	1996, 2000	LM	7
Drying Ovens (11):			
Shel-Lab and VWR models	1988 - 2003	LM	15
Flash Point Testers (2):			
ERDCO Setaflash Tester	1991	LM	4
Petroleum Systems Services	2005	LM	4
Flow-Injection Analyzers (2):			
Bran-Leubbe	2002	LM	4
Lachat 8500	2007	LM	4
Ion Chromatographs (4)			
Dionex 2000i with Peaknet Data Systems	1988	LM	3
Dionex DX-120 with Peaknet Data System	1998	LM	3
Dionex ICS-2500 with Chromchem Data System	2002	LM	3
Dionex ICS-2000 with Chromchem Data System	2006	LM	3
Ion Selective Electrode Meters (5)			
Fisher Scientific Accument Model 50	1997	LM	6
Fisher Scientific Accument Model 25	1993	LM	6
Fisher Scientific Accument Model 20	2000	LM	6
Orion Model 920A	1990	LM	6
Corning pH/ion Meter Model 135	1992	LM	6
Microscope - Olympus	1988	LM	1
Muffle Furnace- Sybron Thermolyne Model F-A1730	1991	LM	15
pH Meters (2):			
Fisher Scientific Accument Model 20	1993	LM	6
Fisher Scientific Accument Model AR25	2005	LM	6

GENERAL CHEMISTRY/WATER CHEMISTRY LABORATORY (continued)			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Shatter Box - GP 1000	1989	LM	5
Sieve Shakers (2):			
CE Tyler - Portable RX 24	1990	LM	5
WS Tyler - RX 86	1991	LM	5
Thomas-Wiley Laboratory Mill, Model 4	1989	LM	7
Total Organic Carbon (TOC) Analyzers (2)			
Coulemetrics Model 5012	1997	LM	3
O-I Corporation Model 1010	2002	LM	3
Total Organic Halogen (TOX) Analyzers (3):			
Mitsubishi TOX-Sigma	1995	LM	4
Mitsubishi TOX-100 (2)	2001	LM	4
Turbidimeter - Hach Model 2100N	1996	LM	8
UV-Visible Spectrophotometers (2):			
Hitachi 100-40 Single Beam	1986	LM	5
Beckman-Coulter DU520	2005	LM	5
Vacuum Pumps (2):			
Welch Duo-Seal Model 1376	1990	LM	13
Busch R-5 Series Single Stage	1991	LM	13
Water Baths/Incubators (6):			
Hach Model 15320 Incubator	1986	LM	15
Precision Model L-6 (2)	1989, 1990	LM	15
VWR 1540	1991	LM	15
Fisher 11-680-626M Incubator	1992	LM	15
Fisher Isotemp Incubator	2001	LM	15

METALS LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance (6)			
Mettler AE 200 analytical balance	1990	MM	12
Various Mettler, Sartorius, and Ohaus models (5)	1988	MM	12
Atomic Absorption Spectrophotometers (5):			
Varian SpectrAA Zeeman/220 AA w/Data Systems (2)	2000	LM	3
CETAC Mercury Analyzer	2000	LM	2
Perkin Elmer AAnalyst 200 Flame AA	2005	MM	2
Atomic Fluorescence Spectrophotometer			
Brooks-Rand Model III (2)	1996, 2005	LM	3
Leeman Mercury Analyzer (1)	2006	LM	2
Centrifuge - IEC Model Clinical Centrifuge	1990	LM	12
Drying Oven - VWR Model 1370F	1990	LM	12
Freeze Dryers (2) - Labconco	1992, 2006	LM	5
Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES) (3)			
Thermo Jarrell Ash Model 61E	1988	LM	4
Thermo Jarrell Ash, Model IRIS	2000	MM	4
Thermo Scientific Model iCAP 6500	2007	MM	1
Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES):	2000	MM	4
Inductively Coupled Plasma Mass Spectrometers (ICP-MS):			
VG PQ-S	1997	MM	3
VG Excell	2001	MM	3
Thermo X-Series	2006	MM	3
Muffle Furnace - Thermolyne Furnatrol Model 53600 (2)	1991, 2005	LM	5
Shaker - Burrell Wrist Action Model 75	1990	LM	12
TCLP Extractors (3)	1989, 2002	LM	5

SEMIVOLATILE ORGANICS SAMPLE PREPARATION LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance (4)			
Mettler PM480, AE166, BB300	1999 - 2005	MM	18
OHaus EP613	2006	MM	18
Centrifuge - Sorvall Model GLC-1	1988	LM	18
Drying Ovens (2)			
Fisher Model 655G	1991	LM	18
VWR Model 1305U	1999	LM	18
Evaporators (14):			
Organomation N-Evap (7)	1989-98, 2001, 2006	LM	18
Organomation S-Evap (7)	1989-1991, 2006	LM	18
Extractor Heaters: Lab-Line Multi-Unit Models for Continuous Liquid-Liquid and Soxhlet Extractions (102)	1987-1992, 2007	LM	12
Extractors (52):			
Branson Model 450 Sonifier (2)	1991	LM	6
Tekmar Sonicator	1994	LM	6
Fisher Scientific Sonicator	1994	LM	6
Soxhtherm (48)	2000, 2008	LM	8
Extractors, TCLP (10):			
Millipore TCLP Zero Headspace Extractors (10)	1987-1992	LM	2
TCLP Extractor - Tumbler (12 position)	1989	LM	2
Gel Permeation Chromatography (GPC) (5)			
ABC single column (3)	1998, 1999, 2007	LM	4
ABC Autoprep 1000	1995	LM	4
J2 Scientific	2005	LM	4
Muffle Furnace - Parflow MIC 6000	1994	LM	4
Solid Phase Extractors (8) – Dionex SPE-Dex 4790	2003, 2006	LM	4
Ultrasonic Water Bath – VWR 550D	2007	LM	18
Vacuum Pump – Edwards	1992	LM	8

GC SEMIVOLATILE ORGANICS INSTRUMENT LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance - Mettler AT 250	1989	MM	5
Chromatography Data Systems (12)			
HP Enviroquant (8)	1994-2002	LM	5
Thruput Target (4)	1998-2000	LM	5
Gas Chromatographs (14):			
Hewlett-Packard 5890 GC with HP 7673 Autosampler and Dual ECD Detectors (7)	1990 – 1995	LM	5
Hewlett-Packard 5890 GC with HP 7673 Autosampler and Dual FPD Detectors	1991	LM	5
Agilent 6890 GC with Agilent 7683 Autosampler and Dual ECD Detectors (5)	2001, 2005, 2007	LM	5
Agilent 6890 GC with Agilent 7683 Autosampler and Dual FPD Detectors	2003	LM	5

GC/MS SEMIVOLATILE ORGANICS INSTRUMENT LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Accelerated Solvent Extractor - Dionex ASE 200	1996	LM	5
HP Enviroquant Chromatography Data Systems (9)	1994-2002	LM	6
Gas Chromatograph: Hewlett-Packard 5890 with HP 7673 autosampler and FID Detector	1994	LM	2
Semivolatile GC/MS Systems (9):			
Agilent 6890/5973 with ATAS Optic2 LVI and HP 7673 Autosampler (2)	1997, 2001	LM	5
Agilent 5890/5970 and HP 7673 Autosampler	1990	LM	5
Agilent 5890/5970 with ATAS Optic2 LVI and HP 7673 Autosampler	1994	LM	5
Agilent 5890/5972 with ATAS Optic2 LVI and HP 7673 Autosampler (3)	1993, 1994, 1998	LM	5
Agilent 6890/5973 with ATAS Optic3 LVI and 7683 Autosampler	2004	LM	
Agilent 6890/5973 with Agilent PTV Injector and 7683 Autosampler	2007	LM	4
Semivolatile GC/MS/MS –			
Waters Quattro Micro GC Micromass with Agilent 6890, Agilent PTV Injector, 7683B Autosampler	2008	MM	1

PETROLEUM HYDROCARBONS GC/HPLC LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance - Mettler BB240	1994	MM	6
Aspirator pump – GAST	2004	LM	6
Drying Oven - Fisher Model 630F	1991	LM	6
Evaporator - Organomation N-Evap	1990	LM	6
HP Enviroquant Chromatography Data Systems (8)	1994-2002	LM	6
Gas Chromatographs (5):			
Hewlett-Packard 5890 Series II with PID/PID/FID:	1991	LM	4
Tekmar LSC-2000 Purge and Trap Concentrator	1991	LM	4
Dynatech Archon 5100 Autosampler	1992	LM	4
Hewlett-Packard 5890 GC with HP 7673 Autosampler and FID Detector	1995	LM	4
Agilent 6890 with Dual FID Detectors and Agilent 7873 Autosampler (3)	2001, 2005	LM	4
High-Performance Liquid Chromatographs (2):			
HP 1090M Series II with Diode Array UV Detector	1999	LM	4
HP 1050/1100 Series with Fluorescence & Diode Array UV Detectors	2004	LM	4
High-Performance Liquid Chromatograph/Mass Spectrometer - Thermo Electron TSQ Quantum LC/MS/MS with Thermo Surveyor HPLC and Autosampler	2005	MM	2

VOLATILE ORGANICS LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance - Mettler PE 160	1989	MM	5
Fisher Vortex Mixer	1989	LM	5
HP Enviroquant Chromatography Data Systems (10)	1994-2002	LM	5
Drying Ovens (2):			
Narco 420	1989	LM	5
VWR 1305 U	1991	LM	5
Sonic Water Bath - Branson Model 2200	1989	LM	5
Volatile GC/MS Systems (7):			
Agilent 5890/5970 (2)	1989	LM	5
Tekmar 3000 Purge and Trap Concentrator	1995	LM	5
Dynatech ARCHON 5100 Autosampler	1996	LM	5
Agilent 5890/5971	1991	LM	5
Tekmar 3000 Purge and Trap Concentrator	2001	LM	5
Dynatech ARCHON 5100 Autosampler	1995	LM	5
Agilent 5890/5972A	1993	LM	5
Tekmar 3000 Purge and Trap Concentrator	1995	LM	5
Dynatech ARCHON 5100 Autosampler	1996	LM	5
Agilent 6890/5973	2001	LM	5
Tekmar 3100 Purge and Trap Concentrator	2001	LM	5
Varian Archon Autosampler	2001	LM	5
Agilent 6890/5973	2005	LM	5
Tekmar Velocity Purge and Trap Concentrator	2005	LM	5
Tekmar Aquatech Autosampler	2005	LM	5
Agilent 6890/5973	2007	LM	5
Tekmar 3000 Purge and Trap Concentrator	2007	LM	5
Varian Archon 5100 Autosampler	2007	LM	5

DRINKING WATER ORGANICS LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance - Mettler BB300	1991	MM	2
Extractors (5) – Horizon SPE-DEX Solid Phase Extractor	2003	LM	2
Aglinet Enviroquant Chromatography Data Systems (2)	2003	LM	2
Varian Saturn Chromatography Data System	2003	LM	2
Evaporator - Organomation N-Evap	2003	LM	2
Agilent 1100 HPLC w/post-column derivitization:	2003	LM	2
UV/Fluoescence detectors	2003	LM	2
Pickering PCX-5200 Post-column derivitization unit	2003	LM	2
Agilent 6890N GC/ECD system:	2003	LM	2
Dual micro-ECD detectors	2003	LM	2
Agilent autosampler	2003	LM	2
Varian Ion trap GC/MS:	2003	LM	2
Varian 3800 GC w/CP8400 autosampler	2006	LM	2
Varian 3900 GC	2003	LM	2
Varian Saturn 2100T mass spectrometer	2003	LM	2

AUTOMATED DATA PROCESSING EQUIPMENT			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
1-WAN: LIMS Sample Manager using Oracle 10g DBMS running on Redhat Advanced Server 3.0 (Linux) platform connected/linked on a frame relay WAN environment	1994-2004	LM	NA
1 - Network Server Pentium 4 class, 1 for Reporting and Data Acquisition running Windows 2003 Advanced Server, 1 for Applications running Windows 2003 Advanced Server. Data acquisition capacity at 65GB with redundant tape and disk arrays.	2004	LM	NA
Approximately 50+ HP and Dell Laserjet printers (various types including models III, 4, 5, 8150, 4000, 4050, 4250, 8150, 1720dn, W5300)	1991 - 2007	LM	NA
Approximately 130 Gateway/Dell PC/Workstations running Windows 2000/XP on LAN connected via 10BT/100BT and TCP/IP for LIMs Terminal Emulation	1993 - 2004	LM	NA
Microsoft Office 2003 Professional as the base application for all PC/Workstations. Some systems using Office 2000/97.	1996 - 2004	LM	NA
E-Mail with link to SMTP for internal/external messaging. Web mail via Outlook Web Access interface. Microsoft Outlook 2003.	1994 - 2006	LM	NA
Standard Excel (R) reporting platform application linked to LAN/WAN for data connectivity and EDD generation.	1996 - 2004	LM	NA
Standard Excel (R) reporting platform application linked to LAN/WAN for data connectivity and EDD generation.	1996 - 2004	LM	NA
Facsimile Machines - Brother 4750e (2); Brother SuperG3 (1); Canon CFX-L4000 (1)	1991 - 2007	LM	NA
Copiers/Scanners: Konica BizHub 420 (1), BizHub 600 (1), BizHub 920 (2), BizHub Pro 1050 (3). The 920s and 1050s are accessible via LAN for network scanning.	2000 - 2007	LM	NA
Dot Matrix Epson FX-880, LQ-1050, LX-300	1991 - 2004	LM	NA
Thruput, MARRS, Stealth, Harold, Blackbird, EDDGE, StarLIMS reporting software systems.	1998 - 2004	LM	NA

NA: Not applicable. This equipment administered by IT staff but may be used by all staff.

APPENDIX D

PREVENTIVE MAINTENANCE PROCEDURES

Instrument	Activity	Frequency
Refrigerators and Coolers	Record temperatures	Daily
	Clean coils	Annually
	Check coolant	Annually or if temperature outside limits
Vacuum Pumps	Clean and change pump oil	Every month or as needed
Fume Hoods	Face velocity measured	Quarterly
	Sash operation	As needed
	Change filters	Annually
	Inspect fan belts	Annually
Ovens	Clean	As needed or if temperature outside lim.
	Record temperatures	Daily, when in use
Incubators	Record temperatures	Daily, morning and evening
Water Baths	Record temperatures	Daily, morning and evening
	Wash with disinfectant solution	When water is murky, dirty, or growth appears
Autoclave	Check sterility	Every month
	Check temperature	Every month
	Clean	When mold or growth appears
Analytical Balances	Check alignment	Before every use
	Check calibration	Daily
	Clean pans and compartment	After every use
Dissolved Oxygen Meter	Change membrane	When fluctuations occur
pH probes	Condition probe	When fluctuations occur
Fluoride ISE	Store in storage solution	Between uses
Ammonia ISE	Store in storage solution	Between uses
UV-visible Spectrophotometer	Wavelength check	Annually
Total Organic Carbon Analyzers	Check IR zero	Weekly
	Check digestion/condensation vessels	Each use
	Clean digestion chamber	Every 2000 hours, or as needed
	Clean permeation tube	Every 2000 hours, or as needed
	Clean six-port valves	Every 200 - 2000 hours, or as needed
	Clean sample pump	Every 200 - 2000 hours, or as needed
	Clean carbon scrubber	Every 200 - 2000 hours, or as needed
	Clean IR cell	Every 2000 - 4000 hours, or as needed

Instrument	Activity	Frequency
Total Organic Halogen Analyzers	Change cell electrolyte	Daily
	Change electrode fluids	Daily
	Change pyrolysis tube	As needed
	Change inlet and outlet tubes	As needed
	Change electrodes	As needed
Flow Injection Analyzer	Check valve flares	Each use
	Check valve ports	Each use
	Check pump tubing	Each use
	Check light counts	Each use
	Check flow cell flares	Quarterly
	Change bulb	As needed
	Check manifold tubing	Each use
	Check T's and connectors	Each use
Ion Chromatographs	Change column	Every six months or as needed
	Change valve port face & hex nut	Every six months or as needed
	Clean valve slider	Every six months or as needed
	Change tubing	Annually or as needed
	Eluent pump	Annually
Atomic Absorption Spectro-photometers - FAA and CVAA	Check gases	Daily
	Clean burner head	Daily
	Check aspiration tubing	Daily
	Clean optics	Every three months
	Empty waste container	Weekly
Atomic Absorption Spectro-photometers - GFAA	Check gases	Daily
	Check argon dewar	Daily
	Change graphite tube	Daily, as needed
	Clean furnace windows	Monthly
ICP - AES	Check argon dewar	Daily
	Replace peristaltic pump tubing	Daily
	Empty waste container	Weekly
	Clean nebulizer, spray chamber, and torch	Every two weeks
	Replace water filter	Quarterly
	Replace vacuum air filters	Monthly

Instrument	Activity	Frequency
ICP - MS	Check argon dewar	Daily
	Check water level in chiller	Daily
	Complete instrument log	Daily
	Replace peristaltic pump tubing	Daily
	Clean sample and skimmer cones	As needed
	Clean RF contact strip	As needed
	Inspect nebulizer, spray chamber, and torch	Clean as needed
	Clean lens stack/extraction lens	As needed
	Check rotary pump oil	Monthly
	Change rotary pump oil	Every six months
Gel-Permeation Chromatographs	Clean and repack column	As needed
	Backflush valves	As needed
High Pressure Liquid Chromatographs	Backflush guard column	As needed
	Backflush column	As needed
	Change guard column	As needed when back pressure too high
	Change column	Annually or as needed
	Change in-line filters	As needed
	Leak check	After column maintenance
	Change pump seals	As needed
	Change pump diaphragm	Annually
	Clean flow cell	As needed
	Fluorescence detector check	Daily
	Diode array absorbance check	Daily
Gas Chromatographs, Semivolatiles	Check gas supplies	Daily, replace if pressure reaches 50psi
	Change in-line filters	Quarterly or after 30 tanks of gas
	Change septum	Daily
	Change injection port liner	Weekly or as needed
	Clip first 6-12" of capillary column	As needed
	Change guard column	As needed
	Replace analytical column	As needed when peak resolution fails
	Check system for gas leaks	After changing columns and after any power failure
	Clean FID	Weekly or as needed
	Clean ECD	Quarterly or as needed
	Leak test ECD	Annually

Instrument	Activity	Frequency
Gas Chromatograph/Mass Spectrometers, Semivolatiles	Check gas supplies	Daily, replace if pressure reaches 50psi
	Change in-line filters	Annually or as needed
	Change septum	Daily, when in use
	Change injection port liner	Weekly or as needed
	Clip first 6-12" of capillary column	As needed
	Change guard column	As needed
	Replace analytical column	As needed when peak resolution fails
	Clean source	As needed when tuning problems
	Change pump oil	As specified by service specifications
Purge and Trap Concentrators	Change trap	Every four months or as needed
	Change transfer lines	Every six months or as needed
	Clean purge vessel	Daily
Gas Chromatographs, Volatiles	Check gas supplies	Daily, replace when pressure reaches 50 psi
	Change in-line filters	Quarterly or after 30 tanks of gas
	Change septum	Daily
	Clip first 6-12" of capillary column	As needed
	Change guard column	As needed
	Replace analytical column	As needed when peak resolution fails
	Check system for gas leaks	After changing columns and after any power failure
	Clean PID lamp	As needed
	Clean FID	As needed
	Change ion exchange resin	Every 60 days
	Replace nickel tubing	Quarterly or as needed
Gas Chromatograph/Mass Spectrometers, Volatiles	Check gas supplies	Daily, replace when pressure reaches 50 psi
	Change in-line filters	Annually or as needed
	Change septum	Daily
	Clip first foot of capillary column	As needed
	Change guard column	As needed
	Replace analytical column	As needed when peak resolution fails
	Clean jet separator	As needed
	Clean source	As needed when tuning problems
	Change pump oil	As specified by service specifications

APPENDIX E

SOP LIST AND LIST OF NELAC ACCREDITED METHODS

COLUMBIA ANALYTICAL SERVICES, INC. , KELSO, WA.

STANDARD OPERATING PROCEDURES TABLE OF CONTENTS

SOP NAME	FILE NAME	REV #
ARMY CORPS OF ENGINEERS HTRW PROJECT MANAGEMENT	ADM-HTRW	1
CHECKING PIPETTE CALIBRATION	ADM-CPIP	4
CONTINGENCY PLAN FOR LABORATORY EQUIPMENT FAILURE	ADM-ECP	1
CONTROL CHARTING QUALITY CONTROL DATA	ADM-CHRT	1
DATA ARCHIVING	ADM-ARCH	3
DATA REPORTING AND REPORT GENERATION	ADM-RG	5
DEPARTMENT OF DEFENSE PROJECTS LABORATORY PRACTICES AND PROJECT MANAGEMENT	ADM-DOD	2
ELECTRONIC DATA BACKUP AND ARCHIVING	ADM-EBACKUP	0
INTERNAL QUALITY ASSURANCE AUDITS	ADM-IAUD	6
LABORATORY BALANCE MONITORING AND CALIBRATION	ADM-BAL	0
LABORATORY DATA REVIEW PROCESS	ADM-DREV	5
METHOD DETECTION LIMIT DOCUMENTATION AND CONTROL	ADM-MDLC	2
PROJECT MANAGEMENT	ADM-PCM	8
REAGENT LOGIN AND TRACKING	ADM-RLT	2
SUPPORT EQUIPMENT MONITORING AND CALIBRATION	ADM-SEMC	9
COLIFORM, FECAL	BIO-9221FC	5
COLIFORM, FECAL (MEMBRANE FILTER PROCEDURE)	BIO-9222D	1
COLIFORM, TOTAL	BIO-9221TC	4
COLIFORM, TOTAL (DRINKING WATER)	BIO-9221DW	4
COLILERT COMPLETED TEST VERIFICATION OF E. COLI IN MUG CULTURES	BIO-CCT	0
COLILERT	BIO-9223	4
ENTEROLERT	BIO-ENT	0
FECAL STREPTOCOCCUS/ENTEROCOCCUS	BIO-9230B	5
HEPTEROTROPHIC PLATE COUNT	BIO-HPC	3
MICROBIOLOGY QUALITY ASSURANCE AND QUALITY CONTROL	BIO-QAQC	12
SHEEN SCREEN/OIL DEGRADING MICROORGANISMS	BIO-SHEEN	1
EPA CLP ORGANICS ANALYSES	CLP_ORGA	1
ADDITION OF SPIKES AND SURROGATES	EXT-SAS	6
AUTOMATED SOXHLET EXTRACTION	EXT-3541	4
CONTINUOUS LIQUID - LIQUID EXTRACTION	EXT-3520	11
DIAZOMETHANE PREPARATION	EXT-DIAZ	5
FLORISIL CLEANUP	EXT-FLOR	2
ORGANIC EXTRACTIONS GLASSWARE CLEANING	EXT-GC	3
MEASURING SAMPLE WEIGHTS AND VOLUMES FOR ORGANIC ANALYSIS	EXT-WVOL	2
PREPARATION OF REAGENTS AND BLANK MATRICES USED IN SEMIVOLATILE ORGANICS ANALYSIS	EXT-REAG	0
REMOVAL OF SULFUR USING COPPER	EXT-3660	4
SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION	EXT-3510	7
SILICA GEL CLEANUP	EXT-3630	1
SOLID PHASE DISPERSION IN TISSUES	EXT-SPD	0
SOLID PHASE EXTRACTION	EXT-3535	3
SOXHLET EXTRACTION	EXT-3540	9
SULFURIC ACID CLEANUP	EXT-3665	2
ULTRASONIC EXTRACTION	EXT-3550	9
WASTE DILUTION EXTRACTION	EXT-3580	2
FACILITY AND LABORATORY CLEANING	FAC-CLEAN	0
OPERATION AND MAINTENANCE OF LABORATORY REAGENT WATER SYSTEMS	FAC-WATER	0
ACIDITY	GEN-305.2	3
ALKALINITY TOTAL	GEN-310.1	6
AMMONIA AS NITROGEN BY ION SPECIFIC ELECTRODE	GEN-350.3	6
AMMONIA BY FLOW INJECTION ANALYSIS	GEN-350.1	7
AUTOFLUFF	GEN-AUTOFLU	0
BIOCHEMICAL OXYGEN DEMAND	GEN-405.1	10
BULK DENSITY OF SOLID WASTE FRACTIONS	GEN-E1109	0
CARBON, TOTAL ORGANIC DETERMINATION (WALKELY BLACK METHOD)	GEN-OSU	2
CARBON, TOTAL ORGANIC IN SOIL	GEN-ASTM	6
CARBONATE (CO3) BY EVOLUTION AND COLUMETRIC TITRATION	GEN-D513-82M	0
CHEMICAL OXYGEN DEMAND	GEN-COD	7

CHLORIDE (TITRIMETRIC, MERCURIC NITRATE)	GEN-325.3	4
CHLORINE, TOTAL/FREE RESIDUAL	GEN-330-4	2
COLOR	GEN-110.2	5
COLOR, NCASI	GEN-NCAS	2
CONDUCTIVITY IN WATER AND WASTES	GEN-COND	8
CORROSIVITY TOWARDS STEEL	GEN-CORR	1
CYANIDE EXTRACTION OF SOLIDS AND OILS	GEN-9013	0
CYANIDE, WEAK ACID DISSOCIABLE	GEN-CNWAD	0
DETERMINATION OF INORGANIC ANIONS IN DRINKING WATER BY ION CHROMATOGRAPHY	GEN-300.1	3
DISSOLVED SILICA	GEN-370.1	1
FERROUS IRON IN WATER	GEN-FeII	2
FLASHPOINT DETERMINATION - SETAFLASH	GEN-1020	6
FLUORIDE BY ION SELECTIVE ELECTRODE	GEN-FISE	5
FORMALDEHYDE COLORIMETRIC DETERMINATION	GEN-FORM	1
GLASSWASHING FOR INORGANIC ANALYSES	GEN-WASH	3
GRAVIMETRIC SULFATE	GEN-375.3	2
HALIDES, ADSORBABLE ORGANIC (AOX)	GEN-1650	2
HALIDES, ADSORBABLE ORGANIC (AOX) - SM 5320B	GEN-5320B	1
HALIDES, EXTRACTABLE ORGANIC (EOX)	GEN-9020M	2
HALIDES, TOTAL ORGANIC (TOX)	GEN-9020	8
HALOGENS TOTAL AS CHLORIDE BY BOMB COMBUSTION	GEN-5050	2
HARDNESS, TOTAL	GEN-130.2	6
HEAT OF COMBUSTION	GEN-BTU	3
HEXAVALENT CHROMIUM - COLORIMETRIC	GEN-CR6	7
HYDAZINE IN WATER USING COLORIMETRIC PROCEDURE	GEN-HYD	1
HYDROGEN HALIDES BY ION CHROMATOGTRAPHY (METHOD 26)	GEN-HA26	2
ION CHROMATOGRAPHY	GEN-IONC	11
MBAS	GEN-425.1	3
MERCURY IN COAL SAMPLE PREPARATION BY PARR BOMB COMBUSTION	GEN-HGPREP	0
NITRATE/NITRITE, NITRITE BY FLOW INJECTION ANALYSIS	GEN-353.2	6
NITRITE BY COLORIMETRIC PROCEDURE	GEN-354.1	1
NITROGEN, TOTAL AND SOLUBLE KJELDAHL	GEN-TKN	10
ORTHOPHOSPHATE BY FLOW INJECTION ANALYSIS-STANDARD METHODS 4500P-F	GEN-4500P-F	1
OXYGEN CONSUMPTION RATE	GEN-O2RATE	0
PARTICLE SIZE DETERMINATION	GEN-PSP	5
PARTICLE SIZE DETERMINATION - ASTM PROCEDURE	GEN-PSASTM	1
PERCHLORATE BY ION CHROMATOGRAPHY	GEN-314-0	12
Ph IN SOIL AND SOLIDS	GEN-Phs	9
Ph IN WATER	GEN-Phw	10
PHENOLICS, TOTAL	GEN-420.1	10
PHOSPHORUS DETERMINATION USING COLORMETRIC PROCEDURE	GEN-365.3	8
POST DIGESTION DETERMINATION OF TOTAL KJELDAHL NITROGEN BY SEMIAUTOMATED COLORIMETRY	GEN-TKNAA	0
SETTEABLE SOLIDS	GEN-160.5	4
SOLIDS, TOTAL DISSOLVED (TDS)	GEN-160.1	7
SOLIDS, TOTAL SUSPENDED (TSS)	GEN-160.2	7
SOLIDS, TOTAL VOLATILE AND PERCENT ASH IN SOIL AND SOLID SAMPLES	GEN-160.4	5
SPECIFIC GRAVITY	GEN-SPGRAV	0
SUBSAMPLING AND COMPOSITING OF SAMPLES	GEN-SUBS	3
SULFIDE, SOLUBLE DETERMINATION OF SOLUBLE SULFIDE IN SEDIMENT	GEN-DIS.S2	2
SULFIDE, TITRIMETRIC (IODINE)	GEN-376-1	1
SULFIDES, ACIDS VOLATILE	GEN-AVS	5
SULFIDE, METHYLENE BLUE	GEN-376-2	1
SULFIDES, REACTIVE	GEN-RS	4
SULFITE	GEN-SO3	2
TANNIN AND LIGNIN	GEN-5550	5
THIOCYANATE	GEN-THIOCN	0
TOTAL CYANIDES AND CYANIDES AMENABLE TO CHLORINATION	GEN-335	13
TOTAL HALIDES BY OXIDATIVE COMBUSTION AND MICROCOULOMETRY	GEN-9076	1
TOTAL ORGANIC CARBON IN WATER	GEN-TOC	9
TOTAL RESIDUAL CHLORINE - METHOD 330.5	GEN-330.5	0
TOTAL SOLIDS	GEN-160.3	11
TOTAL SULFIDE BY PSEP	GEN-S2PS	0
TOTAL SULFIDES BY METHYLENE BLUE DETERMINATION	GEN-9030	9
TOTAL SULFUR FOR ION CHROMATOGRAPHY	GEN-ICS	1
TURBIDITY MEASUREMENT	GEN-TURB	4
ULTIMATE BOD	GEN-UBOD	0

ARSENIC BY BOROHYDRIDE REDUCTION ATOMIC ABSORPTION	MET-7062	0
CATION-EXCHANGE CAPACITYOF SOILS (SODIUM ACETATE) - METHOD 9081	MET-9081	1
CLOSED VESSEL OIL DIGESTION	MET-3051M	0
DETERMINATION OF METALS & TRACE ELEMENTS BY INDUCTIVELY COUPLED PLASMA-MS (METHOD 6020)	MET-6020	11
DETERMINATION OF METALS & TRACE ELEMENTS BY INDUCTIVELY COUPLED PLASMA-MS (METHOD 200.8)	MET-ICP.MS	12
DETERMINATION OF METALS AND TRACE ELEMENTS BY ICP/AES	MET-ICP	19
DETERMINATION OF TRACE METALS BY GRAPHITE FURNACE ATOMIC ABSORPTION SPECTROMETRY (GFAA)	MET-GFAA	16
FLAME ATOMIC ABSORPTION SPECTROPHOTOMETRIC ANALYSES	MET-FAA	1
MERCURY ANALYSIS BY COLD VAPOR ABSORPTION SPECTROPHOTOMETRY	MET-HG	5
MERCURY IN LIQUID WASTE	MET-7470A	11
MERCURY IN SOLID OR SEMISOLID WASTE	MET-7471A	11
MERCURY IN WATER	MET-245.1	11
MERCURY IN WATER BY OXIDATION, PURGE&TRAP, AND COLD VAPOR ATOMIC FLUORES. SPECTROMETRY	MET-1631	8
METALS AND SEMIVOLATILES TCLP EXTRACTION (EPA METHOD 1311)	MET-TCLP	6
METALS DIGESTION	MET-3005A	5
METALS DIGESTION	MET-3010A	10
METALS DIGESTION	MET-3020A	12
METALS DIGESTION	MET-3050	10
METALS DIGESTION	MET-7195	5
METALS DIGESTION - CLP	MET-DIG	9
METALS LABORATORY GLASSWARE CLEANING	MET-GC	2
METHYL MERCURY IN SOIL AND SEDIMENT BY ATOMIC FLUORESCENCE SPECTROMETRY	MET-1630S	1
METHYL MERCURY IN TISSUE BY ATOMIC FLUORESCENCE SPECTROMETRY	MET-1630T	0
METHYL MERCURY IN WATER BY ATOMIC FLUORESCENCE SPECTROMETRY	MET-1630W	0
MULTIPLE EXTRACTION PROCEDURE	MET-MEP	0
SAMPLE FILTRATION FOR METALS ANALYSIS	MET-FILT	0
SAMPLE PREPARATION OF AQUEOUS SAMPLES BY "CLEAN" TECHNIQUES	MET-ACT	3
SAMPLE PREPARATION OF BIOLOGICAL TISSUES FOR METALS ANALYSIS BY GFAA, ICP-OES, AND ICP-MS	MET-TDIG	1
SELENIUM BY BOROHYDRIDE REDUCTION ATOMIC ABSORPTION	MET-7742	2
TISSUE SAMPLE PREPARATION	MET-TISP	5
TRACE METALS IN WATER BY PRECONCENTRATION USING REDUCTIVE PRECIPITATION FOLLOWED BY ICP-MS	MET-RPMS	4
WASTE EXTRACTION TEST (WET) PROCEDURE (STLC) for NONVOLATILE and SEMIVOLATILE PARAMETERS	MET-STLC	0
ANALYSIS OF SOLID AND AQUEOUS SAMPLES FOR STATE OF WISCONSIN DIESEL RANGE ORGANICS	PHC-WIDRO	0
ANALYSIS OF WATER, SOLIDS AND SOLUBLE WASTE SAMPLES FOR SEMI-VOLATILE FUEL HYDROCARBONS	PET-SVF	11
GASOLINE RANGE ORGANICS BY GAS CHROMATOGRAPHY	PET-GRO	7
GRAVIMETRIC DETERMINATION OF HEAXANE EXTRACTABLE MATERIAL (1664)	PET-1664	5
BOTTLE ORDER PREPARATION AND SHIPPING	SMO-BORD	8
FOREIGN SOILS HANDLING TREATMENT	SMO-FSHT	7
SAMPLE DISPOSAL	SMO-SDIS	6
SAMPLE RECEIVING	SMO-GEN	23
SAMPLE TRACKING AND LABORATORY CHAIN OF CUSTODY	SMO-SCOC	10
ACETAMIDE HERBICIDE DEGRADATES IN DRINKING WATER BY SPE AND HPLC/MS/MS	SOC-535	0
ALDEHYDES BY HPLC	SOC-8315A	4
BUTYLTINS	SOC-BUTYL	8
CALIBRATION OF INSTRUMENTS FOR ORGANICS CHROMATOGRAPHIC ANALYSES	SOC-CAL	5
CARBON CLEANUP	SOC-CARCU	0
CHLORINATED HERBICIDES	SOC-8151	13
CHLORINATED PHENOLICS IN WASTE WATER BY IN-SITU	SOC-1653A	5
CHLORINATED PHENOLS METHOD 8151 MODIFIED	SOC-8151M	8
CONFIRMATION PROCEDURE FOR GC AND HPLC ANALYSES	SOC-CONF	4
CONGENER-SPECIFIC DETERMINATION OF PCBS BY GG/ECD	SOC-8082C	8
DETERMINATION OF NITROGEN OR PHOSPHORUS CONTAINING PESTICIDES	SOC-8141	10
DIMP	SOC-DIMP	6
DMD SYNTHESIS	SOC-DMD	1
EXTRACTION METHOD FOR ORGANOTINS IN SEDIMENTS, WATER, AND TISSUE	SOC-OSWT	5
GEL PERMEATION CHROMATOGRAPHY	SOC-3640A	5
GLYCOLS	SOC-8015M	8
HAPS AND OTHER COMPOUNDS IN IMPINGER/CANISTER SAMPLES FROM WOOD PRODUCTS FACILITIES	SOC-9902	2
HAZARDOUS AIR POLLUTANTS (HAPS) IN PULP AND PAPER INDUSTRY CONDENSATES	SOC-9901	3
METHANOL IN PROCESS LIQUIDS	SOC-9403	4

MONOCHLOROACETIC ACID BY GC-ECD	SOC-MCA	4
NITROAROMATICS AND NITRAMINES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY	SOC-8330	10
NITROGLYCERIN AND PETN BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY	SOC-8332	7
NITROGUANIDINE BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY	SOC-NITG	2
NONYLPHENOLS ISOMERS AND NONYLPHENOL ETHOXYLATES	SOC-NONYL	0
ORGANIC ACIDS IN AQUEOUS MATRICES BY HPLC	SOC-OALC	1
ORGANOCHLORINE PESTICIDES AND PCBs (METHOD 608)	SOC-608	5
ORGANOCHLORINE PESTICIDES BY GAS CHROMATOGRAPHY: CAPILLARY COLUMN TECHNIQUE	SOC-8081	10
PCBS AS AROCLORS	SOC-8082A	10
PERCENT LIPIDS IN TISSUE	SOC-LIPID	1
PESTICIDES BY GC/MS/MS	SOC-PESTMS	0
PHARMACEUTICALS, PERSONAL CARE PRODUCTS AND ENDOCRINE DISRUPTING COMPOUNDS (EDCS) BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY/TANDEM MASS SPECTROMETRY (HPLC/MS/MS)	SOC-LCMS	1
PICRIC ACID AND PICRAMIC ACID BY HPLC	SOC-PICRIC	2
POLYNUCLEAR AROMATIC HYDROCARBONS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY SIM	SOC-8270P	6
POLYNUCLEAR AROMATIC HYDROCARBONS BY HPLC	SOC-8310	11
RESIN AND FATTY ACIDS BY GC/MS - NCASI METHOD 85.02 MODIFIED	SOC-85.02	0
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS	SOC-625	4
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS	SOC-8270C	8
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS - LOW LEVEL PROCEDURE	SOC-8270L	3
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS SELECTED ION MONITORING	SOC-8270S	4
SEMI-VOLATILE ORGANICS SCREENING	SOC-SCR	2
TOTAL OLEANOLIC ACID SAPONINS IN WATER BY ACID HYDROLYSIS AND HPLC/MS/MS	SOC-LCMS3	0
1,2-DIBROMOETHANE, 1,2-DIBROMO-3-CHLOROPROPANE, AND 1,2,3-TCP BY GC	SVD-504	5
CARBAMATES AND CARBAMOYLOXIMES IN WATER BY POST-COLUMN DERIVITIZATION HPLC	SVD-531 -1	4
CHLORINATED HEBICIDES IN DRINKING WATER	SVD-515_4	5
DETERMINATION OF EXPLOSIVES AND RELATED COMPOUNDS IN DRINKING WATER BY GC/MS	SVD-529	0
DIQUAT AND PARAQUAT BY HPLC	SVD-549	4
ENDOTHALL IN DRINKING WATER BY GC/MS	SVD-548	6
GLYPHOSATE IN DRINKING WATER BY HPLC	SVD-547	4
HALOACETIC ACIDS IN DRINKING WATER	SVD-552	5
ORGANOCHLORINE PESTICIDES AND PCBS IN DRINKING WATER	SVD-508_1	4
N-NITROSAMINES BY GC/MS/MS	SVD-521	1
SELECTED PESTICIDES AND FLAME RETARDANTS IN DRINKING WATER BY GC/MS (EPA METHOD 527)	SVD-527	0
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS (METHOD 525.2)	SVD-525	5
AROMATIC VOLATILE ORGANICS (BTEX) BY GC - METHOD 602	VOC-602BTEX	2
AROMATIC VOLATILE ORGANICS (BTEX) BY GC - METHOD 8021	VOC-8021BTEX	4
PURGE AND TRAP FOR AQUEOUS SAMPLES	VOC-5030	4
PURGE AND TRAP/EXTRACTION FOR VOC IN SOIL AND WASTE SAMPLES , CLOSED SYSTEM	VOC-5035	7
SAMPLE SCREENING FOR VOLATILE ORGANIC COMPOUNDS IN SOIL, WATER AND MISC. MATRICES	VOC-BVOC	3
VOA STORAGE BLANKS	VOC-BLAN	5
VOLATILE ORGANIC COMPOUNDS BY GC/MS	VOC-524.2	10
VOLATILE ORGANIC COMPOUNDS BY GC/MS	VOC-624	8
VOLATILE ORGANIC COMPOUNDS BY GC/MS	VOC-8260	11
WA-DOH DRINKING WATER PROTOCOL	VOC-WA.DOH	2
ZERO HEADSPACE EXTRACTION (EPA METHOD 1311)	VOC-ZHE	5

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,1,1-Trichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,1,2,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,1,2-Trichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,1-Dichloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,1-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,1-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,2,3-Trichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,2,3-Trichloropropane	EPA 504.1	Group II Unregulated Contaminants	NELAP	7/17/2003
1,2,3-Trichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,2,4-Trichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,2,4-Trimethylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1	Synthetic Organic Contaminants	NELAP	7/17/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504.1	Synthetic Organic Contaminants	NELAP	7/17/2003
1,2-Dichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,2-Dichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,2-Dichloropropane	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,3,5-Trimethylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,3-Dichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,3-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,4-Dichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
2,2-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
2,4,5-T	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
2,4-D	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003
2-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
3-Hydroxycarbofuran	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/17/2003
4,4'-DDD	EPA 508.1	Group I Unregulated Contaminants	NELAP	7/17/2003
4,4'-DDD	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
4,4'-DDE	EPA 508.1	Group I Unregulated Contaminants	NELAP	7/17/2003
4,4'-DDE	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
4,4'-DDT	EPA 508.1	Group I Unregulated Contaminants	NELAP	7/17/2003
4,4'-DDT	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
4-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/17/2003
4-Isopropyltoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001

Clients and Customers are urged to verify the laboratory's current certification status with the Environmental Laboratory Certification Program.

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Acetochlor	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Acifluorfen	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
Alachlor	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Aldicarb (Temik)	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Aldicarb sulfone	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Aldicarb sulfoxide	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Aldrin	EPA 508.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Aldrin	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Alkalinity as CaCO3	SM 2320 B	Primary Inorganic Contaminants	NELAP	10/8/2001
Aluminum	EPA 200.7	Secondary Inorganic Contaminants	NELAP	10/8/2001
Aluminum	EPA 200.8	Secondary Inorganic Contaminants	NELAP	10/8/2001
Antimony	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Antimony	EPA 200.9	Primary Inorganic Contaminants	NELAP	10/8/2001
Arsenic	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Arsenic	EPA 200.9	Primary Inorganic Contaminants	NELAP	10/8/2001
Atrazine	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Barium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Barium	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Benzene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Benzo(a)pyrene	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Beryllium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Beryllium	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Boron	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2007
Bromate	EPA 300.1	Primary Inorganic Contaminants	NELAP	7/17/2003
Bromide	EPA 300.1	Primary Inorganic Contaminants	NELAP	7/17/2003
Bromoacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Bromobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Bromochloroacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Bromochloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/17/2003
Bromodichloromethane	EPA 524.2	Other Regulated Contaminants,Group II Unregulated Contaminants	NELAP	10/8/2001
Bromoform	EPA 524.2	Other Regulated Contaminants,Group II Unregulated Contaminants	NELAP	10/8/2001
Butachlor	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Butyl benzyl phthalate	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Cadmium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Cadmium	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Calcium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Carbaryl (Sevin)	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Carbofuran (Furaden)	EPA 531.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Carbon tetrachloride	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Chlorate	EPA 300.1	Secondary Inorganic Contaminants	NELAP	12/23/2005
Chlordane (tech.)	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Chloride	EPA 300.0	Secondary Inorganic Contaminants	NELAP	10/8/2001
Chlorite	EPA 300.1	Primary Inorganic Contaminants	NELAP	7/17/2003
Chloroacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Chlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Chloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Chloroform	EPA 524.2	Other Regulated Contaminants,Group II Unregulated Contaminants	NELAP	10/8/2001
Chromium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Chromium	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
cis-1,2-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
cis-1,3-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Color	SM 2120 B	Secondary Inorganic Contaminants	NELAP	7/17/2003
Conductivity	SM 2510 B	Primary Inorganic Contaminants	NELAP	10/8/2001
Copper	EPA 200.7	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	10/8/2001
Copper	EPA 200.8	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	10/8/2001
Copper	EPA 200.9	Primary Inorganic Contaminants	NELAP	10/8/2001
Cyanide	EPA 335.4	Primary Inorganic Contaminants	NELAP	10/8/2001
Dacthal (DCPA)	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Dalapon	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
DCPA di acid degradate	EPA 515.4	Group I Unregulated Contaminants	NELAP	7/17/2003
DCPA mono acid degradate	EPA 515.4	Group I Unregulated Contaminants	NELAP	7/17/2003
Di(2-ethylhexyl)adipate	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Dibromoacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Dibromochloromethane	EPA 524.2	Other Regulated Contaminants,Group II Unregulated Contaminants	NELAP	10/8/2001
Dibromomethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Dicamba	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
Dichloroacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Dichlorodifluoromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Dichloromethane (DCM, Methylene chloride)	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Dieldrin	EPA 508.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Dieldrin	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Diethyl phthalate	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003
Dimethyl phthalate	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003
Di-n-butyl phthalate	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003
Di-n-octyl phthalate	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
Diquat	EPA 549.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Endothall	EPA 548.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Endrin	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Endrin	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
EPTC (Eptam, s-ethyl-dipropyl thio carbamate)	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Ethylbenzene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Fluoride	EPA 300.0	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	10/8/2001
Fluoride	SM 4500 F-C	Secondary Inorganic Contaminants,Primary Inorganic Contaminants	NELAP	10/8/2001
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Glyphosate	EPA 547	Synthetic Organic Contaminants	NELAP	7/17/2003
Hardness	SM 2340 B	Secondary Inorganic Contaminants	NELAP	10/8/2007
Heptachlor	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Heptachlor	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Heptachlor epoxide	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Heptachlor epoxide	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Heterotrophic plate count	SM 9215 B	Microbiology	NELAP	7/17/2003
Hexachlorobenzene	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Hexachlorobutadiene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Hexachlorocyclopentadiene	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Iron	EPA 200.7	Secondary Inorganic Contaminants	NELAP	10/8/2001
Isophorone	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Isopropylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Lead	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Lead	EPA 200.9	Primary Inorganic Contaminants	NELAP	10/8/2001
Magnesium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Manganese	EPA 200.7	Secondary Inorganic Contaminants	NELAP	10/8/2001
Manganese	EPA 200.8	Secondary Inorganic Contaminants	NELAP	10/8/2001
Mercury	EPA 245.1	Primary Inorganic Contaminants	NELAP	10/8/2001
Methomyl (Lannate)	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Methoxychlor	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Methoxychlor	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Methyl bromide (Bromomethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Methyl chloride (Chloromethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Methyl tert-butyl ether (MTBE)	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Metolachlor	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Metribuzin	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Molinate	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Molybdenum	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2007
Naphthalene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
n-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Nickel	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Nickel	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Nitrate	EPA 300.0	Primary Inorganic Contaminants	NELAP	10/8/2001
Nitrate	EPA 353.2	Primary Inorganic Contaminants	NELAP	10/8/2001
Nitrite	EPA 300.0	Primary Inorganic Contaminants	NELAP	10/8/2001
Nitrite	EPA 353.2	Primary Inorganic Contaminants	NELAP	10/8/2001
n-Propylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Orthophosphate as P	SM 4500-P F	Primary Inorganic Contaminants	NELAP	10/8/2001
Oxamyl	EPA 531.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Paraquat	EPA 549.2	Synthetic Organic Contaminants	NELAP	12/23/2005
PCBs	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Pentachlorophenol	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
Pentachlorophenol	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Perchlorate	EPA 314.0	Primary Inorganic Contaminants	NELAP	7/17/2003
pH	EPA 150.1	Secondary Inorganic Contaminants,Primary Inorganic Contaminants	NELAP	10/8/2001
pH	SM 4500-H+-B	Primary Inorganic Contaminants	NELAP	4/11/2007

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Picloram	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
Potassium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2007
Propachlor (Ramrod)	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
sec-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Selenium	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Selenium	EPA 200.9	Primary Inorganic Contaminants	NELAP	10/8/2001
Silica as SiO2	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Silver	EPA 200.7	Secondary Inorganic Contaminants	NELAP	10/8/2001
Silver	EPA 200.8	Secondary Inorganic Contaminants	NELAP	10/8/2001
Silvex (2,4,5-TP)	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
Simazine	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Sodium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Styrene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Sulfate	EPA 300.0	Secondary Inorganic Contaminants,Primary Inorganic Contaminants	NELAP	10/8/2001
Terbacil	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
tert-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Tetrachloroethylene (Perchloroethylene)	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Thallium	EPA 200.8	Primary Inorganic Contaminants	NELAP	11/18/2004
Thallium	EPA 200.9	Primary Inorganic Contaminants	NELAP	10/8/2001
Toluene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Total coliforms & E. coli	SM 9223 B	Microbiology	NELAP	10/8/2001
Total dissolved solids	SM 2540 C	Secondary Inorganic Contaminants	NELAP	10/8/2001
Total haloacetic acids	EPA 552.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Total nitrate-nitrite	EPA 300.0	Primary Inorganic Contaminants	NELAP	10/8/2001
Total nitrate-nitrite	EPA 353.2	Primary Inorganic Contaminants	NELAP	10/8/2001
Total organic carbon	SM 5310C	Primary Inorganic Contaminants	NELAP	4/11/2007
Total trihalomethanes	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Toxaphene (Chlorinated camphene)	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
trans-1,2-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
trans-1,3-Dichloropropylene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Trichloroacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Trichloroethene (Trichloroethylene)	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Trichlorofluoromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Turbidity	EPA 180.1	Secondary Inorganic Contaminants	NELAP	10/8/2001
Vanadium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2007

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Vinyl chloride	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Xylene (total)	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Zinc	EPA 200.7	Secondary Inorganic Contaminants	NELAP	10/8/2001
Zinc	EPA 200.8	Secondary Inorganic Contaminants	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,1-Trichloroethane	EPA 624	Volatile Organics	NELAP	10/8/2001
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,2,2-Tetrachloroethane	EPA 624	Volatile Organics	NELAP	10/8/2001
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,2-Trichloroethane	EPA 624	Volatile Organics	NELAP	10/8/2001
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloroethane	EPA 624	Volatile Organics	NELAP	10/8/2001
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloroethylene	EPA 624	Volatile Organics	NELAP	10/8/2001
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2,4-Trichlorobenzene	EPA 625	Extractable Organics	NELAP	10/8/2001
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	10/8/2001
1,2-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	10/8/2001
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2-Dichloroethane	EPA 624	Volatile Organics	NELAP	10/8/2001
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichloropropane	EPA 624	Volatile Organics	NELAP	10/8/2001
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	7/1/2003
1,3-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	10/8/2001
1,3-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	10/8/2001
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	7/1/2003
1,4-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	10/8/2001
1,4-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	10/8/2001
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3,4,6-Tetrachlorophenol	EPA 1653	Extractable Organics	NELAP	10/8/2001
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,3-Dichlorobiphenyl (BZ 5)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4,5-Trichlorophenol	EPA 1653	Extractable Organics	NELAP	10/8/2001
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trichlorophenol	EPA 1653	Extractable Organics	NELAP	10/8/2001

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,4,6-Trichlorophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4-Dichlorophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dimethylphenol	EPA 625	Extractable Organics	NELAP	10/8/2001
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 625	Extractable Organics	NELAP	10/8/2001
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 625	Extractable Organics	NELAP	10/8/2001
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Chlorobiphenyl (BZ 1)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2-Chloroethyl vinyl ether	EPA 624	Volatile Organics	NELAP	10/8/2001
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Chloronaphthalene	EPA 625	Extractable Organics	NELAP	10/8/2001
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Chlorophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Hexanone	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Methyl-4,6-dinitrophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitrophenol	EPA 625	Extractable Organics	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	7/1/2003
3,3'-Dichlorobenzidine	EPA 625	Extractable Organics	NELAP	10/8/2001
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
3,4,5-Trichlorocatechol	EPA 1653	Extractable Organics	NELAP	10/8/2001
3,4,5-Trichloroguaiacol	EPA 1653	Extractable Organics	NELAP	10/8/2001
3,4,6-Trichlorocatechol	EPA 1653	Extractable Organics	NELAP	10/8/2001
3,4,6-Trichloroguaiacol	EPA 1653	Extractable Organics	NELAP	10/8/2001
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
4,4'-DDD	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,4'-DDE	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,4'-DDT	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,5,6-Trichloroguaiacol	EPA 1653	Extractable Organics	NELAP	10/8/2001
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	7/1/2003
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Bromophenyl phenyl ether	EPA 625	Extractable Organics	NELAP	10/8/2001
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloro-3-methylphenol	EPA 625	Extractable Organics	NELAP	10/8/2001
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chlorophenyl phenylether	EPA 625	Extractable Organics	NELAP	10/8/2001
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	7/1/2003
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitrophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acenaphthene	EPA 625	Extractable Organics	NELAP	10/8/2001
Acenaphthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acenaphthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Acenaphthylene	EPA 625	Extractable Organics	NELAP	10/8/2001
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Acetone	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acetonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acetophenone	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acidity, as CaCO3	SM 2310 B (4A)	General Chemistry	NELAP	4/11/2007
Acrolein (Propenal)	EPA 624	Volatile Organics	NELAP	7/17/2003
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acrylonitrile	EPA 624	Volatile Organics	NELAP	7/17/2003
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Adsorbable organic halogens (AOX)	EPA 1650	General Chemistry	NELAP	10/8/2001
Aldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Alkalinity as CaCO3	EPA 310.1	General Chemistry	NELAP	10/8/2001
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	4/11/2007
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	12/23/2005
Aluminum	EPA 200.7	Metals	NELAP	10/8/2001
Aluminum	EPA 200.8	Metals	NELAP	10/8/2001
Aluminum	EPA 6010	Metals	NELAP	7/1/2003
Aluminum	EPA 6020	Metals	NELAP	7/1/2003
Amenable cyanide	EPA 335.1	General Chemistry	NELAP	10/8/2001
Amenable cyanide	SM 4500-CN G	General Chemistry	NELAP	4/11/2007
Ammonia as N	EPA 350.1	General Chemistry	NELAP	10/8/2001
Ammonia as N	EPA 350.3	General Chemistry	NELAP	10/8/2001
Ammonia as N	SM 4500-NH3 G	General Chemistry	NELAP	4/11/2007

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Ammonia as N	SM 4500-NH3E	General Chemistry	NELAP	10/8/2007
Aniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
Anthracene	EPA 625	Extractable Organics	NELAP	10/8/2001
Anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Anthracene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Antimony	EPA 200.7	Metals	NELAP	10/8/2001
Antimony	EPA 200.8	Metals	NELAP	10/8/2001
Antimony	EPA 6010	Metals	NELAP	7/1/2003
Antimony	EPA 6020	Metals	NELAP	7/1/2003
Aramite	EPA 8270	Extractable Organics	NELAP	7/1/2003
Aroclor-1016 (PCB-1016)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1221 (PCB-1221)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1232 (PCB-1232)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1242 (PCB-1242)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1248 (PCB-1248)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1254 (PCB-1254)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1260 (PCB-1260)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Arsenic	EPA 200.7	Metals	NELAP	10/8/2001
Arsenic	EPA 200.8	Metals	NELAP	10/8/2001
Arsenic	EPA 200.9	Metals	NELAP	10/8/2001
Arsenic	EPA 6010	Metals	NELAP	10/8/2001
Arsenic	EPA 6020	Metals	NELAP	7/1/2003
Arsenic	EPA 7060	Metals	NELAP	10/8/2001
Arsenic	EPA 7062	Metals	NELAP	10/8/2007
Azinphos-methyl (Guthion)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Barium	EPA 200.7	Metals	NELAP	10/8/2001
Barium	EPA 200.8	Metals	NELAP	10/8/2001
Barium	EPA 6010	Metals	NELAP	7/1/2003
Barium	EPA 6020	Metals	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Benzene	EPA 624	Volatile Organics	NELAP	10/8/2001
Benzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Benzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Benzidine	EPA 625	Extractable Organics	NELAP	10/8/2001
Benzo(a)anthracene	EPA 625	Extractable Organics	NELAP	10/8/2001
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzo(a)pyrene	EPA 625	Extractable Organics	NELAP	10/8/2001
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzo(b)fluoranthene	EPA 625	Extractable Organics	NELAP	10/8/2001
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzo(g,h,i)perylene	EPA 625	Extractable Organics	NELAP	10/8/2001
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzo(k)fluoranthene	EPA 625	Extractable Organics	NELAP	10/8/2001
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzoic acid	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Beryllium	EPA 200.7	Metals	NELAP	10/8/2001
Beryllium	EPA 200.8	Metals	NELAP	10/8/2001
Beryllium	EPA 6010	Metals	NELAP	7/1/2003
Beryllium	EPA 6020	Metals	NELAP	7/1/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
beta-Naphthylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Biochemical oxygen demand	EPA 405.1	General Chemistry	NELAP	10/8/2001
Biochemical oxygen demand	SM 5210 B	General Chemistry	NELAP	4/11/2007
bis(2-Chloroethoxy)methane	EPA 625	Extractable Organics	NELAP	10/8/2001
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroethyl) ether	EPA 625	Extractable Organics	NELAP	10/8/2001
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 625	Extractable Organics	NELAP	10/8/2001

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 625	Extractable Organics	NELAP	10/8/2001
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Bolstar (Sulprofos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Boron	EPA 200.7	Metals	NELAP	10/8/2001
Boron	EPA 6010	Metals	NELAP	10/8/2007
Bromide	EPA 300.0	General Chemistry	NELAP	10/8/2001
Bromobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromodichloromethane	EPA 624	Volatile Organics	NELAP	10/8/2001
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromoform	EPA 624	Volatile Organics	NELAP	10/8/2001
Bromoform	EPA 8260	Volatile Organics	NELAP	7/1/2003
Butyl benzyl phthalate	EPA 625	Extractable Organics	NELAP	10/8/2001
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Cadmium	EPA 200.7	Metals	NELAP	10/8/2001
Cadmium	EPA 200.8	Metals	NELAP	10/8/2001
Cadmium	EPA 6010	Metals	NELAP	10/8/2001
Cadmium	EPA 6020	Metals	NELAP	7/1/2003
Calcium	EPA 200.7	Metals	NELAP	10/8/2001
Calcium	EPA 6010	Metals	NELAP	10/8/2001
Carbazole	EPA 8270	Extractable Organics	NELAP	7/1/2003
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	7/1/2003
Carbon tetrachloride	EPA 624	Volatile Organics	NELAP	10/8/2001
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chemical oxygen demand	EPA 410.1	General Chemistry	NELAP	10/8/2001
Chemical oxygen demand	EPA 410.2	General Chemistry	NELAP	12/23/2005
Chemical oxygen demand	SM 5220 C	General Chemistry	NELAP	4/11/2007
Chlordane (tech.)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Chloride	EPA 300.0	General Chemistry	NELAP	10/8/2001
Chloride	EPA 325.3	General Chemistry	NELAP	10/8/2001
Chloride	SM 4500 Cl- C	General Chemistry	NELAP	4/11/2007
Chlorobenzene	EPA 624	Volatile Organics	NELAP	10/8/2001
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Chloroethane	EPA 624	Volatile Organics	NELAP	10/8/2001
Chloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chloroform	EPA 624	Volatile Organics	NELAP	10/8/2001
Chloroform	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chloroprene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chlorpyrifos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Chromium	EPA 200.7	Metals	NELAP	10/8/2001
Chromium	EPA 200.8	Metals	NELAP	10/8/2001
Chromium	EPA 6010	Metals	NELAP	7/1/2003
Chromium	EPA 6020	Metals	NELAP	7/1/2003
Chromium	EPA 7191	Metals	NELAP	10/8/2007
Chromium VI	EPA 7195	Metals	NELAP	7/1/2003
Chromium VI	EPA 7196	General Chemistry	NELAP	7/1/2003
Chrysene	EPA 625	Extractable Organics	NELAP	10/8/2001
Chrysene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Chrysene	EPA 8310	Extractable Organics	NELAP	7/1/2003
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
cis-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	10/8/2001
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	7/1/2003
cis-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Cobalt	EPA 200.7	Metals	NELAP	10/8/2001
Cobalt	EPA 200.8	Metals	NELAP	10/8/2001
Cobalt	EPA 6010	Metals	NELAP	7/1/2003
Cobalt	EPA 6020	Metals	NELAP	7/1/2003
Color	EPA 110.2	General Chemistry	NELAP	10/8/2001
Color	SM 2120 B	General Chemistry	NELAP	4/11/2007
Conductivity	EPA 120.1	General Chemistry	NELAP	10/8/2001
Copper	EPA 200.7	Metals	NELAP	10/8/2001
Copper	EPA 200.8	Metals	NELAP	10/8/2001
Copper	EPA 6010	Metals	NELAP	10/8/2001
Copper	EPA 6020	Metals	NELAP	7/1/2003
Coumaphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
delta-BHC	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Demeton-o	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Diazinon	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dibenz(a,h) anthracene	EPA 625	Extractable Organics	NELAP	10/8/2001
Dibenz(a,h) anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dibenz(a,h) anthracene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dibromochloromethane	EPA 624	Volatile Organics	NELAP	10/8/2001
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dibromomethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dichlorovos (DDVP, Dichlorvos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dieldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Diesel range organics (DRO)	CA-LUFT	Extractable Organics	NELAP	7/1/2003
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	7/28/2003
Diesel range organics (DRO)	NWTPH-Dx	Extractable Organics	NELAP	7/1/2003
Diethyl phthalate	EPA 625	Extractable Organics	NELAP	10/8/2001
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dimethyl phthalate	EPA 625	Extractable Organics	NELAP	10/8/2001
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-n-butyl phthalate	EPA 625	Extractable Organics	NELAP	10/8/2001
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-n-octyl phthalate	EPA 625	Extractable Organics	NELAP	10/8/2001
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Disulfoton	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan I	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan II	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan sulfate	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin aldehyde	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2007
Enterococci	SM 9223 B /QUANTI-TRAY	Microbiology	NELAP	10/8/2007
Escherichia coli	SM 9223 B /QUANTI-TRAY	Microbiology	NELAP	10/8/2007
Ethanol	EPA 8015	Volatile Organics	NELAP	7/1/2003
Ethoprop	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Ethylbenzene	EPA 624	Volatile Organics	NELAP	10/8/2001
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Ethylene glycol	EPA 8015	Volatile Organics	NELAP	7/1/2003
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Fecal coliforms	SM 9221 E	Microbiology	NELAP	10/8/2001
Fensulfothion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Fenthion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Fluoranthene	EPA 625	Extractable Organics	NELAP	10/8/2001
Fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Fluoranthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Fluorene	EPA 625	Extractable Organics	NELAP	10/8/2001
Fluorene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Fluorene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Fluoride	EPA 300.0	General Chemistry	NELAP	10/8/2001
Fluoride	EPA 340.2	General Chemistry	NELAP	10/8/2001
Fluoride	SM 4500 F-C	General Chemistry	NELAP	4/11/2007
Formaldehyde	EPA 8315	Extractable Organics	NELAP	7/1/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	12/23/2005
Gasoline range organics (GRO)	CA-LUFT	Extractable Organics	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Gasoline range organics (GRO)	EPA 8015	Volatile Organics	NELAP	7/17/2003
Gasoline range organics (GRO)	NWTPH-Gx	Extractable Organics	NELAP	7/1/2003
Hardness	EPA 130.2	General Chemistry	NELAP	10/8/2001
Hardness	SM 2340 C	General Chemistry	NELAP	4/11/2007
Hardness (calc.)	EPA 200.7	Metals	NELAP	10/8/2007
Heptachlor	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Heptachlor epoxide	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Hexachlorobenzene	EPA 625	Extractable Organics	NELAP	10/8/2001
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorobutadiene	EPA 625	Extractable Organics	NELAP	10/8/2001
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorocyclopentadiene	EPA 625	Extractable Organics	NELAP	10/8/2001
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachloroethane	EPA 625	Extractable Organics	NELAP	10/8/2001
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Ignitability	EPA 1020	General Chemistry	NELAP	7/1/2003
Indeno(1,2,3-cd)pyrene	EPA 625	Extractable Organics	NELAP	10/8/2001
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Iron	EPA 200.7	Metals	NELAP	10/8/2001
Iron	EPA 6010	Metals	NELAP	7/1/2003
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Isophorone	EPA 625	Extractable Organics	NELAP	10/8/2001
Isophorone	EPA 8270	Extractable Organics	NELAP	7/1/2003
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Isosafrole	EPA 8270	Extractable Organics	NELAP	7/1/2003
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Kjeldahl nitrogen	ASTM D3590-89A	General Chemistry	NELAP	4/11/2007
Kjeldahl nitrogen - total	EPA 351.4	General Chemistry	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Lead	EPA 200.7	Metals	NELAP	10/8/2001
Lead	EPA 200.8	Metals	NELAP	10/8/2001
Lead	EPA 200.9	Metals	NELAP	10/8/2001
Lead	EPA 6010	Metals	NELAP	10/8/2001
Lead	EPA 6020	Metals	NELAP	7/1/2003
Lead	EPA 7421	Metals	NELAP	10/8/2001
Magnesium	EPA 200.7	Metals	NELAP	10/8/2001
Magnesium	EPA 6010	Metals	NELAP	7/1/2003
Malathion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Manganese	EPA 200.7	Metals	NELAP	10/8/2001
Manganese	EPA 200.8	Metals	NELAP	10/8/2001
Manganese	EPA 6010	Metals	NELAP	7/1/2003
Manganese	EPA 6020	Metals	NELAP	7/1/2003
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Mercury	EPA 1631	Metals	NELAP	10/8/2001
Mercury	EPA 245.1	Metals	NELAP	10/8/2001
Mercury	EPA 7470	Metals	NELAP	10/8/2001
Merphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methanol	NCASI 99.01	Volatile Organics	NELAP	10/8/2001
Methanol	NCASI DI/MEOH-94.03	Volatile Organics	NELAP	10/8/2001
Methapyrilene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Methyl bromide (Bromomethane)	EPA 624	Volatile Organics	NELAP	10/8/2001
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methyl chloride (Chloromethane)	EPA 624	Volatile Organics	NELAP	10/8/2001
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methyl mercury	EPA 1630	Metals	NELAP	10/8/2007
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methyl parathion (Parathion, methyl)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methylene chloride	EPA 624	Volatile Organics	NELAP	10/8/2001
Methylene chloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Mevinphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Molybdenum	EPA 200.7	Metals	NELAP	10/8/2001
Molybdenum	EPA 200.8	Metals	NELAP	10/8/2001
Molybdenum	EPA 6010	Metals	NELAP	10/8/2001
Molybdenum	EPA 6020	Metals	NELAP	10/8/2007
Naphthalene	EPA 625	Extractable Organics	NELAP	10/8/2001
Naphthalene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Naphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Naphthalene	EPA 8310	Extractable Organics	NELAP	7/1/2003
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Nickel	EPA 200.7	Metals	NELAP	10/8/2001
Nickel	EPA 200.8	Metals	NELAP	10/8/2001
Nickel	EPA 6010	Metals	NELAP	10/8/2001
Nickel	EPA 6020	Metals	NELAP	7/1/2003
Nitrate as N	EPA 300.0	General Chemistry	NELAP	10/8/2001
Nitrate as N	EPA 353.2	General Chemistry	NELAP	7/17/2003
Nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	10/8/2001
Nitrite as N	EPA 300.0	General Chemistry	NELAP	10/8/2001
Nitrite as N	EPA 353.2	General Chemistry	NELAP	7/17/2003
Nitrobenzene	EPA 625	Extractable Organics	NELAP	10/8/2001
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	7/1/2003
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodimethylamine	EPA 625	Extractable Organics	NELAP	10/8/2001
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodi-n-propylamine	EPA 625	Extractable Organics	NELAP	10/8/2001
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodiphenylamine	EPA 625	Extractable Organics	NELAP	10/8/2001
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	7/1/2003

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Oil & Grease	EPA 1664	General Chemistry	NELAP	10/8/2001
Orthophosphate as P	EPA 365.3	General Chemistry	NELAP	10/8/2001
o-Toluidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Oxygen, dissolved	SM 4500-O G	General Chemistry	NELAP	4/11/2007
Parathion, ethyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Pentachloronitrobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pentachlorophenol	EPA 1653	Extractable Organics	NELAP	10/8/2001
Pentachlorophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
pH	EPA 150.1	General Chemistry	NELAP	10/8/2001
pH	EPA 9040	General Chemistry	NELAP	7/1/2003
pH	SM 4500-H+-B	General Chemistry	NELAP	4/11/2007
Phenacetin	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phenanthrene	EPA 625	Extractable Organics	NELAP	10/8/2001
Phenanthrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phenanthrene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Phenol	EPA 625	Extractable Organics	NELAP	10/8/2001
Phenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phorate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Phosphorus, total	EPA 365.3	General Chemistry	NELAP	10/8/2001
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Potassium	EPA 200.7	Metals	NELAP	10/8/2001
Potassium	EPA 6010	Metals	NELAP	10/8/2001
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Pyrene	EPA 625	Extractable Organics	NELAP	10/8/2001
Pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pyrene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Pyridine	EPA 8270	Extractable Organics	NELAP	7/1/2003
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Residual free chlorine	EPA 330.4	General Chemistry	NELAP	10/8/2001
Residue-filterable (TDS)	EPA 160.1	General Chemistry	NELAP	10/8/2001
Residue-filterable (TDS)	SM 2540 C	General Chemistry	NELAP	4/11/2007
Residue-nonfilterable (TSS)	EPA 160.2	General Chemistry	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Residue-nonfilterable (TSS)	SM 2540 D	General Chemistry	NELAP	4/11/2007
Residue-settleable	EPA 160.5	General Chemistry	NELAP	10/8/2001
Residue-settleable	SM 2540 F	General Chemistry	NELAP	4/11/2007
Residue-total	EPA 160.3	General Chemistry	NELAP	10/8/2001
Residue-total	SM 2540 B	General Chemistry	NELAP	4/11/2007
Residue-volatile	EPA 160.4	General Chemistry	NELAP	10/8/2001
Ronnel	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Safrole	EPA 8270	Extractable Organics	NELAP	7/1/2003
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Selenium	EPA 200.7	Metals	NELAP	10/8/2001
Selenium	EPA 200.8	Metals	NELAP	10/8/2001
Selenium	EPA 200.9	Metals	NELAP	10/8/2001
Selenium	EPA 6010	Metals	NELAP	10/8/2001
Selenium	EPA 6020	Metals	NELAP	10/8/2007
Selenium	EPA 7740	Metals	NELAP	10/8/2001
Selenium	EPA 7742	Metals	NELAP	7/17/2003
Silica as SiO2	EPA 200.7	Metals	NELAP	10/8/2007
Silver	EPA 200.7	Metals	NELAP	10/8/2001
Silver	EPA 200.8	Metals	NELAP	10/8/2001
Silver	EPA 6010	Metals	NELAP	7/1/2003
Silver	EPA 6020	Metals	NELAP	7/1/2003
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Sodium	EPA 200.7	Metals	NELAP	10/8/2001
Sodium	EPA 6010	Metals	NELAP	7/1/2003
Stirofos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Strontium	EPA 200.7	Metals	NELAP	10/8/2007
Styrene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Sulfate	EPA 300.0	General Chemistry	NELAP	10/8/2001
Sulfide	EPA 376.1	General Chemistry	NELAP	10/8/2001
Sulfide	SM 4500-S F (20th Ed.)	General Chemistry	NELAP	4/11/2007
Sulfite-SO3	SM 4500-SO3 B	General Chemistry	NELAP	4/11/2007
Surfactants - MBAS	SM 5540 C	General Chemistry	NELAP	4/11/2007
Tannin & Lignin	SM 5550 B	General Chemistry	NELAP	10/8/2007
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Tetrachlorocatechol	EPA 1653	Extractable Organics	NELAP	10/8/2001
Tetrachloroethylene (Perchloroethylene)	EPA 624	Volatile Organics	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Tetrachloroguaiacol	EPA 1653	Extractable Organics	NELAP	10/8/2001
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Thallium	EPA 200.7	Metals	NELAP	10/8/2001
Thallium	EPA 200.8	Metals	NELAP	10/8/2001
Thallium	EPA 200.9	Metals	NELAP	10/8/2001
Thallium	EPA 6010	Metals	NELAP	10/8/2007
Thallium	EPA 6020	Metals	NELAP	7/1/2003
Thallium	EPA 7841	Metals	NELAP	7/1/2003
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Tin	EPA 200.7	Metals	NELAP	7/17/2003
Tin	EPA 6010	Metals	NELAP	10/8/2007
Titanium	EPA 200.7	Metals	NELAP	7/17/2003
Titanium	EPA 6010	Metals	NELAP	10/8/2007
Tokuthion (Prothiophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Toluene	EPA 624	Volatile Organics	NELAP	10/8/2001
Toluene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Toluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Total coliforms	SM 9221 B	Microbiology	NELAP	10/8/2001
Total coliforms	SM 9223 B /QUANTI-TRAY	Microbiology	NELAP	10/8/2007
Total coliforms & E. coli	SM 9223 B	Microbiology	NELAP	10/8/2007
Total cyanide	EPA 335.4	General Chemistry	NELAP	7/17/2003
Total cyanide	EPA 9012	General Chemistry	NELAP	12/23/2005
Total hardness as CaCO3	EPA 200.7	Metals	NELAP	10/8/2001
Total organic carbon	EPA 415.1	General Chemistry	NELAP	10/8/2001
Total organic carbon	EPA 9060	General Chemistry	NELAP	7/1/2003
Total organic carbon	SM 5310C	General Chemistry	NELAP	4/11/2007
Total organic halides (TOX)	EPA 9020	General Chemistry	NELAP	7/1/2003
Total Petroleum Hydrocarbons (TPH)	EPA 1664	General Chemistry	NELAP	10/8/2001
Total Petroleum Hydrocarbons (TPH)	EPA 8015	Extractable Organics	NELAP	7/1/2003
Total Petroleum Hydrocarbons (TPH)	NWTPH-HCID	Extractable Organics	NELAP	7/1/2003
Total phenolics	EPA 420.1	General Chemistry	NELAP	10/8/2001
Total residual chlorine	SM 4500-Cl F	General Chemistry	NELAP	4/11/2007
Toxaphene (Chlorinated camphene)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
trans-1,2-Dichloroethylene	EPA 624	Volatile Organics	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
trans-1,3-Dichloropropylene	EPA 624	Volatile Organics	NELAP	10/8/2001
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trichloroethene (Trichloroethylene)	EPA 624	Volatile Organics	NELAP	10/8/2001
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trichlorofluoromethane	EPA 624	Volatile Organics	NELAP	10/8/2001
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trichloronate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Trichlorosyringol	EPA 1653	Extractable Organics	NELAP	10/8/2001
Turbidity	EPA 180.1	General Chemistry	NELAP	10/8/2001
Uranium	EPA 200.8	Metals	NELAP	10/8/2001
Vanadium	EPA 200.7	Metals	NELAP	10/8/2001
Vanadium	EPA 200.8	Metals	NELAP	10/8/2001
Vanadium	EPA 6010	Metals	NELAP	7/1/2003
Vanadium	EPA 6020	Metals	NELAP	10/8/2007
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Vinyl chloride	EPA 624	Volatile Organics	NELAP	10/8/2001
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Xylene (total)	EPA 624	Volatile Organics	NELAP	10/8/2001
Xylene (total)	EPA 8021	Volatile Organics	NELAP	7/1/2003
Xylene (total)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Zinc	EPA 200.7	Metals	NELAP	10/8/2001
Zinc	EPA 200.8	Metals	NELAP	10/8/2001
Zinc	EPA 6010	Metals	NELAP	10/8/2001
Zinc	EPA 6020	Metals	NELAP	7/1/2003

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	7/17/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	10/8/2001
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	10/8/2001
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
1-Chlorohexane	EPA 8260	Volatile Organics	NELAP	7/17/2003
1-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	7/17/2003
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/8/2001
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,3-Dichlorobiphenyl (BZ 5)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	10/8/2001
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	10/8/2001
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	10/8/2001
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	10/8/2001
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Chlorobiphenyl (BZ 1)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	10/8/2001
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	10/8/2001
2-Hexanone	EPA 8260	Volatile Organics	NELAP	10/8/2001
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Nitropropane	EPA 8260	Volatile Organics	NELAP	7/17/2003
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	10/8/2001
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	10/8/2001
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	10/8/2001
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	10/8/2001
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	10/8/2001
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	7/17/2003
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	10/8/2001
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	10/8/2001
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	10/8/2001
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	10/8/2001
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	10/8/2001
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	10/8/2001
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	10/8/2001
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
Acenaphthene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Acenaphthene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Acetone	EPA 8260	Volatile Organics	NELAP	10/8/2001
Acetonitrile	EPA 8260	Volatile Organics	NELAP	10/8/2001
Acetophenone	EPA 8270	Extractable Organics	NELAP	10/8/2001
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	10/8/2001
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	10/8/2001
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aluminum	EPA 6010	Metals	NELAP	10/8/2001
Aluminum	EPA 6020	Metals	NELAP	10/8/2001
Ammonia as N	EPA 350.1	General Chemistry	NELAP	10/8/2007
Aniline	EPA 8270	Extractable Organics	NELAP	10/8/2001
Anthracene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Anthracene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Antimony	EPA 6010	Metals	NELAP	10/8/2001
Antimony	EPA 6020	Metals	NELAP	10/8/2001
Aramite	EPA 8270	Extractable Organics	NELAP	10/8/2001
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Arsenic	EPA 6010	Metals	NELAP	7/1/2003
Arsenic	EPA 6020	Metals	NELAP	10/8/2001
Arsenic	EPA 7060	Metals	NELAP	10/8/2001
Arsenic	EPA 7062	Metals	NELAP	10/8/2007

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Azinphos-methyl (Guthion)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Barium	EPA 6010	Metals	NELAP	10/8/2001
Barium	EPA 6020	Metals	NELAP	10/8/2001
Benzene	EPA 8021	Volatile Organics	NELAP	10/8/2001
Benzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Benzoic acid	EPA 8270	Extractable Organics	NELAP	10/8/2001
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	10/8/2001
Beryllium	EPA 6010	Metals	NELAP	10/8/2001
Beryllium	EPA 6020	Metals	NELAP	10/8/2001
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
beta-Naphthylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	10/8/2001
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	10/8/2001
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	10/8/2001
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	10/8/2001
Bolstar (Sulprofos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Boron	EPA 6010	Metals	NELAP	10/8/2007
Bromobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Bromoform	EPA 8260	Volatile Organics	NELAP	10/8/2001
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	10/8/2001
Cadmium	EPA 6010	Metals	NELAP	10/8/2001
Cadmium	EPA 6020	Metals	NELAP	10/8/2001
Calcium	EPA 6010	Metals	NELAP	10/8/2001
Carbazole	EPA 8270	Extractable Organics	NELAP	10/8/2001

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	10/8/2001
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	10/8/2001
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Chloride	EPA 300.0	General Chemistry	NELAP	2/17/2006
Chloride	EPA 9056	General Chemistry	NELAP	7/17/2003
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Chloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Chloroform	EPA 8260	Volatile Organics	NELAP	10/8/2001
Chloroprene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Chlorpyrifos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Chromium	EPA 6010	Metals	NELAP	10/8/2001
Chromium	EPA 6020	Metals	NELAP	10/8/2001
Chromium	EPA 7191	Metals	NELAP	10/8/2007
Chromium VI	EPA 7195	Metals	NELAP	10/8/2001
Chromium VI	EPA 7196	General Chemistry	NELAP	10/8/2001
Chrysene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Chrysene	EPA 8310	Extractable Organics	NELAP	10/8/2001
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	10/8/2001
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	10/8/2001
cis-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Cobalt	EPA 6010	Metals	NELAP	10/8/2001
Cobalt	EPA 6020	Metals	NELAP	10/8/2001
Copper	EPA 6010	Metals	NELAP	10/8/2001
Copper	EPA 6020	Metals	NELAP	10/8/2001
Corrosivity (pH)	EPA 1110	General Chemistry	NELAP	10/8/2001
Coumaphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Demeton-o	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Demeton-s	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Diazinon	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dibenz(a,h) anthracene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Dibenz(a,h) anthracene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Dibromomethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dichlorovos (DDVP, Dichlorvos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Diesel range organics (DRO)	CA-LUFT	Extractable Organics	NELAP	10/8/2001
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	7/17/2003
Diesel range organics (DRO)	NWTPH-Dx	Extractable Organics	NELAP	10/8/2001
Diethyl ether	EPA 8260	Volatile Organics	NELAP	7/17/2003
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	10/8/2001
Dimethoate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	10/8/2001
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	10/8/2001
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	10/8/2001
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Extractable Organics	NELAP	10/8/2001
Disulfoton	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2007
EPN	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Ethoprop	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Ethyl acetate	EPA 8260	Volatile Organics	NELAP	7/17/2003
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/8/2001
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	10/8/2001
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	10/8/2001
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Ethylene glycol	EPA 8015	Volatile Organics	NELAP	10/8/2001
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Fensulfothion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Fenthion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Fluoranthene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Fluoranthene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Fluorene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Fluorene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Fluoride	EPA 300.0	General Chemistry	NELAP	2/17/2006
Fluoride	EPA 9056	General Chemistry	NELAP	7/17/2003
Formaldehyde	EPA 8315	Extractable Organics	NELAP	10/8/2001
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Gasoline range organics (GRO)	CA-LUFT	Extractable Organics	NELAP	10/8/2001
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	7/17/2003
Gasoline range organics (GRO)	NWTPH-Gx	Extractable Organics	NELAP	10/8/2001
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	10/8/2001
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Ignitability	EPA 1020	General Chemistry	NELAP	10/8/2001
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Iron	EPA 6010	Metals	NELAP	10/8/2001
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Isophorone	EPA 8270	Extractable Organics	NELAP	10/8/2001
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Isosafrole	EPA 8270	Extractable Organics	NELAP	10/8/2001
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Lead	EPA 6010	Metals	NELAP	10/8/2001
Lead	EPA 6020	Metals	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Lead	EPA 7421	Metals	NELAP	10/8/2001
Magnesium	EPA 6010	Metals	NELAP	10/8/2001
Malathion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Manganese	EPA 6010	Metals	NELAP	10/8/2001
Manganese	EPA 6020	Metals	NELAP	10/8/2001
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Mercury	EPA 1631	Metals	NELAP	10/8/2007
Mercury	EPA 7470	Metals	NELAP	10/8/2001
Mercury	EPA 7471	Metals	NELAP	10/8/2001
Merphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	10/8/2001
Methapyrilene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Methyl mercury	EPA 1630	Metals	NELAP	10/8/2007
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/8/2001
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	7/17/2003
Methyl parathion (Parathion, methyl)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Methylene chloride	EPA 8260	Volatile Organics	NELAP	10/8/2001
Mevinphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Molybdenum	EPA 6010	Metals	NELAP	10/8/2001
Molybdenum	EPA 6020	Metals	NELAP	10/8/2007
Naphthalene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Naphthalene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Naphthalene	EPA 8310	Extractable Organics	NELAP	10/8/2001
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Nickel	EPA 6010	Metals	NELAP	10/8/2001
Nickel	EPA 6020	Metals	NELAP	10/8/2001
Nitrate	EPA 9056	General Chemistry	NELAP	7/17/2003
Nitrate as N	EPA 353.2	General Chemistry	NELAP	10/8/2007
Nitrite	EPA 9056	General Chemistry	NELAP	7/17/2003
Nitrite as N	EPA 353.2	General Chemistry	NELAP	10/8/2007

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	10/8/2001
Nitroglycerin	EPA 8332	Extractable Organics	NELAP	7/17/2003
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	10/8/2001
Oil & Grease	EPA 1664	General Chemistry	NELAP	10/8/2001
Oil & Grease	EPA 9071	General Chemistry	NELAP	10/8/2001
Orthophosphate as P	EPA 365.3	General Chemistry	NELAP	10/8/2007
o-Toluidine	EPA 8270	Extractable Organics	NELAP	10/8/2001
Parathion, ethyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
p-Dioxane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	7/17/2003
Pentachloronitrobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
pH	EPA 9040	General Chemistry	NELAP	10/8/2001
pH	EPA 9045	General Chemistry	NELAP	7/17/2003
Phenacetin	EPA 8270	Extractable Organics	NELAP	10/8/2001
Phenanthrene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Phenanthrene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Phenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
Phorate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Phosphorus, total	EPA 365.3	General Chemistry	NELAP	10/8/2007
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	10/8/2001

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Potassium	EPA 6010	Metals	NELAP	10/8/2001
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	10/8/2001
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Pyrene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Pyrene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Pyridine	EPA 8270	Extractable Organics	NELAP	10/8/2001
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	10/8/2001
Residue-total	EPA 160.3	General Chemistry	NELAP	10/8/2007
Ronnel	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Safrole	EPA 8270	Extractable Organics	NELAP	10/8/2001
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Selenium	EPA 6010	Metals	NELAP	7/17/2003
Selenium	EPA 6020	Metals	NELAP	10/8/2007
Selenium	EPA 7740	Metals	NELAP	10/8/2001
Selenium	EPA 7742	Metals	NELAP	7/17/2003
Silver	EPA 6010	Metals	NELAP	10/8/2001
Silver	EPA 6020	Metals	NELAP	10/8/2001
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Sodium	EPA 6010	Metals	NELAP	10/8/2001
Stirofos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Strontium	EPA 6010	Metals	NELAP	10/8/2007
Strontium	EPA 6020	Metals	NELAP	10/8/2007
Styrene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Sulfate	EPA 300.0	General Chemistry	NELAP	2/17/2006
Sulfate	EPA 9056	General Chemistry	NELAP	7/17/2003
Sulfide	EPA 9030/9034	General Chemistry	NELAP	7/17/2003
Sulfotepp	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Synthetic Precipitation Leaching Procedure	EPA 1312	General Chemistry	NELAP	7/17/2003
tert-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	7/17/2003
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	10/8/2001
Thallium	EPA 6010	Metals	NELAP	7/17/2003
Thallium	EPA 6020	Metals	NELAP	10/8/2001
Thallium	EPA 7841	Metals	NELAP	10/8/2001
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Tin	EPA 6010	Metals	NELAP	10/8/2007
Tokuthion (Prothiophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Toluene	EPA 8021	Volatile Organics	NELAP	10/8/2001
Toluene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Total cyanide	EPA 9012	General Chemistry	NELAP	12/23/2005
Total nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	10/8/2007
Total organic carbon	EPA 9060	General Chemistry	NELAP	10/8/2001
Total organic halides (TOX)	EPA 9020	General Chemistry	NELAP	10/8/2001
Total Petroleum Hydrocarbons (TPH)	NWTPH-HCID	Extractable Organics	NELAP	10/8/2001
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Toxicity Characteristic Leaching Procedure	EPA 1311	General Chemistry	NELAP	10/8/2001
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	10/8/2001
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	10/8/2001
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Trichloronate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Vanadium	EPA 6010	Metals	NELAP	10/8/2001
Vanadium	EPA 6020	Metals	NELAP	10/8/2007
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	10/8/2001
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	10/8/2001
Xylene (total)	EPA 8021	Volatile Organics	NELAP	10/8/2001
Xylene (total)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Zinc	EPA 6010	Metals	NELAP	10/8/2001
Zinc	EPA 6020	Metals	NELAP	10/8/2001

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	7/1/2003
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	7/1/2003
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3-Dichlorobiphenyl (BZ 5)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2-Chlorobiphenyl (BZ 1)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	7/1/2003
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
Acenaphthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aluminum	EPA 6010	Metals	NELAP	7/1/2003
Aluminum	EPA 6020	Metals	NELAP	7/1/2003
Aniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
Anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Antimony	EPA 6010	Metals	NELAP	7/1/2003
Antimony	EPA 6020	Metals	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Arsenic	EPA 6010	Metals	NELAP	7/1/2003
Arsenic	EPA 6020	Metals	NELAP	7/1/2003
Arsenic	EPA 7060	Metals	NELAP	7/1/2003
Barium	EPA 6010	Metals	NELAP	7/1/2003
Barium	EPA 6020	Metals	NELAP	7/1/2003
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzoic acid	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Beryllium	EPA 6010	Metals	NELAP	7/1/2003
Beryllium	EPA 6020	Metals	NELAP	7/1/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Boron	EPA 6010	Metals	NELAP	10/8/2007
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Cadmium	EPA 6010	Metals	NELAP	7/1/2003
Cadmium	EPA 6020	Metals	NELAP	7/1/2003
Carbazole	EPA 8270	Extractable Organics	NELAP	7/1/2003
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Chromium	EPA 6010	Metals	NELAP	7/1/2003
Chromium	EPA 6020	Metals	NELAP	7/1/2003
Chromium	EPA 7191	Metals	NELAP	10/8/2007
Chromium VI	EPA 7196	Metals	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Chrysene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Cobalt	EPA 6010	Metals	NELAP	7/1/2003
Cobalt	EPA 6020	Metals	NELAP	7/1/2003
Copper	EPA 6010	Metals	NELAP	7/1/2003
Copper	EPA 6020	Metals	NELAP	7/1/2003
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dibenz(a,h) anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Fluorene	EPA 8270	Extractable Organics	NELAP	7/1/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	7/1/2003
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Iron	EPA 6010	Metals	NELAP	7/1/2003
Isophorone	EPA 8270	Extractable Organics	NELAP	7/1/2003
Lead	EPA 6010	Metals	NELAP	7/1/2003
Lead	EPA 6020	Metals	NELAP	7/1/2003
Lead	EPA 7421	Metals	NELAP	7/1/2003
Manganese	EPA 6010	Metals	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Manganese	EPA 6020	Metals	NELAP	7/1/2003
Mercury	EPA 1631	Metals	NELAP	10/8/2007
Mercury	EPA 7471	Metals	NELAP	7/1/2003
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Molybdenum	EPA 6010	Metals	NELAP	7/1/2003
Molybdenum	EPA 6020	Metals	NELAP	10/8/2007
Naphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Nickel	EPA 6010	Metals	NELAP	7/1/2003
Nickel	EPA 6020	Metals	NELAP	7/1/2003
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	7/1/2003
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phenanthrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pyridine	EPA 8270	Extractable Organics	NELAP	7/1/2003
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Selenium	EPA 6010	Metals	NELAP	7/1/2003
Selenium	EPA 6020	Metals	NELAP	10/8/2007
Selenium	EPA 7740	Metals	NELAP	7/1/2003
Selenium	EPA 7742	Metals	NELAP	7/1/2003
Silver	EPA 6010	Metals	NELAP	7/1/2003
Silver	EPA 6020	Metals	NELAP	7/1/2003
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Thallium	EPA 6020	Metals	NELAP	7/1/2003
Thallium	EPA 7841	Metals	NELAP	7/1/2003
Tin	EPA 6010	Metals	NELAP	10/8/2007
Total cyanide	EPA 9012	General Chemistry	NELAP	12/23/2005
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Vanadium	EPA 6010	Metals	NELAP	7/1/2003
Vanadium	EPA 6020	Metals	NELAP	10/8/2007
Zinc	EPA 6010	Metals	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Zinc	EPA 6020	Metals	NELAP	7/1/2003

APPENDIX F

ADDITIONAL AGENCY-SPECIFIC DOCUMENTS

Columbia Analytical Services, Inc.

Rochester, NY

Columbia Analytical Services, Inc.

Rochester, NY

QC Limits May 2009

CAS-ROCHESTER ORGANIC QC LIMITS (effective 5/14/2009)

METHOD		ANALYTE	MATRIX	MRL	UNITS	DUP (RPD)	MS
8015B		DIESEL RANGE ORGANICS	WATER	100	UG/L	30	10-194
8015B		O-TERPHENYL -SURR	WATER	NA	UG/L	NA	51-117
8015B		DIESEL RANGE ORGANICS	SOIL	40000	UG/KG	30	10-153
8015B		O-TERPHENYL -SURR	SOIL	NA	UG/KG	NA	55-116
8015B		OIL RANGE ORGANICS	WATER	100	UG/L	30	50-150
8015B		O-TERPHENYL -SURR	WATER	NA	UG/L	NA	51-117
8015B		OIL RANGE ORGANICS	SOIL	40000	UG/KG	30	50-150
8015B		O-TERPHENYL -SURR	SOIL	NA	UG/KG	NA	55-116
8081A TCL		4,4'-DDD	WATER	0.10	UG/L	30	57-126
8081A TCL		4,4'-DDE	WATER	0.10	UG/L	30	50-123
8081A TCL		4,4'-DDT	WATER	0.10	UG/L	30	24-142
8081A TCL		ALDRIN	WATER	0.05	UG/L	30	10-153
8081A TCL		ALPHA-BHC	WATER	0.05	UG/L	30	51-120
8081A TCL		ALPHA-CHLORDANE	WATER	0.05	UG/L	30	36-127
8081A TCL		ALPHA-ENDOSULFAN	WATER	0.05	UG/L	30	60-126
8081A TCL		BETA-BHC	WATER	0.05	UG/L	30	65-120
8081A TCL		BETA-ENDOSULFAN	WATER	0.10	UG/L	30	64-128
8081A TCL		DELTA-BHC	WATER	0.05	UG/L	30	48-133
8081A TCL		DIELDRIN	WATER	0.10	UG/L	30	31-149
8081A TCL		ENDOSULFAN SULFATE	WATER	0.10	UG/L	30	56-126
8081A TCL		ENDRIN	WATER	0.10	UG/L	30	31-144
8081A TCL		ENDRIN ALDEHYDE	WATER	0.10	UG/L	30	10-146
8081A TCL		ENDRIN KETONE	WATER	0.10	UG/L	30	65-125
8081A TCL		GAMMA-BHC (LINDANE)	WATER	0.05	UG/L	30	40-131
8081A TCL		GAMMA-CHLORDANE	WATER	0.05	UG/L	30	48-122
8081A TCL		HEPTACHLOR	WATER	0.05	UG/L	30	38-128
8081A TCL		HEPTACHLOR EPOXIDE	WATER	0.05	UG/L	30	62-125
8081A TCL		METHOXYCHLOR	WATER	0.50	UG/L	30	10-151
8081A TCL		TOXAPHENE	WATER	1.0	UG/L	30	46-130
8081A TCL		DECACHLOROBIPHENYL (DCB) -SURR	WATER				40-140
8081A TCL		TETRACHLORO-META-XYLENE (TCMX) -SURR	WATER				40-140
8081A ADDITIONAL COMPOUNDS BY REQUEST							
8081A		CHLORDANE, TECHNICAL	WATER	0.25	UG/L	30	50-150
8081A		FAMPHUR	WATER	1.0	UG/L	30	50-150
8081A		HEXACHLOROBENZENE	WATER	0.05	UG/L	30	52-130
8081A		KEPONE	WATER	5.0	UG/L	30	50-150
8081A TCL		4,4'-DDD	SOIL	3.3	UG/KG	30	58-121
8081A TCL		4,4'-DDE	SOIL	3.3	UG/KG	30	56-125
8081A TCL		4,4'-DDT	SOIL	3.3	UG/KG	30	9-149
8081A TCL		ALDRIN	SOIL	1.7	UG/KG	30	15-135
8081A TCL		ALPHA-BHC	SOIL	1.7	UG/KG	30	53-130
8081A TCL		ALPHA-CHLORDANE	SOIL	1.7	UG/KG	30	27-130
8081A TCL		ALPHA-ENDOSULFAN	SOIL	1.7	UG/KG	30	56-119
8081A TCL		BETA-BHC	SOIL	1.7	UG/KG	30	35-142
8081A TCL		BETA-ENDOSULFAN	SOIL	3.3	UG/KG	30	65-127
8081A TCL		DELTA-BHC	SOIL	1.7	UG/KG	30	44-119
8081A TCL		DIELDRIN	SOIL	3.3	UG/KG	30	25-150
8081A TCL		ENDOSULFAN SULFATE	SOIL	3.3	UG/KG	30	37-122
8081A TCL		ENDRIN	SOIL	3.3	UG/KG	30	28-143
8081A TCL		ENDRIN ALDEHYDE	SOIL	3.3	UG/KG	30	18-135
8081A TCL		ENDRIN KETONE	SOIL	3.3	UG/KG	30	57-123
8081A TCL		GAMMA-BHC (LINDANE)	SOIL	1.7	UG/KG	30	37-124
8081A TCL		GAMMA-CHLORDANE	SOIL	1.7	UG/KG	30	38-127
8081A TCL		HEPTACHLOR	SOIL	1.7	UG/KG	30	35-127
8081A TCL		HEPTACHLOR EPOXIDE	SOIL	1.7	UG/KG	30	61-120
8081A TCL		METHOXYCHLOR	SOIL	17	UG/KG	30	38-149
8081A TCL		TOXAPHENE	SOIL	33	UG/KG	30	46-130
8081A TCL		DECACHLOROBIPHENYL (DCB) -SURR	SOIL	NA	UG/KG		40-140
8081A TCL		TETRACHLORO-META-XYLENE (TCMX) -SURR	SOIL	NA	UG/KG		40-140
8081A ADDITIONAL COMPOUNDS BY REQUEST							
8081A		CHLORDANE, TECHNICAL	SOIL	8.3	UG/KG	30	50-150
8081A		FAMPHUR	SOIL	33	UG/KG	30	50-150
8081A		HEXACHLOROBENZENE	SOIL	1.67	UG/KG	30	20-150
8081A		KEPONE	SOIL	167	UG/KG	30	50-150
8081A		MIREX	SOIL	1.67	UG/KG	30	70-130
8082		PCB 1016	WATER	1.0	UG/L	30	58-130
8082		PCB 1221	WATER	2.0	UG/L	30	50-150
8082		PCB 1232	WATER	1.0	UG/L	30	50-150
8082		PCB 1242	WATER	1.0	UG/L	30	50-150
8082		PCB 1248	WATER	1.0	UG/L	30	56-119
8082		PCB 1254	WATER	1.0	UG/L	30	60-143
8082		PCB 1260	WATER	1.0	UG/L	30	10-150
8082		PCB 1268	WATER	1.0	UG/L	30	50-150
8082		DECACHLOROBIPHENYL -SURR	WATER	NA	UG/L		40-140
8082		TETRACHLORO-META-XYLENE -SURR	WATER	NA	UG/L		40-140
8082		PCB 1016	SOIL	33	UG/KG	30	50-150
8082		PCB 1221	SOIL	67	UG/KG	30	50-150
8082		PCB 1232	SOIL	33	UG/KG	30	50-150
8082		PCB 1242	SOIL	33	UG/KG	30	50-150
8082		PCB 1248	SOIL	33	UG/KG	30	50-150
8082		PCB 1254	SOIL	33	UG/KG	30	32-159
8082		PCB 1260	SOIL	33	UG/KG	30	24-160
8082		PCB 1268	SOIL	33	UG/KG	30	50-150
8082		DECACHLOROBIPHENYL -SURR	SOIL	NA	UG/KG		40-140
8082		TETRACHLORO-META-XYLENE -SURR	SOIL	NA	UG/KG		40-140
8260B TCL	*	1,1,1-TRICHLOROETHANE	WATER	5.0	UG/L	30	70-130
8260B TCL		1,1,2,2-TETRACHLOROETHANE	WATER	5.0	UG/L	30	70-130
8260B TCL		1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	WATER	5.0	UG/L	30	70-130
8260B TCL		1,1,2-TRICHLOROETHANE	WATER	5.0	UG/L	30	70-130
8260B TCL	*	1,1-DICHLOROETHANE	WATER	5.0	UG/L	30	70-130
8260B TCL	*	1,1-DICHLOROETHENE	WATER	5.0	UG/L	30	70-130
8260B TCL		1,2,4-TRICHLOROBENZENE	WATER	5.0	UG/L	30	70-130
8260B TCL		1,2-DIBROMO-3-CHLOROPROPANE	WATER	5.0	UG/L	30	50-150
8260B TCL		1,2-DIBROMOETHANE	WATER	5.0	UG/L	30	70-130
8260B TCL	*	1,2-DICHLOROBENZENE	WATER	5.0	UG/L	30	70-130
8260B TCL	*	1,2-DICHLOROETHANE	WATER	5.0	UG/L	30	70-130
8260B TCL		1,2-DICHLOROPROPANE	WATER	5.0	UG/L	30	70-130
8260B TCL		1,3-DICHLOROBENZENE	WATER	5.0	UG/L	30	70-130
8260B TCL		1,4-DICHLOROBENZENE	WATER	5.0	UG/L	30	70-130
8260B TCL		2-BUTANONE (MEK)	WATER	10	UG/L	30	50-150
8260B TCL		2-HEXANONE	WATER	10	UG/L	30	70-130
8260B TCL		4-METHYL-2-PENTANONE (MIBK)	WATER	10	UG/L	30	70-130
8260B TCL		ACETONE	WATER	20	UG/L	30	50-150
8260B TCL	*	BENZENE	WATER	5.0	UG/L	30	70-130
8260B TCL		BROMODICHLOROMETHANE	WATER	5.0	UG/L	30	70-130
8260B TCL		BROMOFORM	WATER	5.0	UG/L	30	70-130
8260B TCL		BROMOMETHANE	WATER	5.0	UG/L	30	50-150
8260B TCL		CARBON DISULFIDE	WATER	10	UG/L	30	70-130
8260B TCL		CARBON TETRACHLORIDE	WATER	5.0	UG/L	30	70-130
8260B TCL	*	CHLOROBENZENE	WATER	5.0	UG/L	30	70-130
8260B TCL		CHLOROETHANE	WATER	5.0	UG/L	30	70-130
8260B TCL	*	CHLOROFORM	WATER	5.0	UG/L	30	70-130
8260B TCL		CHLOROMETHANE	WATER	5.0	UG/L	30	70-130
8260B TCL	*	CIS-1,2-DICHLOROETHENE	WATER	5.0	UG/L	30	70-130
8260B TCL		CIS-1,3-DICHLOROPROPENE	WATER	5.0	UG/L	30	70-130
8260B TCL		CYCLOHEXANE	WATER	10	UG/L	30	50-150
8260B TCL		DIBROMOCHLOROMETHANE	WATER	5.0	UG/L	30	70-130
8260B TCL		DICHLORODIFLUOROMETHANE (FREON 12)	WATER	5.0	UG/L	30	70-130
8260B TCL		DICHLOROMETHANE	WATER	5.0	UG/L	30	70-130
8260B TCL	*	ETHYLBENZENE	WATER	5.0	UG/L	30	70-130
8260B TCL		ISOPROPYLBENZENE	WATER	5.0	UG/L	30	70-130
8260B TCL		M+P-XYLENE	WATER	5.0	UG/L	30	70-130
8260B TCL		METHYL ACETATE	WATER	10	UG/L	30	50-150
8260B TCL		METHYLCYCLOHEXANE	WATER	10	UG/L	30	50-150
8260B TCL		METHYL-TERT-BUTYL ETHER (MTBE)	WATER	5.0	UG/L	30	70-130
8260B TCL	*	O-XYLENE	WATER	5.0	UG/L	30	70-130
8260B TCL		STYRENE	WATER	5.0	UG/L	30	70-130
8260B TCL	*	TETRACHLOROETHENE	WATER	5.0	UG/L	30	70-130
8260B TCL	*	TOLUENE	WATER	5.0	UG/L	30	70-130
8260B TCL	*	TRANS-1,2-DICHLOROETHENE	WATER	5.0	UG/L	30	70-130

CAS-ROCHESTER ORGANIC QC LIMITS (effective 5/14/2009)

METHOD		ANALYTE	MATRIX	MRL	UNITS	DUP (RPD)	MS
8260B TCL		TRANS-1,3-DICHLOROPROPENE	WATER	5.0	UG/L	30	70-130
8260B TCL	*	TRICHLOROETHENE	WATER	5.0	UG/L	30	70-130
8260B TCL		TRICHLOROFLUOROMETHANE (FREON 11)	WATER	5.0	UG/L	30	70-130
8260B TCL	*	VINYL CHLORIDE	WATER	5.0	UG/L	30	70-130
8260B TCL		DICHLOROETHANE-D4 -SURR	WATER	NA	UG/L		
8260B TCL		4-BROMOFLUOROBENZENE -SURR	WATER	NA	UG/L		70-130
8260B TCL		DIBROMOFLUOROMETHANE -SURR	WATER	NA	UG/L		70-130
8260B TCL		TOLUENE-D8 -SURR	WATER	NA	UG/L		70-130
8260B ADDITIONAL COMPOUNDS BY REQUEST							
8260B		1,1,1,2-TETRACHLOROETHANE	WATER	5.0	UG/L	30	70-130
8260B		1,1-DICHLOROPROPENE	WATER	5.0	UG/L	30	70-130
8260B		1,2,3-TRICHLOROBENZENE	WATER	5.0	UG/L	30	70-130
8260B		1,2,3-TRICHLOROPROPANE	WATER	5.0	UG/L	30	70-130
8260B		1,2,4-TRIMETHYLBENZENE	WATER	5.0	UG/L	30	70-130
8260B		1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC114)	WATER	5.0	UG/L	30	70-130
8260B		1,2-DICHLORO-1,1,2-TRIFLUOROETHANE (FREON 123A)	WATER	5.0	UG/L	30	70-130
8260B		1,3,5-TRIMETHYLBENZENE	WATER	5.0	UG/L	30	70-130
8260B		1,3-DICHLOROPROPANE	WATER	5.0	UG/L	30	70-130
8260B		1,4-DIOXANE	WATER	100	UG/L	30	50-150
8260B		2,2-DICHLORO-1,1,1-TRIFLUOROETHANE (FREON 123)	WATER	5.0	UG/L	30	70-130
8260B		2,2-DICHLOROPROPANE	WATER	5.0	UG/L	30	70-130
8260B		2-CHLORO-1,3-BUTADIENE	WATER	5.0	UG/L	30	70-130
8260B		2-CHLOROETHYLVINYL ETHER	WATER	5.0	UG/L	30	50-150
8260B		2-CHLOROTOLUENE	WATER	5.0	UG/L	30	70-130
8260B		2-METHYL-1-PROPANOL (ISOBUTLYL ALC)	WATER	100	UG/L	30	50-150
8260B		2-METHYL-2-PROPANOL (TERTBUTYL ALC)	WATER	100	UG/L	30	50-150
8260B		2-NITROPROPANE	WATER	5.0	UG/L	30	50-150
8260B		2-PROPANOL	WATER	100	UG/L	30	70-130
8260B		3-CHLOROPROPENE (ALLYL CHLORIDE)	WATER	5.0	UG/L	30	70-130
8260B		4-CHLOROTOLUENE	WATER	5.0	UG/L	30	70-130
8260B		4-ETHYLTOLUENE	WATER	5.0	UG/L	30	70-130
8260B		4-ISOPROPYLTOLUENE	WATER	5.0	UG/L	30	70-130
8260B		ACETONITRILE	WATER	100	UG/L	30	50-150
8260B		ACROLEIN	WATER	100	UG/L	30	50-150
8260B		ACRYLONITRILE	WATER	100	UG/L	30	50-150
8260B		BENZYL CHLORIDE	WATER	5.0	UG/L	30	70-130
8260B		BROMOBENZENE	WATER	5.0	UG/L	30	70-130
8260B		BROMOCHLOROMETHANE	WATER	5.0	UG/L	30	70-130
8260B		CYCLOHEXANONE	WATER	100	UG/L	30	50-150
8260B		DECAMETHYLPENTASILOXANE	WATER	5	UG/L	30	50-150
8260B		DIBROMOMETHANE	WATER	5.0	UG/L	30	70-130
8260B		DICHLOROFLUOROMETHANE (FREON 21)	WATER	5.0	UG/L	30	50-150
8260B		DIETHYL ETHER	WATER	5.0	UG/L	30	70-130
8260B		DIISOPROPYL ETHER	WATER	5.0	UG/L	30	70-130
8260B		ETBE	WATER	5.0	UG/L	30	70-130
8260B		ETHYL METHACRYLATE	WATER	10	UG/L	30	70-130
8260B		HEXACHLOROBUTADIENE	WATER	5.0	UG/L	30	70-130
8260B		IODOMETHANE	WATER	10	UG/L	30	50-150
8260B		METHACRYLONITRILE	WATER	20	UG/L	30	50-150
8260B		METHYL METHACRYLATE	WATER	10	UG/L	30	70-130
8260B		NAPTHALENE	WATER	5.0	UG/L	30	50-150
8260B		N-BUTYLACETATE	WATER	5.0	UG/l	30	70-130
8260B		N-BUTYLBENZENE	WATER	5.0	UG/L	30	70-130
8260B		N-HEPTANE	WATER	5.0	UG/L	30	70-130
8260B		N-PROPYLBENZENE	WATER	5.0	UG/L	30	70-130
8260B		OCTAMETHYLTETRASILOXANE	WATER	5.0	UG/L	30	50-150
8260B		PROPIONITRILE	WATER	100	UG/L	30	50-150
8260B		SEC-BUTYLBENZENE	WATER	5.0	UG/L	30	70-130
8260B		TAME	WATER	5.0	UG/L	30	70-130
8260B		TERT-BUTYLBENZENE	WATER	5.0	UG/L	30	70-130
8260B		TETRA HYDROFURAN	WATER	5.0	UG/L	30	50-150
8260B		TRANS-1,4-DICHLORO-2-BUTENE	WATER	5.0	UG/L	30	50-150
8260B		VINYL ACETATE	WATER	10	UG/L	30	50-150
8260B TCL	*	1,1,1-TRICHLOROETHANE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		1,1,2,2-TETRACHLOROETHANE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	SOIL	5.0	UG/KG	30	70-130
8260B TCL		1,1,2-TRICHLOROETHANE	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	1,1-DICHLOROETHANE	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	1,1-DICHLOROETHENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		1,2,4-TRICHLOROBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		1,2-DIBROMO-3-CHLOROPROPANE	SOIL	5.0	UG/KG	30	50-150
8260B TCL		1,2-DIBROMOETHANE	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	1,2-DICHLOROBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	1,2-DICHLOROETHANE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		1,2-DICHLOROPROPANE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		1,3-DICHLOROBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		1,4-DICHLOROBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		2-BUTANONE (MEK)	SOIL	10	UG/KG	30	50-150
8260B TCL		2-HEXANONE	SOIL	10	UG/KG	30	70-130
8260B TCL		4-METHYL-2-PENTANONE (MIBK)	SOIL	10	UG/KG	30	70-130
8260B TCL		ACETONE	SOIL	20	UG/KG	30	50-150
8260B TCL	*	BENZENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		BROMODICHLOROMETHANE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		BROMOFORM	SOIL	5.0	UG/KG	30	70-130
8260B TCL		BROMOMETHANE	SOIL	5.0	UG/KG	30	50-150
8260B TCL		CARBON DISULFIDE	SOIL	10	UG/KG	30	70-130
8260B TCL		CARBON TETRACHLORIDE	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	CHLOROBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		CHLOROETHANE	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	CHLOROFORM	SOIL	5.0	UG/KG	30	70-130
8260B TCL		CHLOROMETHANE	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	CIS-1,2-DICHLOROETHENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		CIS-1,3-DICHLOROPROPENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		CYCLOHEXANE	SOIL	10	UG/KG	30	70-130
8260B TCL		DIBROMOCHLOROMETHANE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		DICHLORODIFLUOROMETHANE (FREON 12)	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	ETHYLBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		ISOPROPYLBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		M+P-XYLENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		METHYLCYCLOHEXANE	SOIL	10	UG/KG	30	50-150
8260B TCL		METHYLENE CHLORIDE	SOIL	5.0	UG/KG	30	70-130
8260B		METHYL-TERT-BUTYL ETHER (MTBE)	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	O-XYLENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		STYRENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	TETRACHLOROETHENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	TOLUENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	TRANS-1,2-DICHLOROETHENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		TRANS-1,3-DICHLOROPROPENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	TRICHLOROETHENE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		TRICHLOROFLUOROMETHANE (FREON 11)	SOIL	5.0	UG/KG	30	70-130
8260B TCL	*	VINYL CHLORIDE	SOIL	5.0	UG/KG	30	70-130
8260B TCL		4-BROMOFLUOROBENZENE -SURR	SOIL	NA	UG/KG		70-130
8260B TCL		DIBROMOFLUOROMETHANE -SURR	SOIL	NA	UG/KG		
8260B TCL		DICHLOROETHANE-D4	SOIL	NA	UG/KG		70-130
8260B TCL		TOLUENE-D8 -SURR	SOIL	NA	UG/KG		70-130
8260B ADDITIONAL COMPOUNDS BY REQUEST							
8260B		1,1,1,2-TETRACHLOROETHANE	SOIL	5.0	UG/KG	30	70-130
8260B		1,1-DICHLOROPROPENE	SOIL	5.0	UG/KG	30	70-130
8260B		1,2-DICHLORO-1,1,2-TRIFLUOROETHANE (FREON 123A)	SOIL	5.0	UG/KG	30	70-130
8260B		1,2,3-TRICHLOROBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B		1,2,3-TRICHLOROPROPANE	SOIL	5.0	UG/KG	30	70-130
8260B		1,2,4-TRIMETHYLBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B		1,3,5-TRIMETHYLBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B		1,3-DICHLOROPROPANE	SOIL	5.0	UG/KG	30	70-130
8260B		1,4-DIOXANE	SOIL	100	UG/KG	30	50-150

CAS-ROCHESTER ORGANIC QC LIMITS (effective 5/14/2009)

METHOD		ANALYTE	MATRIX	MRL	UNITS	DUP (RPD)	MS
8260B		2,2-DICHLOROPROPANE	SOIL	5.0	UG/KG	30	70-130
8260B		2-CHLORO-1,3-BUTADIENE	SOIL	5.0	UG/KG	30	70-130
8260B		2-CHLOROETHYLVINYL ETHER	SOIL	5.0	UG/KG	30	50-150
8260B		2-CHLOROTOLUENE	SOIL	5.0	UG/KG	30	70-130
8260B		2-NITROPROPANE	SOIL	5.0	UG/KG	30	50-150
8260B		2-PROPANOL	SOIL	100	UG/KG	30	70-130
8260B		2,2-DICHLORO-1,1,1-TRIFLUOROETHANE (FREON 123)	SOIL	5.0	UG/KG	30	70-130
8260B		3-CHLOROPROPENE (ALLYL CHLORIDE)	SOIL	5.0	UG/KG	30	70-130
8260B		4-CHLOROTOLUENE	SOIL	5.0	UG/KG	30	70-130
8260B		ACETONITRILE	SOIL	100	UG/KG	30	50-150
8260B		ACROLEIN	SOIL	100	UG/KG	30	50-150
8260B		ACRYLONITRILE	SOIL	100	UG/KG	30	50-150
8260B		BENZYL CHLORIDE	SOIL	5.0	UG/KG	30	70-130
8260B		BROMOBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B		BROMOCHLOROMETHANE	SOIL	5.0	UG/KG	30	70-130
8260B		CYCLOHEXANONE	SOIL	100	UG/KG	30	70-130
8260B		DIBROMOMETHANE	SOIL	5.0	UG/KG	30	70-130
8260B		DICHLOROFLUOROMETHANE (FREON 21)	SOIL	5.0	UG/KG	30	70-130
8260B		DIETHYL ETHER	SOIL	5.0	UG/KG	30	70-130
8260B		DIISOPROPYL ETHER	SOIL	5.0	UG/KG	30	70-130
8260B		ETBE	SOIL	5.0	UG/KG	30	70-130
8260B		ETHYL METHACRYLATE	SOIL	10.0	UG/KG	30	70-130
8260B		HEXACHLOROBUTADIENE	SOIL	5.0	UG/KG	30	70-130
8260B		IODOMETHANE	SOIL	10	UG/KG	30	50-150
8260B		ISOBUTYL ALCOHOL	SOIL	100	UG/KG	30	50-150
8260B		METHACRYLONITRILE	SOIL	20	UG/KG	30	50-150
8260B		METHYL ACETATE	SOIL	10	UG/KG	30	50-150
8260B		METHYL METHACRYLATE	SOIL	10	UG/KG	30	70-130
8260B		NAPTHALENE	SOIL	5.0	UG/KG	30	50-150
8260B		N-BUTYLBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B		N-HEPTANE	SOIL	5.0	UG/KG	30	70-130
8260B		N-PROPYLBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B		P-ISOPROPYLTOLUENE	SOIL	5.0	UG/KG	30	70-130
8260B		PROPIONITRILE	SOIL	100	UG/KG	30	50-150
8260B		SEC-BUTYLBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B		TAME	SOIL	5.0	UG/KG	30	70-130
8260B		TERT-BUTYL ALCOHOL	SOIL	100	UG/KG	30	50-150
8260B		TERT-BUTYLBENZENE	SOIL	5.0	UG/KG	30	70-130
8260B		TETRA HYDROFURAN	SOIL	5.0	UG/KG	30	50-150
8260B		TRANS-1,4-DICHLORO-2-BUTENE	SOIL	5.0	UG/KG	30	50-150
8260B		VINYL ACETATE	SOIL	10	UG/KG	30	50-150
8270C TCL		2,6-DINITROTOLUENE	WATER	10	UG/L	30	48-125
8270C TCL		2,4,5-TRICHLOROPHENOL	WATER	10	UG/L	30	62-117
8270C TCL		2,4,6-TRICHLOROPHENOL	WATER	10	UG/L	30	62-115
8270C TCL		2,4-DICHLOROPHENOL	WATER	10	UG/L	30	62-109
8270C TCL		2,4-DIMETHYLPHENOL	WATER	10	UG/L	30	33-130
8270C TCL		2,4-DINITROPHENOL	WATER	50	UG/L	30	48-142
8270C TCL		2,4-DINITROTOLUENE	WATER	10	UG/L	30	69-122
8270C TCL		2,6-DINITROTOLUENE	WATER	10	UG/L	30	66-117
8270C TCL	*	2-CHLORONAPHTHALENE	WATER	10	UG/L	30	47-130
8270C TCL		2-CHLOROPHENOL	WATER	10	UG/L	30	37-112
8270C TCL	*	2-METHYLNAPHTHALENE	WATER	10	UG/L	30	34-102
8270C TCL		2-METHYLPHENOL	WATER	10	UG/L	30	51-130
8270C TCL		2-NITROANILINE	WATER	50	UG/L	30	60-119
8270C TCL		2-NITROPHENOL	WATER	10	UG/L	30	60-113
8270C TCL		3,3'-DICHLOROBENZIDINE	WATER	10	UG/L	30	18-108
8270C TCL		3-NITROANILINE	WATER	50	UG/L	30	34-130
8270C TCL	*	4,6-DINITRO-2-METHYLPHENOL	WATER	50	UG/L	30	60-135
8270C TCL	*	4-BROMOPHENYL-PHENYLETHER	WATER	10	UG/L	30	63-124
8270C TCL		4-CHLORO-3-METHYLPHENOL	WATER	10	UG/L	30	22-136
8270C TCL		4-CHLOROANILINE	WATER	10	UG/L	30	24-130
8270C TCL		4-CHLOROPHENYL-PHENYLETHER	WATER	10	UG/L	30	59-112
8270C TCL		4-METHYLPHENOL	WATER	10	UG/L	30	49-130
8270C TCL	*	4-NITROANILINE	WATER	50	UG/L	30	36-124
8270C TCL	*	4-NITROPHENOL	WATER	50	UG/L	30	15-130
8270C TCL	*	ACENAPHTHENE	WATER	10	UG/L	30	57-104
8270C TCL		ACENAPHTHYLENE	WATER	10	UG/L	30	57-109
8270C TCL		ACETOPHENONE	WATER	10	UG/L	30	10-187
8270C TCL		ANTHRACENE	WATER	10	UG/L	30	55-116
8270C TCL		ATRAZINE	WATER	10	UG/L	30	12-179
8270C TCL		BENZALDEHYDE	WATER	10	UG/L	30	48-243
8270C TCL		BENZO(A)ANTHRACENE	WATER	10	UG/L	30	66-130
8270C TCL		BENZO(A)PYRENE	WATER	10	UG/L	30	44-114
8270C TCL		BENZO(B)FLUORANTHENE	WATER	10	UG/L	30	64-122
8270C TCL		BENZO(G,H,I)PERYLENE	WATER	10	UG/L	30	60-127
8270C TCL		BENZO(K)FLUORANTHENE	WATER	10	UG/L	30	49-133
8270C TCL		BIS(-2-CHLOROETHOXY)METHANE	WATER	10	UG/L	30	44-141
8270C TCL		BIS(2-CHLOROETHYL)ETHER	WATER	10	UG/L	30	12-106
8270C TCL		BIS(2-ETHYLHEXYL)PHTHALATE	WATER	10	UG/L	30	62-124
8270C TCL		BUTYL BENZYL PHTHALATE	WATER	10	UG/L	30	41-148
8270C TCL		CAPROLACTAM	WATER	10	UG/L	30	8-130
8270C TCL		CARBAZOLE	WATER	10	UG/L	30	66-117
8270C TCL		CHRYSENE	WATER	10	UG/L	30	57-118
8270C TCL		DIBENZO(A,H)ANTHRACENE	WATER	10	UG/L	30	58-132
8270C TCL		DIBENZOFURAN	WATER	10	UG/L	30	58-105
8270C TCL		DIETHYLPHTHALATE	WATER	10	UG/L	30	65-122
8270C TCL		DIMETHYL PHTHALATE	WATER	10	UG/L	30	69-130
8270C TCL		DI-N-BUTYLPHTHALATE	WATER	10	UG/L	30	57-139
8270C TCL		DI-N-OCTYL PHTHALATE	WATER	10	UG/L	30	44-151
8270C TCL		FLUORANTHENE	WATER	10	UG/L	30	62-123
8270C TCL		FLUORENE	WATER	10	UG/L	30	60-112
8270C TCL	*	HEXACHLOROBENZENE	WATER	10	UG/L	30	51-132
8270C TCL		HEXACHLOROBUTADIENE	WATER	10	UG/L	30	27-130
8270C TCL		HEXACHLOROCYCLOPENTADIENE	WATER	10	UG/L	30	10-130
8270C TCL		HEXACHLOROETHANE	WATER	10	UG/L	30	28-130
8270C TCL		INDENO(1,2,3-CD)PYRENE	WATER	10	UG/L	30	64-126
8270C TCL		ISOPHORONE	WATER	10	UG/L	30	61-128
8270C TCL	*	NAPHTHALENE	WATER	10	UG/L	30	40-130
8270C TCL	*	NITROBENZENE	WATER	10	UG/L	30	51-113
8270C TCL	*	N-NITROSO-DI-N-PROPYLAMINE	WATER	10	UG/L	30	25-120
8270C TCL		N-NITROSODIPHENYLAMINE	WATER	10	UG/L	30	45-123
8270C TCL	*	PENTACHLOROPHENOL	WATER	50	UG/L	30	39-147
8270C TCL	*	PHENANTHRENE	WATER	10	UG/L	30	58-118
8270C TCL	*	PHENOL	WATER	10	UG/L	30	16-130
8270C TCL	*	PYRENE	WATER	10	UG/L	30	45-125
8270C TCL		2,4,6-TRIBROMOPHENOL -SURR	WATER	NA	UG/L		45-145*
8270C TCL		2-FLUOROBIPHENYL -SURR	WATER	NA	UG/L		45-135*
8270C TCL		2-FLUOROPHENOL -SURR	WATER	NA	UG/L		45-135*
8270C TCL		NITROBENZENE-d5 -SURR	WATER	NA	UG/L		45-135*
8270C TCL		PHENOL-d6 -SURR	WATER	NA	UG/L		45-135*
8270C TCL		TERPHENYL-d14 -SURR	WATER	NA	UG/L		45-135*
8270C ADDITIONAL COMPOUNDS BY REQUEST							
8270C		1,2,4,5-TETRACHLOROBENZENE	WATER	10	UG/L	30	40-150
8270C	*	1,2,4-TRICHLOROBENZENE	WATER	10	UG/L	30	27-104
8270C		1,2-DICHLOROBENZENE	WATER	10	UG/L	30	23-130
8270C		1,2-DIPHENYLHYDRAZINE	WATER	10	UG/L	30	10-142
8270C		1,3,5-TRINITROBENZENE	WATER	10	UG/L	30	40-150
8270C		1,3-DICHLOROBENZENE	WATER	10	UG/L	30	17-130
8270C	*	1,4-DICHLOROBENZENE	WATER	10	UG/L	30	30-82
8270C		1,4-DIOXANE	WATER	10	UG/L	30	10-130
8270C		1,4-NAPHTHOQUINONE	WATER	50	UG/L	30	40-150
8270C		1-METHYL-2-PYRROLIDINONE	WATER	10	UG/L	30	40-150
8270C		1-METHYLNAPHTHALENE	WATER	10	UG/L	30	40-150
8270C		1-NAPHTHYLAMINE	WATER	50	UG/L	30	40-150
8270C		2,3,4,6-TETRACHLOROPHENOL	WATER	10	UG/L	30	40-150
8270C		2,6-DICHLOROPHENOL	WATER	10	UG/L	30	40-150
8270C		2-ACETYLAMINOFLUORENE	WATER	10	UG/L	30	40-150
8270C		2-NAPHTHYLAMINE	WATER	50	UG/L	30	40-150
8270C		2-PICOLINE	WATER	10	UG/L	30	40-150
8270C		3,3'-DIMETHYLBENZIDINE	WATER	50	UG/L	30	40-150
8270C		3+4 METHYLPHENOL	WATER	10	UG/L	30	26-99
8270C		3-METHYLCHOLANTHRENE	WATER	10	UG/L	30	40-150
8270C		4-AMINOBIPHENYL	WATER	50	UG/L	30	40-150
8270C		4-NITROQUINOLINE-1-OXIDE	WATER	50	UG/L	30	40-150
8270C		5-NITRO-O-TOLUIDINE	WATER	10	UG/L	30	40-150

CAS-ROCHESTER ORGANIC QC LIMITS (effective 5/14/2009)

METHOD		ANALYTE	MATRIX	MRL	UNITS	DUP (RPD)	MS
8270C		7,12-DIMETHYLBENZ(a)ANTHRACENE	WATER	10	UG/L	30	40-150
8270C		aa-DIMETHYLPHENETHYLAMINE	WATER	50	UG/L	30	40-150
8270C		alpha-TERPINEOL	WATER	10	UG/L	30	40-150
8270C		ANILINE	WATER	10	UG/L	30	13-123
8270C		ARAMITE	WATER	50	UG/L	30	40-150
8270C		BENZIDINE	WATER	100	UG/L	30	10-130
8270C		BENZOIC ACID	WATER	50	UG/L	30	30-130
8270C		BENZYL ALCOHOL	WATER	10	UG/L	30	31-109
8270C		BIPHENYL	WATER	10	UG/L	30	30-126
8270C		CHLOROBENZILATE	WATER	10	UG/L	30	40-150
8270C		DIALLATE	WATER	10	UG/L	30	40-150
8270C		DIMETHOATE	WATER	50	UG/L	30	40-150
8270C		DINOSEB	WATER	50	UG/L	30	40-150
8270C		DIPHENYLAMINE	WATER	10	UG/L	30	40-150
8270C		DISULFOTON	WATER	10	UG/L	30	40-150
8270C		ETHYL METHANESULFONATE	WATER	10	UG/L	30	40-150
8270C		ETHYL PARATHION	WATER	10	UG/L	30	40-150
8270C		HEXACHLOROPHENE	WATER	500	UG/L	30	40-150
8270C		HEXACHLOROPROPENE	WATER	10	UG/L	30	40-150
8270C		ISODRIN	WATER	10	UG/L	30	40-150
8270C		ISOSAFROLE	WATER	10	UG/L	30	40-150
8270C		m-DINITROBENZENE	WATER	10	UG/L	30	40-150
8270C		METHAPYRILENE	WATER	50	UG/L	30	40-150
8270C		METHYL METHANESULFONATE	WATER	10	UG/L	30	40-150
8270C		METHYL PARATHION	WATER	10	UG/L	30	40-150
8270C		N-NITROSODIETHYLAMINE	WATER	10	UG/L	30	40-150
8270C		N-NITROSODIMETHYLAMINE	WATER	10	UG/L	30	27-130
8270C		N-NITROSODI-N-BUTYLAMINE	WATER	10	UG/L	30	40-150
8270C		N-NITROSODI-N-PROPYLAMINE	WATER	10	UG/L	30	25-120
8270C		N-NITROSOMETHYLETHYLAMINE	WATER	10	UG/L	30	40-150
8270C		N-NITROSOMORPHOLINE	WATER	10	UG/L	30	40-150
8270C		N-NITROSOPIERIDINE	WATER	10	UG/L	30	40-150
8270C		N-NITROSOPYROLIDINE	WATER	10	UG/L	30	40-150
8270C		OCTACHLOROSTYRENE	WATER	10	UG/L	30	43-102
8270C		ooo-TRIETHYL PHOSPHOROTHIOATE	WATER	10	UG/L	30	40-150
8270C		o-TOLUIDINE	WATER	10	UG/L	30	40-150
8270C		p-DIMETHYLAMINOAZORENZENE	WATER	10	UG/L	30	40-150
8270C		PENTACHLOROBENZENE	WATER	10	UG/L	30	40-150
8270C		PENTACHLOROETHANE	WATER	10	UG/L	30	40-150
8270C		PENTACHLORONITROBENZENE	WATER	10	UG/L	30	40-150
8270C		PHENACETIN	WATER	10	UG/L	30	40-150
8270C		PHORATE	WATER	10	UG/L	30	40-150
8270C		p-PHENYLENEDIAMINE	WATER	50	UG/L	30	40-150
8270C		PRONAMIDE	WATER	10	UG/L	30	40-150
8270C		PYRIDINE	WATER	50	UG/L	30	10-123
8270C		SAFROLE	WATER	10	UG/L	30	40-150
8270C		SULFOTEPP	WATER	10	UG/L	30	40-150
8270C		THIONAZIN	WATER	10	UG/L	30	40-150
8270C TCL		1'1-BIPHENYL	SOIL	330	UG/KG	30	37-129
8270C TCL		2,2'-OXYBIS(1-CHLOROPROPANE)	SOIL	330	UG/KG	30	40-143
8270C TCL		2,4,5-TRICHLOROPHENOL	SOIL	330	UG/KG	30	30-138
8270C TCL	*	2,4,6-TRICHLOROPHENOL	SOIL	330	UG/KG	30	49-124
8270C TCL	*	2,4-DICHLOROPHENOL	SOIL	330	UG/KG	30	31-131
8270C TCL		2,4-DIMETHYLPHENOL	SOIL	330	UG/KG	30	46-115
8270C TCL		2,4-DINITROPHENOL	SOIL	1700	UG/KG	30	10-133
8270C TCL	*	2,4-DINITROTOLUENE	SOIL	330	UG/KG	30	50-141
8270C TCL		2,6-DINITROTOLUENE	SOIL	330	UG/KG	30	48-127
8270C TCL		2-CHLORONAPHTHALENE	SOIL	330	UG/KG	30	37-124
8270C TCL	*	2-CHLOROPHENOL	SOIL	330	UG/KG	30	31-123
8270C TCL		2-METHYLNAPHTHALENE	SOIL	330	UG/KG	30	34-128
8270C TCL	*	2-METHYLPHENOL	SOIL	330	UG/KG	30	53-119
8270C TCL		2-NITROANILINE	SOIL	1700	UG/KG	30	43-128
8270C TCL		2-NITROPHENOL	SOIL	330	UG/KG	30	25-137
8270C TCL		3,3'-DICHLOROBENZIDINE	SOIL	330	UG/KG	30	15-130
8270C TCL		3-NITROANILINE	SOIL	1700	UG/KG	30	32-98
8270C TCL		4,6-DINITRO-2-METHYLPHENOL	SOIL	1700	UG/KG	30	18-142
8270C TCL	*	4-BROMOPHENYL-PHENYLETHER	SOIL	330	UG/KG	30	49-136
8270C TCL	*	4-CHLORO-3-METHYLPHENOL	SOIL	330	UG/KG	30	39-127
8270C TCL		4-CHLOROANILINE	SOIL	330	UG/KG	30	14-130
8270C TCL		4-CHLOROPHENYL-PHENYLETHER	SOIL	330	UG/KG	30	39-128
8270C TCL		4-METHYLPHENOL	SOIL	330	UG/KG	30	51-122
8270C TCL		4-NITROANILINE	SOIL	1700	UG/KG	30	32-135
8270C TCL	*	4-NITROPHENOL	SOIL	1700	UG/KG	30	34-131
8270C TCL	*	ACENAPHTHENE	SOIL	330	UG/KG	30	41-132
8270C TCL	*	ACENAPHTHYLENE	SOIL	330	UG/KG	30	29-146
8270C TCL		ACETOPHENONE	SOIL	330	UG/KG	30	52-112
8270C TCL		ANTHRACENE	SOIL	330	UG/KG	30	31-146
8270C TCL		ATRAZINE	SOIL	330	UG/KG	30	29-176
8270C TCL		BENZALDEHYDE	SOIL	330	UG/KG	30	10-251
8270C TCL		BENZO(A)ANTHRACENE	SOIL	330	UG/KG	30	33-148
8270C TCL		BENZO(A)PYRENE	SOIL	330	UG/KG	30	25-140
8270C TCL		BENZO(B)FLUORANTHENE	SOIL	330	UG/KG	30	33-148
8270C TCL		BENZO(G,H,I)PERYLENE	SOIL	330	UG/KG	30	28-161
8270C TCL		BENZO(K)FLUORANTHENE	SOIL	330	UG/KG	30	33-143
8270C TCL		BIS(-2-CHLOROETHOXY)METHANE	SOIL	330	UG/KG	30	54-118
8270C TCL		BIS(2-CHLOROETHYL)ETHER	SOIL	330	UG/KG	30	41-119
8270C TCL		BIS(2-ETHYLHEXYL)PHTHALATE	SOIL	330	UG/KG	30	26-166
8270C TCL		BUTYL BENZYL PHTHALATE	SOIL	330	UG/KG	30	37-132
8270C TCL		CAPROLACTAM	SOIL	330	UG/KG	30	43-140
8270C TCL		CARBAZOLE	SOIL	330	UG/KG	30	42-135
8270C TCL		CHRYSENE	SOIL	330	UG/KG	30	31-148
8270C TCL		DIBENZO(A,H)ANTHRACENE	SOIL	330	UG/KG	30	35-154
8270C TCL		DIBENZOFURAN	SOIL	330	UG/KG	30	37-128
8270C TCL		DIETHYLPHTHALATE	SOIL	330	UG/KG	30	37-142
8270C TCL		DIMETHYL PHTHALATE	SOIL	330	UG/KG	30	43-130
8270C TCL		DI-N-BUTYLPHTHALATE	SOIL	330	UG/KG	30	13-193
8270C TCL		DI-N-OCTYL PHTHALATE	SOIL	330	UG/KG	30	32-139
8270C TCL		FLUORANTHENE	SOIL	330	UG/KG	30	36-155
8270C TCL		FLUORENE	SOIL	330	UG/KG	30	37-140
8270C TCL	*	HEXACHLOROBENZENE	SOIL	330	UG/KG	30	41-135
8270C TCL		HEXACHLOROBUTADIENE	SOIL	330	UG/KG	30	25-126
8270C TCL		HEXACHLOROCYCLOPENTADIENE	SOIL	330	UG/KG	30	10-152
8270C TCL		HEXACHLOROETHANE	SOIL	330	UG/KG	30	20-113
8270C TCL		INDENO(1,2,3-CD)PYRENE	SOIL	330	UG/KG	30	38-148
8270C TCL		ISOPHORONE	SOIL	330	UG/KG	30	41-137
8270C TCL	*	NAPHTHALENE	SOIL	330	UG/KG	30	37-124
8270C TCL	*	NITROBENZENE	SOIL	330	UG/KG	30	39-117
8270C TCL	*	N-NITROSO-DI-N-PROPYLAMINE	SOIL	330	UG/KG	30	45-127
8270C TCL		N-NITROSODIPHENYLAMINE	SOIL	330	UG/KG	30	38-129
8270C TCL	*	PENTACHLOROPHENOL	SOIL	1700	UG/KG	30	35-142
8270C TCL	*	PHENANTHRENE	SOIL	330	UG/KG	30	27-151
8270C TCL	*	PHENOL	SOIL	330	UG/KG	30	35-118
8270C TCL	*	PYRENE	SOIL	330	UG/KG	30	26-152
8270C TCL		2,4,6-TRIBROMOPHENOL -SURR	SOIL	NA	UG/KG		45-135*
8270C TCL		2-FLUOROBIPHENYL -SURR	SOIL	NA	UG/KG		45-135*
8270C TCL		2-FLUOROPHENOL -SURR	SOIL	NA	UG/KG		45-135*
8270C TCL		NITROBENZENE-d5 -SURR	SOIL	NA	UG/KG		45-135*
8270C TCL		PHENOL-d6 -SURR	SOIL	NA	UG/KG		45-135*
8270C TCL		TERPHENYL-d14 -SURR	SOIL	NA	UG/KG		45-135*
8270C ADDITIONAL COMPOUNDS BY REQUEST							
8270C		1,2,4,5-TETRACHLOROBENZENE	SOIL	330	UG/KG	30	18-130
8270C	*	1,2,4-TRICHLOROBENZENE	SOIL	330	UG/KG	30	47-105
8270C		1,2-DICHLOROBENZENE	SOIL	330	UG/KG	30	45-130
8270C		1,2-DIPHENYLHYDRAZINE	SOIL	330	UG/KG	30	10-136

CAS-ROCHESTER ORGANIC QC LIMITS (effective 5/14/2009)

METHOD		ANALYTE	MATRIX	MRL	UNITS	DUP (RPD)	MS
8270C		1,3,5-TRINITROBENZENE	SOIL	330	UG/KG	30	40-150
8270C		1,3-DICHLOROBENZENE	SOIL	330	UG/KG	30	43-130
8270C	*	1,4-DICHLOROBENZENE	SOIL	330	UG/KG	30	29-104
8270C		1,4-DIOXANE	SOIL	330	UG/KG	30	31-130
8270C		1,4-NAPHTHOQUINONE	SOIL	1700	UG/KG	30	40-150
8270C		1-METHYLNAPHTHALENE	SOIL	330	UG/KG	30	40-150
8270C		1-NAPHTHYLAMINE	SOIL	1700	UG/KG	30	40-150
8270C		2,3,4,6-TETRACHLOROPHENOL	SOIL	330	UG/KG	30	40-150
8270C		2,6-DICHLOROPHENOL	SOIL	330	UG/KG	30	40-150
8270C		2-ACETYLAMINOFLUORENE	SOIL	330	UG/KG	30	40-150
8270C		2-NAPHTHYLAMINE	SOIL	1700	UG/KG	30	40-150
8270C		2-PICOLINE	SOIL	330	UG/KG	30	40-150
8270C		3,3'-DIMETHYLBENZINE	SOIL	1700	UG/KG	30	40-150
8270C		3+4 METHYLPHENOL	SOIL	330	UG/KG	30	47-130
8270C		3-METHYLCHOLANTHRENE	SOIL	330	UG/KG	30	40-150
8270C		4-AMINOBIPHENYL	SOIL	1700	UG/KG	30	40-150
8270C		4-NITROQUINOLINE-1-OXIDE	SOIL	1700	UG/KG	30	40-150
8270C		5-NITRO-O-TOLUIDINE	SOIL	330	UG/KG	30	40-150
8270C		7,12-DIMETHYLBENZ(a)ANTHRACENE	SOIL	330	UG/KG	30	40-150
8270C		aa-DIMETHYLPHENETHYLAMINE	SOIL	1700	UG/KG	30	40-150
8270C		ANILINE	SOIL	330	UG/KG	30	17-130
8270C		ARAMITE	SOIL	1700	UG/KG	30	40-150
8270C		BENZIDINE	SOIL	3300	UG/KG	30	30-130
8270C		BENZOIC ACID	SOIL	1700	UG/KG	30	30-130
8270C		BENZYL ALCOHOL	SOIL	330	UG/KG	30	38-106
8270C		CHLOROBENZILATE	SOIL	330	UG/KG	30	40-150
8270C		DIALLATE	SOIL	330	UG/KG	30	40-150
8270C		DIMETHOATE	SOIL	1700	UG/KG	30	40-150
8270C		DINOSEB	SOIL	1700	UG/KG	30	40-150
8270C		DIPHENYLAMINE	SOIL	330	UG/KG	30	40-150
8270C		DISULFOTON	SOIL	330	UG/KG	30	40-150
8270C		ETHYL METHANESULFONATE	SOIL	330	UG/KG	30	40-150
8270C		ETHYL PARATHION	SOIL	330	UG/KG	30	40-150
8270C		HEXACHLOROPHENE	SOIL	17000	UG/KG	30	40-150
8270C		HEXACHLOROPROPENE	SOIL	330	UG/KG	30	40-150
8270C		ISODRIN	SOIL	330	UG/KG	30	40-150
8270C		ISOSAFROLE	SOIL	330	UG/KG	30	40-150
8270C		m-DINITROBENZINE	SOIL	330	UG/KG	30	40-150
8270C		METHAPYRILENE	SOIL	1700	UG/KG	30	40-150
8270C		METHYL METHANESULFONATE	SOIL	330	UG/KG	30	40-150
8270C		METHYL PARATHION	SOIL	330	UG/KG	30	40-150
8270C		N-NITROSODIETHYLAMINE	SOIL	330	UG/KG	30	40-150
8270C		N-NITROSODIMETHYLAMINE	SOIL	330	UG/KG	30	38-130
8270C		N-NITROSODI-N-BUTYLAMINE	SOIL	330	UG/KG	30	40-150
8270C		N-NITROSOMETHYLETHYLAMINE	SOIL	330	UG/KG	30	40-150
8270C		N-NITROSOMORPHOLINE	SOIL	330	UG/KG	30	40-150
8270C		N-NITROSOPIPERIDINE	SOIL	330	UG/KG	30	40-150
8270C		N-NITROSOPYRROLIDINE	SOIL	330	UG/KG	30	40-150
8270C		OCTACHLOROSTYRENE	SOIL	330	UG/KG	30	52-116
8270C		ooo-TRIETHYL PHOSPHOROTHIOATE	SOIL	330	UG/KG	30	40-150
8270C		o-TOLUIDINE	SOIL	330	UG/KG	30	40-150
8270C		p-DIMETHYLAMINOAZOBENZENE	SOIL	330	UG/KG	30	40-150
8270C		PENTACHLOROBENZENE	SOIL	330	UG/KG	30	40-150
8270C		PENTACHLOROETHANE	SOIL	330	UG/KG	30	40-150
8270C		PENTACHLORONITROBENZENE	SOIL	330	UG/KG	30	19-106
8270C		PHENACETIN	SOIL	330	UG/KG	30	40-150
8270C		PHORATE	SOIL	330	UG/KG	30	40-150
8270C		p-PHENYLENEDIAMINE	SOIL	1700	UG/KG	30	40-150
8270C		PRONAMIDE	SOIL	330	UG/KG	30	40-150
8270C		PYRIDINE	SOIL	1700	UG/KG	30	10-103
8270C		SAFROLE	SOIL	330	UG/KG	30	40-150
8270C		SULFOTEPP	SOIL	330	UG/KG	30	40-150
8270C		THIONAZIN	SOIL	330	UG/KG	30	40-150

CAS-ROCHESTER WETCHEM QC LIMITS (effective 5/14/2009)

Columbia Analytical Services Rochester, NY

METHOD			ANALYTE	MATRIX	UNITS	MRL	DUP		MS		LCS		ICV/CCV
EPA	SM	Other					(RPD)	Freq	(% REC)	Freq	(% Rec)	Frequency	
310.1	2320B		Alkalinity, Total, Carbonate, Bicarb	Water	mg/L	2.00	20	1/10	81-112	1/10	90-108	1/20	90-110
			Alkalinity, Total, Carbonate, Bicarb	Soil	mg/L	200	20	1/10	46-149	1/10	46-149	1/20	90-110
350.1			Ammonia	Water	mg/L	0.050	20	1/10	68-119	1/10	90-110	1/20	90-110
350.1			Ammonia - Low Level	Water	mg/L	0.010	20	1/10	68-119	1/10	90-110	1/20	90-110
350.1 M			Ammonia	Soil	mg/Kg	5.00	30	1/10	74-131	1/10	90-110	1/20	90-110
		D482	Ash, Percent	Non-Aq	%	0.10	10	1/10	NA	NA	59-109	1/20	NA
405.1	5210B		BOD/CBOD	Water	mg/L	2.00	20	1/20	64-129	1/20	85-115	1/20	NA
300.0/9056			Bromide by IC	Water	mg/L	0.10	20	1/10	54-121	1/10	90-110	1/20	90-110
300.0M/9056			Bromide by IC	Soil	mg/Kg	10.0	30	1/10	54-121	1/10	90-110	1/20	90-110
26A			Bromide by IC	Water	mg/L	0.10	20	1/10	50-150	1/10	71-119	1/20	90-110
Autotitrator			Bromide	Water	g/L	0.25	20	1/10	80-120	1/20	80-120	1/20	NA
5050/9056			Bromide for total halogens	NonAq/Soil	mg/kg	30.0	20	1/20	NA	NA	50-150	1/20	90-110
		D4809	BTU	Non-Aq	BTU	500	20	1/20	NA	1/20	90-110	1/20	NA
9081			Cation Exchange Capacity	Soil	meqNa/100g	1.0	30	1/20	NA	NA	NA	NA	NA
410.4			Chemical Oxygen Demand - LL	Water	mg/L	5.00	20	1/10	42-139	1/10	71-117	1/20	85-115
410.4 M			Chemical Oxygen Demand	Soil	mg/Kg	100	30	1/10	10-170	1/10	10-167	1/20	85-115
325.2	4500-Cl^- E		Chloride - Colorimetric	Water	mg/L	1.00	20	1/10	70-126	1/10	86-110	1/20	90-110
300.0/9056			Chloride by IC	Water	mg/L	0.200	20	1/10	56-122	1/10	90-110	1/20	90-110
300.0M/9056			Chloride by IC	Soil	mg/Kg	30.0	30	1/10	56-122	1/10	90-110	1/20	90-110
26A			Chloride by IC	Water	mg/L	0.20	20	1/10	50-150	1/10	53-124	1/20	90-110
5050/9056			Chlorine, Percent	Non-Aq	%	0.01	20	1/10	33-141	NA	61-126	1/20	NA
5050/9056			Chloride - for total halogens	NonAq/Soil	mg/kg	60.0	20	1/20	NA	NA	50-150	1/20	90-110
	409A		Chlorine Demand	Water	mg/L	5.00	20	1/20	NA	NA	NA	NA	NA
330.4	4500-Cl F		Chlorine Residual (Free)	Water	mg/L	0.100	20	1/10	70-130	1/20	90-110	1/20	NA
330.4	4500-Cl F		Chlorine Residual (Total)	Water	mg/L	0.100	20	1/10	70-130	1/20	90-110	1/20	NA
110.2	2120B		Color (True)	Water	CU	5.0	+/-5units	1/10	NA	NA	NA	NA	NA
120.1			Conductivity	Water	umhos/cm	NA	20	1/20	NA	NA	90-110	1/10	NA
7196A	3500-Cr B		CR+6 Hexavalent Chromium	Water	mg/L	0.010	20	1/10	85-115	1/10	92-110	1/20	90-110
218.6			CR+6 Hexavalent Chromium	Water	mg/L	0.010	20	1/20	90-110	1/10	90-110	1/20	95-105
7199			CR+6 Hexavalent Chromium	Water	mg/L	0.010	20	1/20	39-144	1/20	92-110	1/20	90-110
3060/7196A			CR+6 Hexavalent Chromium	Soil	mg/Kg	4.00	20	1/20	75-125	1/10	80-120	1/20	90-110
3060/7199			CR+6 Hexavalent Chromium	Soil	mg/Kg	0.40	20	1/20	75-125	1/20	80-120	1/20	90-110

CAS-ROCHESTER WETCHEM QC LIMITS (effective 5/14/2009)

Columbia Analytical Services Rochester, NY

METHOD			ANALYTE	MATRIX	UNITS	MRL	DUP		MS		LCS		ICV/CCV
EPA	SM	Other					(RPD)	Freq	(% REC)	Freq	(% Rec)	Frequency	
		ILM05.3	Cyanide, Total	Water	mg/L	0.010	20	1/20	75-125	1/20	85-115	1/20	85-115
		ILM05.3	Cyanide, Total	Soil	mg/Kg	1.00	20	1/20	46-159	1/20	85-115	1/20	85-115
335.4/9012			Cyanide, Total	Water	mg/L	0.010	20	1/10	44-144	1/10	90-110	HL & LL 1/20	90-110
9012A			Cyanide, Total	Water	mg/L	0.010	20	1/10	44-148	1/10	85-115	HL & LL 1/20	85-115
9012A			Cyanide, Total	Soil	mg/Kg	1.00	30	1/10	46-159	1/10	85-115	HL & LL 1/20	85-115
S. 7.3 SW846			Cyanide, Reactivity	Water	mg/Kg	20.0	20	1/20	1-100	1/20	1-100	1/20	85-115
S. 7.3 SW846			Cyanide, Reactivity	Soil	mg/Kg	20.0	30	1/20	1-100	1/20	1-100	1/20	85-115
		D1298	Density / Specific Gravity	non-aq	kg/m3	NA	10	1/10	NA	NA	0.002units	1/20/hydrometer	NA
		D4052	Density	Non-Aq	g/cm3	NA	2	1/10	NA	NA	0.002units	1/10	NA
3500-FE D			Ferrous Iron	Water	mg/L	0.10	20	1/10	77-129	1/10	77-129	1/20	90-110
3500-FE D			Ferrous Iron	Soil	mg/kg	10.0	30	1/10	30-161	1/10	77-129	1/20	90-110
340.2			Fluoride by ISE	Water	mg/L	0.100	20	1/20	82-116	1/20	82-116	1/20	90-110
300.0/9056			Fluoride by IC	Water	mg/L	0.100	20	1/10	58-136	1/10	90-110	1/20	90-110
300.0M/9056			Fluoride by IC	Soil	mg/Kg	20.0	30	1/10	58-136	1/10	90-110	1/20	90-110
26A			Fluoride by IC	Water	mg/L	0.10	20	1/10	50-150	1/10	75-108	1/20	90-110
5050/9056			Fluoride for total halogens	NonAq/Soil	mg/kg	30.0	20	1/20	NA	NA	50-150	1/20	90-110
130.2	2340C		Hardness, Total	Water	mg/L	2.00	20	1/10	78-120	1/10	92-110	1/10	NA
1010			IGN- Pensky Martens Closed Cup	Water	degree C	NA	10	1/20	NA	NA	24.3-29.7 C	1/20	NA
D92/ 1010.CC			IGN - Cleveland Open Cup	Soil	degree C	NA	30	1/20	NA	NA	NA	NA	NA
300.0/9056			Iodide	Water	mg/L	0.20	20	1/10	70-130	1/10	90-110	1/20	90-110
5050/9056			Iodide - for total Halogens	NonAq/Soil	mg/kg	30	20	1/20	NA	NA	30-150	1/20	90-110
300.0/9056			Nitrate as N by IC	Water	mg/L	0.050	20	1/10	68-113	1/10	90-110	1/20	90-110
300.0M/9056			Nitrate as N by IC	Soil	mg/Kg	5.00	30	1/10	68-113	1/10	90-110	1/20	90-110
353.2			Nitrate/Nitrite as N	Water	mg/L	0.050	20	1/10	51-137	1/10	90-110	1/20	90-110
353.2			Nitrate/Nitrite as N	Soil	mg/kg	5.000	30	1/10	51-137	1/10	90-110	1/20	90-110
353.2			Nitrate/Nitrite as N - LL	Water	mg/L	0.002	20	1/10	51-137	1/10	90-110	1/20	90-110
300.0/9056			Nitrite as N by IC	Water	mg/L	0.050	20	1/10	70-130	1/10	90-110	1/20	90-110
353.2			Nitrite as N	Water	mg/L	0.010	20	1/10	70-130	1/10	90-110	1/20	90-110
351.2			Nitrogen, Total Kjeldahl	Water	mg/L	0.200	20	1/10	63-127	1/10	75-113	1/20	90-110(I)85-115(C)
351.2-M			Nitrogen, Total Kjeldahl	Soil	mg/Kg	20.0	30	1/10	25-172	1/10	25-172	1/20	90-110(I)85-115(C)
351.2 LL			Nitrogen, Total Kjeldahl-LL	Water	mg/L	0.100	20	1/10	63-127	1/10	75-120	1/20	90-110(I)85-115(C)
1664A			Oil and Grease by 1664A	Water	mg/L	5.00	20	1/20	78-114	1/20	78-114	1/20	NA
365.1			Othophosphate -LL	Water	mg/L	0.0020	20	1/10	53-127	1/10	90-110	1/20	90-110
365.1			Orthophosphate	Water	mg/L	0.010	20	1/10	53-127	1/10	90-110	1/20	90-110
9095			Paint Filter test	Sludge	%	NA	30	1/20	NA	NA	NA	NA	NA
E203			Percent Water	Waste	%	0.1	20	1/20	NA	NA	74-139	1/10	NA

CAS-ROCHESTER WETCHEM QC LIMITS (effective 5/14/2009)

Columbia Analytical Services Rochester, NY

METHOD			ANALYTE	MATRIX	UNITS	MRL	DUP		MS		LCS		ICV/CCV
EPA	SM	Other					(RPD)	Freq	(% REC)	Freq	(% Rec)	Frequency	
150.1	4500-H^+ B		pH	Water	SU	NA	±0.10	1/10	NA	NA	NA	NA	±0.05
9040/9045.			pH / Corrosivity	Water	SU	NA	±0.10	1/20	NA	NA	NA	NA	±0.05
9040/9045.			pH / Corrosivity	Soil	SU	NA	±0.10	1/20	NA	NA	NA	NA	±0.05
420.4			Phenolics, Total LL	Water	mg/L	0.002	20	1/10	82-110	1/10	83-115	1/20	85-115
420.4			Phenolics, Total	Water	mg/L	0.005	20	1/10	82-110	1/10	83-115	1/20	85-115
420.4			Phenolics, Manual Distillation	Water	mg/L	0.005	20	1/10	54-136	1/10	54-136	1/20	85-115
9066			Phenolics, Total	Water	mg/L	0.005	20	1/10	65-126	1/10	83-115	1/20	85-115
9066			Phenolics, Total	Soil	mg/Kg	0.100	30	1/10	65-126	1/10	80-120	1/20	85-115
365.1 M			Phosphorus, Total - LL	Water	mg/L	0.003	20	1/10	48-144	1/10	84-114	1/20	90-110
365.1			Phosphorus, Total	Water	mg/L	0.050	20	1/10	48-144	1/10	90-110	1/20	90-110
365.1-M			Phosphorus, Total	Soil	mg/Kg	5.00	30	1/20	16-184	1/10	33-163	1/20	90-110
GEN-SILICON			Silicon, Percent	Soil/nonAq	%	0.0467	10	1/10	NA	NA	80-120	1/20	NA
370.1		I-2700-85	Silica, Dissolved	Water	mg/L	0.010	20	1/10	80-117	1/10	83-116	1/20	90-110
160.3M			Solids, Dry Weight Percent (DWPS)	Soil	mg/Kg	1.0	20	1/10	NA	NA	NA	NA	NA
160.5			Solids, Settleable	Water	mg/L	0.100	20	1/20	NA	NA	NA	NA	NA
160.3	2540B		Solids, Total (TS)	Water	mg/L	10.0	20	1/10	NA	NA	80-120	1/20	NA
160.1	2540C		Solids, Total Dissolved (TDS)	Water	mg/L	10.0	20	1/10	NA	NA	80-120	1/20	NA
160.2	2540D		Solids, Total Suspended (TSS)	Water	mg/L	1.00	20	1/10	NA	NA	80-120	1/20	NA
160.4			Solids, Total Volatile (TVS)	Water	mg/L	10.0	20	1/10	NA	NA	80-120	NA	NA
160.4D			Solids, Volatile Dissolved (VDS)	Water	mg/L	10.0	20	1/10	NA	NA	NA	NA	NA
160.4S			Solids, Volatile Suspended (VSS)	Water	mg/L	1.00	20	1/10	NA	NA	NA	NA	NA
	2540G		Solids, Percent Volatile	Soil	%	NA	20	1/10	NA	NA	NA	NA	NA
375.4	426C		Sulfate, Turbidimetric	Water	mg/L	5.00	20	1/10	72-129	1/10	74-125	1/20	NA
300.0/9056			Sulfate by IC	Water	mg/L	0.200	20	1/10	55-125	1/10	90-110	1/20	90-110
300.0M/0956			Sulfate by IC	Soil	mg/Kg	30.0	30	1/10	25-151	1/10	90-110	1/20	90-110
AVS			Sulfide, Acid Volatile (AVS)	Soil	umoles/g	1.00	30	1/20	56-196	1/20	56-196	1/20	NA
S. 7.3 SW846			Sulfide Reactivity	Water	mg/Kg	100	20	1/20	0-235	NA	84-224	1/20	NA
S. 7.3 SW846			Sulfide Reactivity	Soil	mg/Kg	100	30	1/20	14-135	NA	30-127	1/20	NA
9030B			Sulfide, Acid Soluble	Water	mg/L	1.00	20	1/20	10-110	1/20	51-105	1/20	NA
9030B			Sulfide, Acid Soluble	Soil	mg/Kg	20.0	30	1/20	10-153	1/20	10-137	1/20	NA
376.1	4500-S F		Sulfide, Total	Water	mg/L	1.00	20	1/10	56-138	1/20	56-138	1/20	NA
300M			Sulfur- Alkaline Digestion	Soil	mg/kg	6.68	30	1/20	43-137	1/20	43-137	1/20	NA
425.1	5540C		Surfactants	Water	mg/L	0.02	20	1/20	58-139	NA	64-142	1/20 HL	NA

CAS-ROCHESTER WETCHEM QC LIMITS (effective 5/14/2009)

Columbia Analytical Services Rochester, NY

METHOD			ANALYTE	MATRIX	UNITS	MRL	DUP		MS		LCS		ICV/CCV
EPA	SM	Other					(RPD)	Freq	(% REC)	Freq	(% Rec)	Frequency	
415.1			TIC	Water	mg/L	1.00	20	1/10	79-125	1/10	79-125	1/20	85-115
415.1	5310C		TOC - LL	Water	mg/L	0.05	20	1/10	62-135	1/10	86-117	1/20	85-115
9060			TOC - LL	Water	mg/L	0.10	20	1/10	62-135	1/10	86-117	1/20	85-115
415.1M/9060	5310C		TOC - RL	Water	mg/L	1.00	20	1/10	62-135	1/10	86-117	1/20	85-115
TOCLK			TOC - Lloyd Kahn	Soil	mg/Kg	300	30	1/20	17-173	1/20	75-125	1/20	85-115
1664A			TPH by 1664A	Water	mg/L	5.00	20	1/20	64-132	1/20	64-132	1/20	NA
180.1			Turbidity	Water	NTU	0.10	10	1/20	NA	NA	90-110	3@run start	90-110

Columbia Analytical Services™

QUALITY ASSURANCE MANUAL

1 Mustard St. Suite 250
Rochester, NY 14609

Phone: (585) 288-5380
Fax: (585) 288-8475

Revision Date: December 10, 2008

Approved by:

Laboratory Director: Mike Perry

Quality Assurance Program Manager: Lisa Reyes

Annual review of this QAM has been performed and the QAM still reflects current practice.
Initials: _____ Date: _____
Initials: _____ Date: _____
Initials: _____ Date: _____

DOCUMENT CONTROL
NUMBER: _____
Initials: _____ Date: _____

UNCONTROLLED COPY

2.0 TABLE OF CONTENTS

Figures Page

Appendices

3.0 INTRODUCTION AND COMPANY QUALITY ASSURANCE POLICY

Columbia Analytical Services, Inc. (CAS) is a professional consulting laboratory which performs chemical and microbiological analyses on a wide variety of sample matrices, including drinking water, groundwater, surface water, wastewater, soil, sediment, sludge, tissue, industrial and hazardous waste, and other material. CAS/Rochester is a part of a multi Lab Network operating throughout the USA. See Corporate Organization Chart (Appendix B) for locations.

It is a policy at CAS that there will be sufficient Quality Assurance (QA) activities conducted in the laboratory to ensure that all analytical data generated and processed will be scientifically sound, legally defensible, of known and documented quality, and will accurately reflect the material being tested. This goal is achieved by ensuring that adequate Quality Control (QC) procedures are used throughout the monitoring process, and by establishing a means to assess performance of these Quality Control and other QA activities. The Quality and Ethics Policy Statement is in Appendix H and is posted on the employee bulletin board.

We recognize that quality assurance requires a commitment to quality and ethics by everyone in the organization - individually, within each operating unit, and throughout the entire laboratory. All employees of CAS undergo lengthy data integrity training and are encouraged to participate in CAS open door policy to ensure a quality product and protect employees from any undue pressures. CAS also has stringent requirements and signed statements from employees to protect client confidentiality and ethical agreements. All personnel must familiarize themselves with the quality documentation and implement the policies and procedures in their work. These policies and procedures also apply to any national security concerns.

The information in this document has been organized according to the format described in *National Environmental Laboratory Accreditation Program (NELAP) Quality Systems Standards*, July 2003 in order to meet the compliance requirements of this standard. This document is controlled under policies required by CAS Document Control SOP (ADM-DOCCTRL). Each CAS network laboratory maintains its own lab specific Quality Assurance Manual.

4.0 QUALITY SYSTEM PROGRAM DESCRIPTION

The purpose of the QA program at CAS is to ensure that our clients are provided with analytical data that is scientifically sound, legally defensible, and of known and documented quality. The concept of Quality Assurance can be extended, and is expressed in the Vision of CAS:

> "CAS Holdings, Inc. applies creative thinking and strategic integration of our talents to be the best in all business endeavors we pursue. The Company is a leader in our industry demonstrated by:
>
> - Unprecedented customer satisfaction
> - Sustained profitability
> - Exceptional technical excellence
> - Superior Quality Systems
>
> We value our company's most valuable asset, our employee-owners. We are committed to make CAS Holdings Inc the preferred place to work and grow as individuals and professionals."

In support of this vision, our QA program addresses all aspects of laboratory operations, including laboratory organization and personnel, standard operating procedures, sample management, sample and quality control data, calibration data, standards traceability data, equipment maintenance records, method proficiency data (such as method detection limit studies and control charts), document storage and staff training records.

4.1 Facilities and Equipment

CAS features over 17,000 square feet of laboratory and administrative workspace at its Rochester, NY location. The facility is secured to the rest of the building using a swipe card entry system. Upon hire, each employee is assigned an access card and security code that must be used with their card. This employee-specific card provides access to the lab. SOP's are in place to protect the integrity of samples throughout the laboratory process (SMO-ICOC). A company software Quality Assurance plan exists to provide standard procedures to protect the integrity of electronic data. The laboratory has been designed and constructed to provide safeguards against cross-contamination of samples and is arranged according to work function, which enhances the efficiency of analytical operations.

Specialized areas include:

- Shipping and Receiving/Purchasing
- Sample Management Office
- Separate sample storage areas. See section 8 for further discussion of storage.
- Inorganic/Metals Sample Preparation Laboratories (2)
- ICP and ICP/MS Laboratory
- AA Laboratory
- Water Chemistry & General Chemistry Laboratories
- Gas Chromatography Laboratory (including a separate sample preparation laboratory)
- Gas Chromatography/Mass Spectrometry Laboratory (including a separate sample preparation laboratory)
- Volatile Organics Laboratory (including a separate standard preparation laboratory)
- HPLC and Petroleum Laboratory (including GC and GC/MS)
- Air Laboratory (Volatiles by GC/MS from canisters)
- Microbiology Laboratory
- Laboratory Deionized Water System
- Laboratory Management, Client Service, Report Generation and Administration
- Data Archive
- Information Technology (IT) and LIMS
- Hazardous Waste Storage Area

In addition, segregated laboratory areas were designed for efficient and safe handling of a variety of sample types. Figures 4-1, 4-2, and 4-3 shows the facility location and layout of our Rochester, NY location. The laboratory is equipped with state-of-the-art analytical and administrative support equipment. Appendix A lists the major equipment at the Rochester facility, illustrating the laboratory's depth and overall capabilities. All analytical instrumentation must be verified for each test prior to reporting data to ensure documented quality (see analytical SOPs and/or ADM-TRANDOC).

Good housekeeping is an essential practice at CAS. Each department is responsible for their own area, keeping isles clear, counters free of debris and chemicals that may cause contamination during analysis. A contracted cleaning service removes all garbage and recyclables, mops the floors, and vacuums each working day.

4.2 Technical Elements of the Quality Assurance (QA) Program

4.2.1 Quality Assurance Manual.

This document describes in detail the company's quality assurance program as well as provides information about test methods available, personnel, equipment, and facilities. The contents of the manual are reviewed annually by the Quality Assurance Program Manager (QAPM) and revised as needed to ensure that it continuously reflects current policies and practices. Personnel information is also updated annually as needed. The QAPM and the Lab Manager must approve all revisions before they are put into effect.

4.2.2 Standard Operating Procedures (SOPs) and Laboratory Notebooks

CAS maintains SOPs for use in both technical and administrative functions. Included in the list of available SOPs (Appendix G) are procedures for the preparation of an SOP document, and for enforcing the control of documents through the laboratory (ADM-SOP & ADM-DOCCTRL, respectively). Each SOP is implemented as written and has been reviewed and approved by the Laboratory Director, the Quality Assurance Program Manager. In most cases, the SOP has also been approved by the appropriate laboratory supervisor. The SOPs are reviewed annually and are revised as necessary to reflect actual objectives, flow of tasks, and staff responsibilities. The document control process associated with an SOP ensures that only the most currently prepared version of an SOP is being used for guidance and instruction. In addition to SOPs, each laboratory supervisor maintains a current file of all the promulgated methodology used to perform analyses. This file is accessible to all laboratory staff regardless of discipline. Laboratory notebook entries have been standardized following the guidelines in the *Making Entries into Logbooks and onto Benchsheets* SOP (SOP No. ADM-DATANTRY). The entries made into laboratory notebooks are reviewed and approved by the appropriate supervisor at a regular interval (quarterly)

4.2.3 Standard Reference Materials, Reagents, and Consumable Materials

All analytical measurements generated at CAS are performed using materials and/or processes that are traceable to a Standard Reference Material (SRM). Metrology equipment (analytical balances, thermometers, etc...) is calibrated using SRMs traceable to the National Institute of Standards and Technology (NIST) at the frequency described in Section 11. Consumable SRMs routinely purchased by the laboratories (e.g. primary stock standards) are purchased from nationally-recognized, reputable vendors. Most vendors have fulfilled the requirements for ISO 9001 certification and/or are accredited by A_2LA. Traceability throughout the laboratory is accomplished by following the guidelines set in the SOP, *Making Entries Into Logbooks and Onto Benchsheets* (ADM-DATANTRY).

All sampling containers provided to the client by the laboratory are purchased as precleaned (Level 1) containers, with certificates of analysis available for each bottle type. Certifications of Analysis provided by the vendors of reference materials and bottles are reviewed prior to use and kept on file by the laboratory.

The laboratory checks new lots of reagents for unacceptable levels of contamination prior to use in sample preservation, sample preparation, and sample analysis by following the SOP, *Checking New Lots of Chemicals for Contamination* (ADM-CTMN).

4.2.4 Operational Assessments

There are a number of methods used to assess the laboratory and its daily operations. In addition to the routine quality control (QC) measurements used by a laboratory to measure quality, the senior laboratory management staff at CAS examine a number of other performance indicators to assess the overall ability of the laboratory to successfully perform analyses for its clients. On-time performance, Analytical Report defect rate and Customer Invoice defect rate are a few of the measurements performed at CAS that are used to assess performance from an external perspective (i.e. client satisfaction). A frequent, routine assessment must also be made of the laboratory's facilities and resources in anticipation of accepting an additional or increased workload. CAS utilizes a number of different methods to insure that adequate resources are available in anticipation of the demand for service. Regularly scheduled senior staff meetings, tracking of outstanding proposals and an accurate, current synopsis of incoming work all assist the senior staff in properly allocating resources to achieve the required results.

4.2.5 Additional Quality Records

Quality Reports to Management, Internal and External Audits, and NCAR Forms discuss quality assurance program issues, continuous process improvements, and corrective actions throughout the program and are the responsibility of the QAPM.

4.2.6 Deviation from Standard Operating Procedures, Policies, or Standard Specifications

When a customer requests a modification to an SOP, policy, or standard specification the Project Manager handling that project must discuss the proposed deviation with the lab director, departmental manager, or QA to obtain approval for the deviation. All project-specific requirements must be on-file and with the service request upon logging in the samples. A Project-Specific Communication Form is available to document such deviations.

4.3 Subcontracting

Analytical services are subcontracted when CAS/Rochester needs to balance workload and/or when the requested analyses are not performed in Rochester. However, subcontracting is only done with the knowledge and approval of the client. Subcontracting to another CAS laboratory is preferred over external-laboratory subcontracting. Further, subcontracting is only done to capable and qualified laboratories approved by the client. Subcontractors must be accredited by the applicable state or program to which apply to the samples being analyzed. Established procedures are followed to qualify external subcontract laboratories, see *Qualifying Subcontract Labs* (ADM-SUBLAB).

Figure 4-1
CAS/Rochester Laboratory Floor Plan

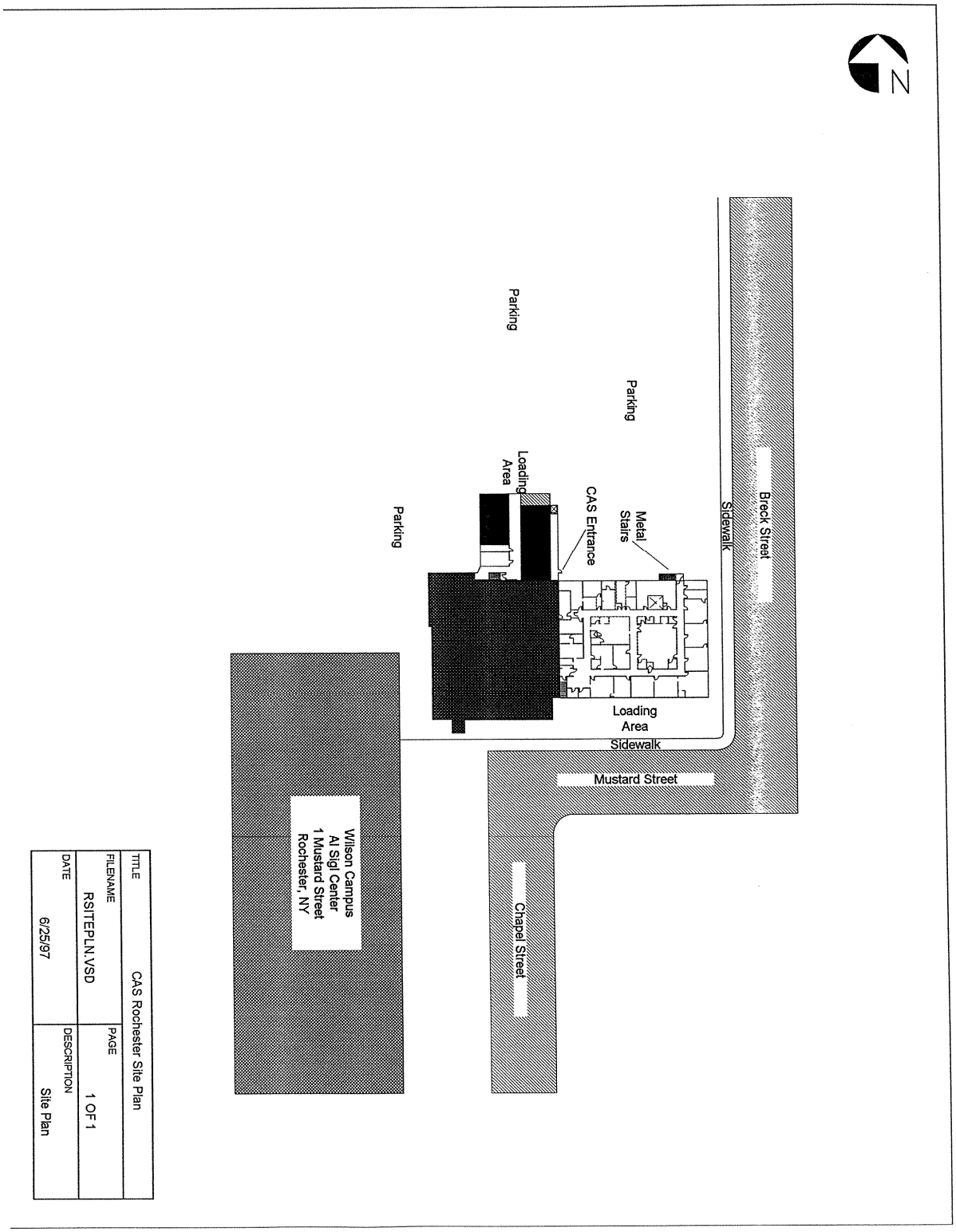


Figure 4-2
CAS/Rochester Laboratory Floor Plan

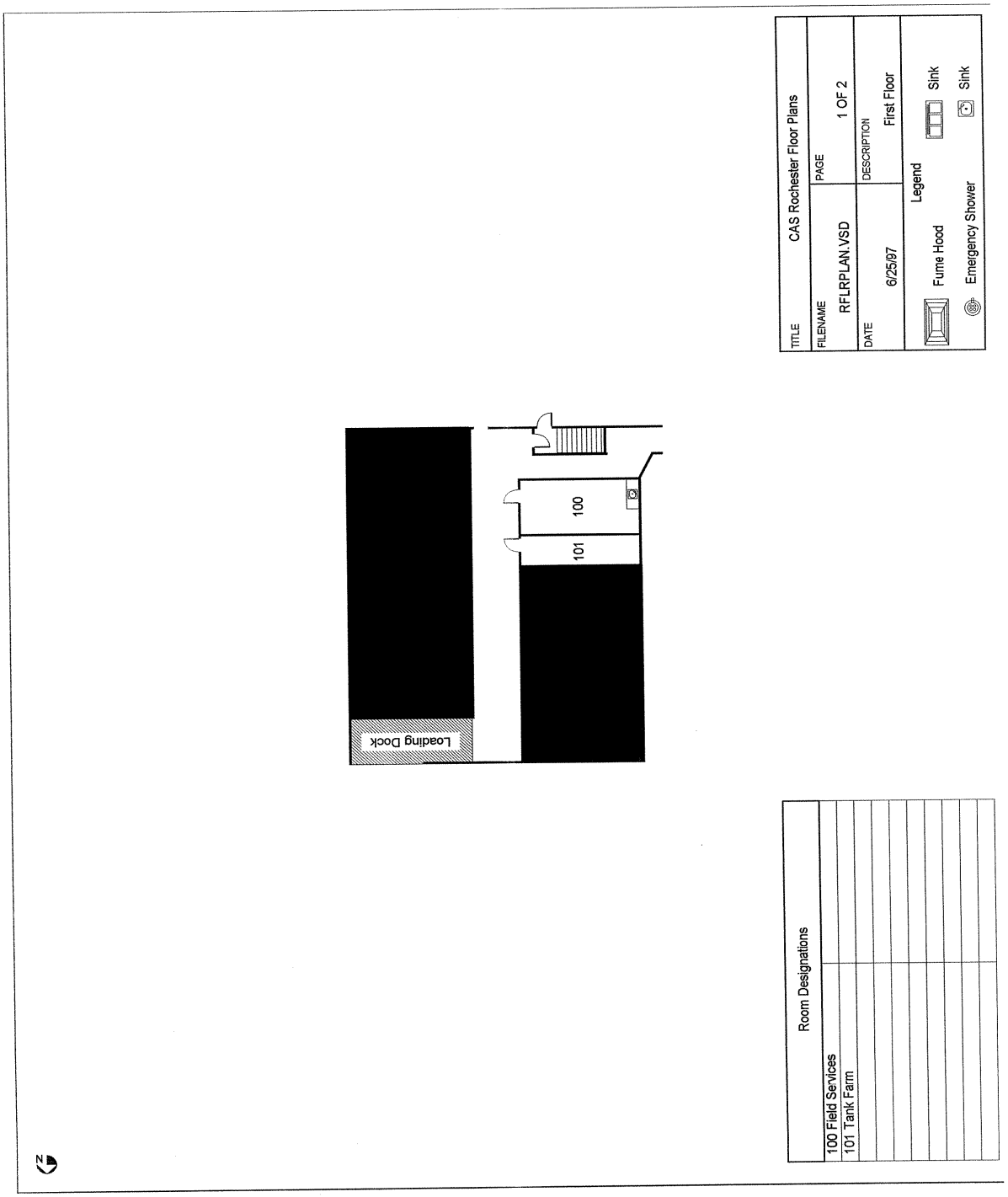
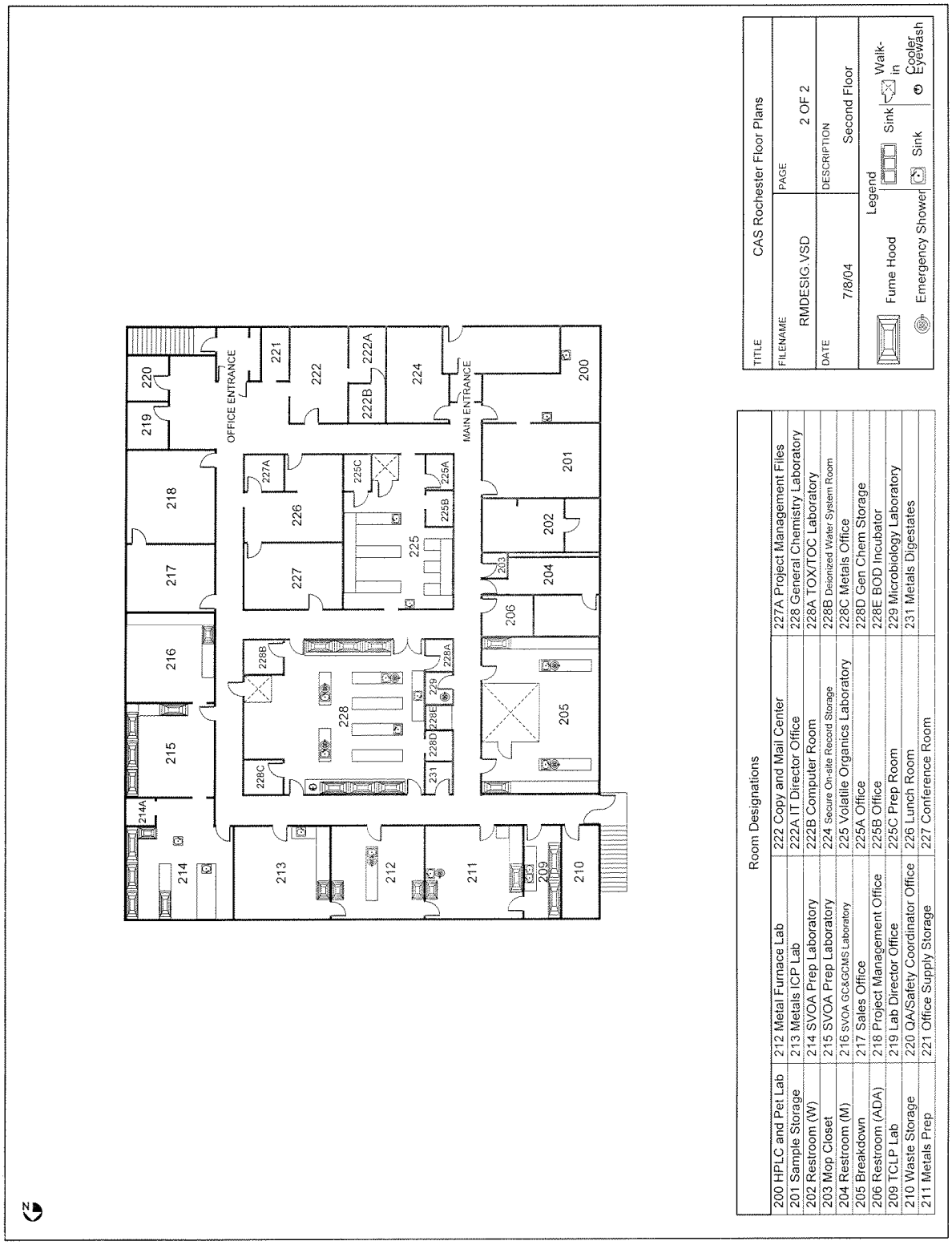


Figure 4-3
CAS/Rochester Laboratory Floor Plan



5.0 STATEMENT OF PROFESSIONAL CONDUCT AND LABORATORY PRACTICE

One of the most important aspects of the success of CAS as a company is the emphasis placed on the integrity of the data provided and the services rendered. This success is reliant on both the professional conduct of all employees within CAS as well as established laboratory practices. All personnel involved with environmental testing and calibration activities must familiarize themselves with the quality documentation and implement the policies and procedures in their work.

5.1 Professional Conduct

To promote quality, CAS requires certain standards of conduct and ethical performance among employees. The following examples of documented CAS policy are representative of these standards, and are not intended to be limiting or all-inclusive:

- Under no circumstances is the willful act of fraudulent manipulation of analytical data condoned. Such acts are to be reported immediately to senior management for appropriate corrective action.

- Unless specifically required in writing by a client, alteration, deviation or omission of written contractual requirements is not permitted. Such changes must be in writing and approved by senior management.

- Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented, and appropriate remedies and punitive measures will be taken toward those individuals responsible.

- Unauthorized release of confidential information about the company or its clients is taken very seriously and is subject to formal disciplinary action. All employees sign a confidentiality agreement upon hire to protect the company and client's confidentiality and proprietary rights.

5.2 Prevention and Detection of Improper, Unethical or Illegal Actions

It is the intention of CAS to proactively prevent and/or detect any improper, unethical or illegal action conducted within the laboratory. This is performed by the implementation of a program designed for not only the detection but also prevention. Prevention consists of educating all laboratory personnel in their roles and duties as employees, company policies, inappropriate practices, and their corresponding implications as described in Section 5.3 of this document.

In addition to education, appropriate and inappropriate practices are included in SOPs such as manual integration, data review and specific method procedures. Other aspects of this program include electronic data tape audits, post-analysis and whenever possible single blind and/or double blind analyses. All aspects of this program is documented and retained on file according to the company policy on record retention.

5.3 Laboratory Ethics Training Plan (Data Integrity Training Plan)

An in-depth (approximately 8 hour) initial Data Integrity/Ethics Training and an annual refresher training is required for each new on-site employee including all full and part time personnel.

Topics covered are documented in writing and provided to all trainees. Key topics covered are the organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting, how and when to report data integrity issues and record keeping. Training includes discussion regarding all data integrity procedures, data integrity training documentation, in-depth data monitoring and data integrity procedure documentation.

Trainees are required to understand that any infractions of the laboratory data integrity procedures will result in a detailed investigation that could lead to very serious consequences including immediate termination, or civil/criminal prosecution.

The initial and annual refresher data integrity training shall have a signature attendance sheet that demonstrates all staff members have participated and understand their obligation related to data integrity/ethics.

Senior managers/department heads acknowledge their support of these procedures by upholding the spirit and intent of the laboratory's data integrity procedures and effectively implement the specific requirements of the procedures.

The training session includes, at a minimum, the following legal and ethical topics:

- Examples of improper actions (defined by DoD as deviations from contract-specified or method-specified analytical practices and may be intentional or unintentional)
- Examples of unethical or illegal actions (deliberate falsification), including at a minimum:
  - Improper data manipulations
  - Adjustments to time clocks
  - Inappropriate changes in concentrations of standards
  - Making failed requirements appear acceptable
- Proper written narration by the analyst with respect to those cases where analytical data may be useful, but are in one sense or another partially deficient.
- CAS Employee Handbook (overview including mechanism for reporting and seeking advice on ethical decisions, organizational mission and its relationship to critical need for honesty and full disclosure).
- CAS' Commitment to Excellence in Data Quality Ethics Agreement (overview including legal consequences and other specific examples of breaches of ethical behavior)
- Measures taken to prevent and detect fraud; how and when to report data integrity issues.
- Record keeping
- Data validation (in-depth data monitoring and electronic audits)
- Implications of laboratory data fraud and data investigations
- Potential punishments and penalties for improper, unethical or illegal actions (immediate termination, or civil/criminal prosecution)

It is the responsibility of the Quality Assurance Program Manager to ensure that the training plan described in this section including content and frequency is conducted. All employees may review the mechanism for reporting and seeking advice on ethical decisions as well as the legal consequences of unethical behavior in the CAS Employee Handbook & CAS Commitment to Excellence in Data Quality Statement, both of which are available to all employees. In addition, the Excellence in data Quality Statement is reviewed and signed on an annual basis by all laboratory personnel.

5.4 Laboratory Practices Affecting Personnel

CAS makes an attempt to ensure that it is impartial and its employees are free from any commercial, financial, or other undue pressures that might affect their technical judgement or quality of work. This is accomplished by utilizing each of the following policies, programs and procedures, wherever necessary.

- CAS Corporate Ethics Point Program – An anonymous and confidential reporting system available to all employees that is used to communicate misconduct and other concerns. The program shall help minimize negative morale and promote a positive work place. Associated upper management is notified and the investigations are documented.

- Open Door Policy (CAS Employee Handbook) – Employees are encouraged to bring any work related problems or concerns to the attention of local management or their Human Resources representative. However, depending on the extent or sensitivity of the concern, employees are encouraged to directly contact any member of upper management.

- Project Scheduling – Jobs are scheduled (when prior notice is available) according to capacity and work schedules set and discussed by customer service personnel and laboratory supervisors. The scheduling is done not only to prevent missed holding times and on-time deliveries but as a way for management and analysts to be prepared for incoming samples and to utilize flexible work schedules, whenever necessary.

- Flexible Work Hours – Analysts are able to work flexible work hours (with management approval). Additionally, analysts may "team" with a co-worker (again with approval) and work split shifts in order to extend the work day and increase the number of samples that can be analyzed, whenever necessary.

- Gifts and Favors (CAS Employee Handbook) – To avoid possible conflict of interest implications, employees do not receive unusual gifts or favors to, nor accept such gifts or favors from, persons outside the Company who are, or may be, in any way concerned with the projects on the Company is professionally engaged. Anything beyond an occasional meal, an evening's entertainment, or a nominal holiday gift is considered an "unusual gift or favor".

6.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The CAS/Rochester staff, consisting of approximately 50 employees, includes chemists, technicians and support personnel. They represent diverse educational backgrounds and experience, and provide the comprehensive skills that a modern, state-of-the-art analytical laboratory requires.

CAS is committed to providing an environment that encourages excellence. Everyone within CAS shares responsibility for maintaining and improving the quality of our analytical services. The responsibilities of key personnel within the laboratory are described below. An organizational chart of the laboratory, as well as the resumes of key personnel, can be found in Appendix B. Specific Job Descriptions are available and kept on file by human resources.

- The role of the **Laboratory Director** is to provide technical, operational, and administrative leadership through planning, allocation and management of personnel and equipment resources. This person is responsible for quality (including compliance with the current version of the Quality Systems, NELAC, Chapter 5), overall laboratory efficiency, and financial performance of the Rochester CAS facility. The Laboratory Director also provides support for business development by identifying and developing new markets and through continuing support of the management of existing client activities. The Lab Director, QA Program Manager and Business Development Manager are authorized signatories for the Rochester facility.
- The responsibility of the **Quality Assurance Program Manager** (QAPM) is to provide a focus for overall QA activities within the laboratory and maintain compliance with the Quality Systems Standards (NELAC, Chapter 5). This person works with individual laboratory production units to establish effective quality assurance and quality control. The QAPM is also responsible for maintaining this QA Manual and performing an annual review of it, updating it if necessary; reviewing, approving, and controlling SOPs; ensure continuous process improvements through the use of control charts and proficiency test samples; reviewing data (Section 12.0); maintaining the laboratory's certifications and approvals (Section 13.0); performing internal QA audits (Section 13.0); preparing QA reports (Section 16.0); maintaining training documentation for all employees including IDCs, CDCs, Training Plan forms, and seminar attendance; maintaining MDL study documentation, responding to QA needs, problems, and requests from technical staff. This person is a technical advisor and is responsible for summarizing and reporting overall unit performance.
- The Quality Assurance Director (Corporate Quality Assurance) is responsible for the overall QA program at all the CAS laboratories. The QA Director is responsible for performing an annual on-site audit at each CAS laboratory and preparing a written report; maintaining a data base of information about state certifications and accreditation programs; writing laboratory-wide SOPs; maintaining a data base of CAS-approved subcontract laboratories; providing assistance to QAPMs and laboratory managers; preparing an annual QA activity report; etc.

- The **Health and Safety Officer** is responsible for the administration of the laboratory health and safety policies. This includes the formulation and implementation of safety policies, the supervision of new-employee safety training, the review of accidents, incidents and prevention plans, the monitoring of hazardous waste disposal and the conducting of departmental safety inspections. The safety officer is also designated as the Chemical Hygiene Officer.
- The **Client Services Manager** is responsible for the Client Services Department (customer services/project managers, and marketing functions). The Client Services Department provides a complete interface with clients from initial project specification to final deliverables.
- The **Project Manager** is a senior-level, non-line scientist assigned to each client to act as a technical liaison between the client and the laboratory. The Project Manager is responsible for ensuring that the analyses performed by the laboratory meet all project, contract, and regulatory-specific requirements. This entails coordinating with the CAS laboratory and administrative staff to ensure that client-specific needs are understood, and that the services CAS provides are properly executed and satisfy the requirements of the client.
- **Information Technology** (IT) staff are responsible for the administration of the Laboratory Information Management System (LIMS) and other necessary support services. Other functions of the IT staff include laboratory network maintenance, education of analytical staff in the use of scientific software, custom software development and implementation, Electronic Data Deliverable (EDD) generation and data back-up, archival and integrity operations.
- The Analytical Laboratory is divided into operational units, based upon specific disciplines. Each department is responsible for establishing, maintaining and documenting a quality control program based upon the requirements within the Quality Assurance Manual. Each **Department Supervisor/Manager** has the responsibility to ensure that quality control functions are carried out as planned, and to guarantee the production of high quality data. Supervisors have the responsibility to monitor the day-to-day operations to ensure that productivity and data quality objectives are met. Each analyst in the laboratory has the responsibility to carry out testing according to prescribed methods, standard operating procedures and quality control guidelines particular to the laboratory in which he/she is working.
- The **Sample Management Office** plays a key role in the laboratory QA program by providing documentation for all samples received by the laboratory, distributing samples, and maintaining proper storage.
- **Support Services** are provided by corporate purchasing departemtn and/or local purchasing representative to coordinate facility and instrument maintenance, ordering of standards, supplies, reagents, and any other services required.

Analytical work will be conducted by the laboratory under the approval of the client. If any aspect of a project requires sub-contracting, CAS project manager shall notify the client and obtain approval for any sub-contractors prior to completing the analytical program.

7.0 SAMPLING, SAMPLE PRESERVATION, AND HANDLING PROCEDURES

The quality of analytical results is highly dependent upon the quality of the procedures used to collect, preserve and store samples. CAS recommends that clients follow sampling guidelines described in reference methods including EPA, NIOSH, ASTM, and SW846. Sample handling factors that must be taken into account to insure accurate, defensible analytical results include:

- Amount of sample taken
- Type of container used
- Type of sample preservation
- Sample storage time
- Proper custodial documentation

CAS uses the sample preservation, container, and holding-time recommendations published in a number of documents. The primary documents of reference are: USEPA SW-846, Third Edition (wastewater, soils, and hazardous waste samples), USEPA 600/4-79-020 and 600/4-82-057 (wastewater samples), USEPA 600/4-88-039, 600/4-91-010 and 600/R-93/100 (drinking water samples) and NIOSH, Manual of Analytical Methods 4th Edition (air samples) . The complete citation for each reference can be found in section 18.0 of this document. The container, preservation and holding time information are summarized in Table 7-1.

CAS routinely provides sample containers with appropriate preservatives for our clients. The containers are purchased as "precleaned" to a level 1 status, and conform to the requirements for analytical sample established by the USEPA. Certificates of analysis for the sampling containers are available upon request. Our sample kits typically consist of foam-lined, precleaned shipping coolers, specially prepared and labeled sample containers individually wrapped in bubble wrap, chain-of-custody (COC) forms, and custody seals. An example of a sample container label and a custody seal is shown in Figure 7-1. Figure 7-2 is a copy of the chain-of-custody form used at CAS. For extremely large sample container shipments, the containers may be shipped in their original boxes. Such shipments will consist of several boxes of labeled sample containers and sufficient materials (bubble wrap, COC forms, custody seals, shipping coolers, etc...) to allow the sampling personnel to process the sample containers and return them to CAS. The proper preservative will be always be added to the sample containers or provided in a separate vial prior to shipment, unless otherwise instructed by the client. See SOP, ADM-CTMN for information about the testing of chemicals added as preservatives. See SOP, SMO-BPS for more specific information regarding the packing and shipping of sample kits. See SOP, SMO-GEN for the Sample Acceptance Policy. CAS keeps client-specific shipping requirements on file and utilizes all major transportation carriers to guarantee that sample shipping requirements (same-day, overnight, etc.) are met. CAS also provides its own courier service that makes regularly scheduled trips to the Buffalo, Rochester area.

Table 7-1
Sample Preservation and Holding Times[a]

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
Bacterial Tests						
Coliform, Fecal and Total	SM9223B	W	Sterile P,G	100	Cool, ≤6°C, 0.008% $Na_2S_2O_3$[d]	6-24 hours[e]
Inorganic Tests						
Acidity	SM2310B	W	P,G	250	Cool, ≤6°C	14 days
Alkalinity	SM2320B	W	P,G	250	Cool, ≤6°C	14 days
Ammonia	350.1	W	P,G	250	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Ash, Percent	ASTM D482	NonAq Liq	P,G	8 oz.	Cool, ≤6°C	None Listed
Biochemical Oxygen Demand (BOD/ CBOD)	SM5210B	W	P,G	1000	Cool, ≤6°C	48 hours
Bromide	300.0/9056	W	P,G	250	Cool, ≤6°C	28 days
Chemical Oxygen Demand (COD)	410.4	W	P,G	250	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Chemical Oxygen Demand (COD)	410.4	S	G	4 oz.	Cool, ≤6°C	28 days
Chloride	300.0/ SM4500Cl E	W	P,G	250	Cool, ≤6°C	28 days
Chlorine, Total Residual	SM4500Cl F	W	P,G	500	None Required- field analysis preferred	15 minutes
Chlorine Demand	SM 409A	W	P,G	500	Cool, ≤6°C	None listed
Chlorophyll a	SM 10200H	W	P,G, or filter	1000 or filter	Filter immediately and freeze filter	None listed
Color	SM2120B	W	P,G	100	Cool, ≤6°C	48 hours
Cyanide, Total and Amenable to Chlorination	335.4/ SM 4500CN G /9012A	W	P,G	250	Cool, ≤6°C, NaOH to pH>12	14 days
Cyanide, Weak Acid Dissociable	SM4500CN G	W	P,G	500	Cool, ≤6°C, NaOH to pH >12	14 days
Cyanide, Total	9012A	S	P,G	250	Cool, ≤6 °C	14 days
Density	ASTM D4052	NonAq Liq	P,G	250	None	None listed
Ethylene Glycol	NYSDEC 89-9	W	G	2x40 mL	Cool, ≤6°C	None listed
Ferrous Iron	SM 3500 Fe-D	W	P,G	250	No headspace – field analysis preferred	None listed – field preferred
Fluoride	300.0/9056	W	P,G	250	Cool, ≤6°C	28 days
Hardness	SM2340C	W	P,G	250	HNO_3 to pH<2	6 months
Hydrogen Ion (pH)	SM4500 H+B/ 9040	W	P,G	100	None Required – field analysis preferred	15 minutes
Ignitability – closed cup	1010	Liquid	G	3 x 40mL	Cool, ≤6°C	14 days
Ignitability – open cup	ASTM D92	S	G	4oz.	Cool, ≤6°C	None listed
Kjeldahl and Organic Nitrogen	351.2	W	P,G	250	Cool, ≤6°C, H_2SO_4 to pH<2	28 days

Table 7-1
Sample Preservation and Holding Times[a]

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
Nitrate	300.0/9056	W	P,G	250	Cool, ≤6°C	48 hours
Nitrate-Nitrite	353.2	W	P,G	250	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Nitrite	300.0/9056/ 353.2	W	P,G	250	Cool, ≤6°C	48 hours
Orthophosphate	365.1	W	P,G	250	Filter Immediately, Cool, ≤6°C	48 hours
Perchlorate	6850	W,S	P	250, 4oz.	Cool, ≤6°C	28 days
Phenolics, Total	420.4/9066	W	Amber G Only	250	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Phosphorus, Total	365.1	W	P,G	250	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Reactive Cyanide and Sulfide	Chpt7/9010	W,S	P,G	10g	Cool, ≤6 °C, no headspace	None listed
Residue, Total	SM2540B	W	P,G	250	Cool, ≤6°C	7 days
Residue, Filterable (TDS)	SM2540C	W	P,G	250	Cool, ≤6°C	7 days
Residue, Nonfilterable (TSS)	SM2540D	W	P,G	1000	Cool, ≤6°C	7 days
Residue, Settleable	SM2540F	W	P,G	1000	Cool, ≤6°C	48 hours
Residue, Volatile	160.4	W	P,G	250	Cool, ≤6°C	7 days
Silica, Dissolved	USGS I-2700-85	W	P Only	250	Cool, ≤6°C	28 days
Specific Conductance	120.1	W	P,G	100	Cool, ≤6°C	28 days
Specific Gravity	ASTM D1475	NonAq Liq	P,G	250	None	None listed
Sulfate	SM15 426C	W	P,G	250	Cool, ≤6°C	28 days
Sulfide, Acid Soluble	SM 4500-S F /9034	W	P,G	500	Cool, ≤6°C, Add Zinc Acetate plus Sodium Hydroxide to pH>9	7 days
Sulfide, Acid Volatile (AVS)	EPA Draft 1991	S	G	8 oz.	Cool, ≤6°C No headspace	14 days
Sulfite	SM 4500-SO32-B	W	P,G	250	None Required- field analysis preferred	15 minutes
Surfactants (MBAS)	SM 5540C	W	P,G	500	Cool, ≤6°C	48 hours
Temperature	170.1	W	P,G	50	None Required	Analyze immediately
Turbidity	180.1	W	P,G	50	Cool, ≤6°C	48 hours
Water, Percent	ASTM E203	W	P,G	4 oz.	Cool, ≤6°C	None listed

Table 7-1
Sample Preservation and Holding Times[a]

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
Metals						
Chromium VI	218.6/ SM3500Cr B	W	P,G	250	Cool, ≤6°C Buffering = pH 9.3-9.7 with specific solution	24 hours: 28 days if buffered
Chromium VI	7196A/ 7199	S	P,G	4 oz.	Cool, ≤6°C	30 days until digestion; 7 days until pH adjustment and analysis
Mercury, Low Level	1631E	W	Fluoropolymer bottle and cap	500	5 mL 1:1 HCl Cool ≤6°C until BrCl Room Temp after BrCl	28 days to BrCl 90 days from collection to analysis
Mercury	245.1/7470A	W	P,G	250	HNO_3 to pH<2	28 days
Mercury	245.5/7471	S	P,G	4 oz.	Cool, ≤6°C	28 days
Metals, except Chromium VI and Mercury	200.7/200.8/6010/06020	W	P,G	250	HNO_3 to pH<2	180 days
Metals, except Chromium VI and Mercury	6010B/6020	S	G, Teflon-Lined Cap	4 oz.	Cool, ≤6°C	180 days
Organics						
Oil and Grease	1664A	W	G, Teflon-Lined Cap	1000	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Organic Carbon, Total (TOC)	SM20 5310C /9060	W	G	3x40	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Organic Carbon, Total (TOC)	EPA Lloyd Kahn	S	G	4 oz	Cool, ≤6°C, no headspace	14 days
Petroleum Hydrocarbons, Total Recoverable (gravimetric)	1664A	W	G, Teflon-Lined Cap	1000	Cool, ≤6°C, HCl or H_2SO_4 to pH<2	28 days
Petroleum Hydrocarbons, Total	310-13	W	G, Teflon-Lined Cap	2000	Cool, ≤6°C, HCl or H_2SO_4 to pH<2	7 days until extraction; 40 days after extraction
Petroleum Hydrocarbons, Total	310-13	S	G, Teflon-Lined Cap	2000	Cool, ≤6°C	14 days until extraction; 40 days after extraction

Table 7-1
Sample Preservation and Holding Times[a]

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
Volatile Organics						
Purgeable Halocarbons and Aromatics (including BTEX, Oxygenates)	524.2/ 601/ 602/ 624/ 8021/ 8260B	W	G, Teflon-Lined Septum Cap	3x40	**No Residual Chlorine Present**: HCl to pH<2, Cool, ≤6°C, No Headspace **Residual Chlorine Present**: 10% $Na_2S_2O_3$, HCl to pH<2, Cool, ≤6°C, No Headspace	14 days 7 days if not chemically preserved
Purgeable Halocarbons and Aromatics (including BTEX, Oxygenates)	8021/8260B	S	G, Teflon-Lined Cap	8 oz.	Cool, ≤6°C, Minimize Headspace	14 days
Purgeable Halocarbons and Aromatics (including BTEX, Oxygenates)	8021/8260B	S - 5035	G, Teflon-Lined, Septum Cap	8 oz.	Freeze at -20°C on site in vial	14 days
					Frozen in coring tool on site	48 hours
					Cool, 4°C, freeze at lab within 48 hours	14 days
					Cool, 4°C, methanol preserved within 48 hours	14 days
					Cool, 4°C in vial	48 hours
					Cool, 4°C in coring tool	48 hours
					Cool, 4°C, sodium bisulfate	14 days
Acrolein	624/8260B	W	G, Teflon-Lined Septum Cap	3x40	Adjust pH to 4-5, Cool, ≤6°C, No Headspace or If not pH 4-5	14 days 3 days if not adjusted to pH 4-5
Petroleum Hydrocarbons, Volatile (Gasoline-Range Organics)	8015B	W	G, Teflon-Lined Septum Cap	3x40	Cool, ≤6°C, HCl to pH<2 No Headspace	14 days 7 days if not chemically preserved
Petroleum Hydrocarbons, Volatile (Gasoline-Range Organics)	8015B	S	G, Teflon-Lined Cap	8 oz.	Cool, ≤6°C Minimize Headspace	14 days
Volatiles	TO-15	Air	Cannisters	6 L	None Required	30 days recommended

Table 7-1
Sample Preservation and Holding Times[a]

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
Semivolatile Organics						
Petroleum Hydrocarbons, Extractable (Diesel-Range Organics)	8015B	W,S	G, Teflon-Lined Cap	1000, 4 oz.	Cool, ≤6°C	7 days until extraction;[f] 40 days after extraction
EDB and DBCP	504.1	W	G, Teflon-Lined Cap	3x40	Cool, ≤6°C, No Headspace	14 days
EDB and DBCP	8011	W	G, Teflon-Lined Cap	3x40	Cool, ≤6°C, No Headspace	28 days
Non-Halogenated Organics	8015B	W,S, NonAq Liq	G, Teflon-Lined Cap	3x40, 4 oz.	Cool, ≤6°C, No Headspace[g]	14 days
Phenols, Phthalate Esters, Nitrosamines, Nitroaromatics and Cyclic Ketones, Haloethers, Chlorinated Hydrocarbons	625/ 8270C	W,S	G, Teflon-Lined Cap	1000, 4 oz.	Cool, ≤6°C, store in dark[g]	7 days until extraction;[f] 40 days after extraction
Chlorinated Phenolics	625/ 8270C	W	G, Teflon-Lined Cap	1000	Cool, ≤6°C	30 days until extraction, 30 days after extraction
Polynuclear Aromatic Hydrocarbons	625/ 8310/ 8270C	W,S	G, Teflon-Lined Cap	1000, 4 oz.	Cool, ≤6°C, Store in Dark	7 days until extraction;[f] 40 days after extraction
Organochlorine Pesticides and PCBs	608/ 8081/ 8082	W,S	G, Teflon-Lined Cap	1000, 4 oz.	Cool, ≤6°C	7 days until extraction;[f] 40 days after extraction
Chlorinated Herbicides	8151A	W,S	G, Teflon-Lined Cap	1000, 4 oz.	Cool, ≤6°C	7 days until extraction;[f] 40 days after extraction
Metabolic/Fatty/Organic Acids	In house	W	G, Teflon-Lined Cap	250	Cool, ≤6°C	28 days recommended
Carbonyl Compounds (Formaldehyde)	8315A	W	G, Teflon-Lined Cap	1000	Cool, ≤6°C	3 days until extraction, 3 days after extraction
Carbonyl Compounds (Formaldehyde)	8315A	S	G, Teflon-Lined Cap	4 oz.	Cool, ≤6°C	14 days
Toxicity Characteristic Leaching Procedure (TCLP)						
Mercury	7470A	HW	P,G	100g/ 1000mL	Sample: Cool, ≤6°C TCLP extract: HNO_3 to pH<2	28 days until extraction; 28 days after extraction
Metals, except Mercury	6010B	HW	P,G	100g/ 1000mL	Sample: Cool, ≤6°C TCLP extract: HNO_3 to pH<2	180 days until extraction; 180 days after extraction
Volatile Organics	8260B	HW	G, Teflon-Lined Cap	125g	Sample: Cool, ≤6°C Minimize Headspace TCLP extract: Cool, ≤6°C, HCl to pH<2, No Headspace	14 days until extraction; 14 days after extraction
Semivolatile Organics	8270C	HW	G, Teflon-Lined Cap	100g/ 1000mL	Sample: Cool, ≤6°C, Store in Darkg TCLP extract: Cool, ≤6°C, Store in Dark	14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction
Organochlorine Pesticides	8081	HW	G, Teflon-Lined Cap	100g/ 1000mL	Sample: Cool, ≤6°C TCLP extract: Cool, ≤6°C	14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction
Chlorinated Herbicides	8151	HW	G, Teflon-Lined Cap	100g/ 1000mL	Sample: Cool, ≤6°C TCLP extract: Cool, ≤6°C	14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction

Table 7-1
Sample Preservation and Holding Times[a]

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
CLP						
Cyanide, Total	ILM05.3	W	P,G	500	Cool, ≤6°C, NaOH to pH 12, plus 0.6 g Ascorbic Acid	12 days[h]
	ILM05.3	S	P,G	8 oz.	Cool, ≤6°C	12 days[h]
Mercury	ILM05.3	W	P,G	500	HNO_3 to pH<2	26 days[h]
	ILM05.3	S	P,G	8 oz.	Cool, ≤6°C	26 days[h]
Metals, except Mercury	ILM05.3	W	P,G	500	HNO3 to pH<2	180 days[h]
	ILM05.3	S	P,G	8 oz.	Cool, ≤6°C	180 days[h]
Volatile Organics	OLM04.3	W,S	G, Teflon-Lined Cap	3x40	W-Cool, ≤6°C, Minimize Headspace Soil – see SOP	10 days[h]
Semivolatile Organics	OLM04.3	W,S	G, Teflon-Lined Cap	2000	Cool, ≤6°C, Store in Dark[g]	5 days until extraction;[h,i] 40 days after extraction
Organochlorine Pesticides and PCBs	OLM04.3	W,S	G, Teflon-Lined Cap	2000	Cool, ≤6°C	5 days until extraction;[h,i] 40 days after extraction

Provide additional volume when specified by client QAPP- especially for Semi-Volatiles

a See Section 18.0 for sources of holding time information. Holding time is from collection to analysis unless otherwise specified.
b W = Water; S = Soil or Sediment; HW = Hazardous Waste; A = Air
c P = Polyethylene; G = Glass
d For chlorinated water samples
e The recommended maximum holding time is variable, and is dependent upon the geographical proximity of sample source to the laboratory.
f Fourteen days until extraction for soil, sediment, and sludge samples.
g If the water sample contains residual chlorine, 10% sodium thiosulfate is used to dechlorinate.
h Number of days following sample receipt at the laboratory.
i Ten days until extraction for soil, sediment, and sludge samples.

Figure 7-1
Sample Container Label and Custody Seal

CLIENT: JOB#: 006
LOCATION:
DATE SAMPLED:
ANALYSIS:
PRESERVATIVE:
COMMENTS:

Custody Seal

Date _____ Project _____

Signature _____ Container# _____ of _____

Columbia Analytical Services, INC.
An Employee-Owned Company
www.caslab.com

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

One Mustard St., Suite 250 • Rochester, NY 14609-0859 • (716) 288-5380 • 800-695-7222 x11 • FAX (716) 288-8475 PAGE _____ OF _____

SR #

CAS Contact

Project Name	Project Number
Project Manager	Report CC
Company/Address	
Phone #	FAX#
Sampler's Signature	Sampler's Printed Name

ANALYSIS REQUESTED *(Include Method Number and Container Preservative)*

PRESERVATIVE

NUMBER OF CONTAINERS

- GC/MS VOA's ☐ 8260 ☐ 624 ☐ CLP
- GC/MS SVOA's ☐ 8270 ☐ 625 ☐ CLP
- GC VOA's ☐ 8021 ☐ 601/602
- PESTICIDES/ PCB's ☐ 8081 ☐ 608 ☐ CLP ☐ 8082
- STAR'S LIST 8021 VOA's ☐ TOTAL ☐ TCLP
- STAR'S LIST 8270 SVOA's ☐ TOTAL ☐ TCLP
- TCLP ☐ VOA's ☐ SVOA's ☐ METALS ☐ H/P
- WASTE CHARACTERIZATION ☐ React ☐ Corros. ☐ Ignit.
- METALS, TOTAL (List in comments below)
- METALS, DISSOLVED (List in comments below)

Preservative Key
0. NONE
1. HCL
2. HNO_3
3. H_2SO_4
4. NaOH
5. Zn. Acetate
6. MeOH
7. $NaHSO_4$
8. Other _____

REMARKS/ ALTERNATE DESCRIPTION

CLIENT SAMPLE ID	FOR OFFICE USE ONLY LAB ID	SAMPLING DATE	SAMPLING TIME	MATRIX

SPECIAL INSTRUCTIONS/COMMENTS
Metals

See QAPP ☐

TURNAROUND REQUIREMENTS
_____ **RUSH** (SURCHARGES APPLY)
_____ **24 hr** _____ **48 hr** _____ **5 day**
_____ **STANDARD**
REQUESTED FAX DATE
_____
REQUESTED REPORT DATE
_____

REPORT REQUIREMENTS
_____ I. Results Only
_____ II. Results + QC Summaries (LCS, DUP, MS/MSD as required)
_____ III. Results + QC and Calibration Summaries
_____ IV. Data Validation Report with Raw Data
_____ V. Speicalized Forms / Custom Report
Edata _____ Yes _____ No

INVOICE INFORMATION
PO#
BILL TO:
SUBMISSION #:

SAMPLE RECEIPT: CONDITION/COOLER TEMP: _____ CUSTODY SEALS: Y N

RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY
Signature	Signature	Signature	Signature	Signature	Signature
Printed Name	Printed Name	Printed Name	Printed Name	Printed Name	Printed Name
Firm	Firm	Firm	Firm	Firm	Firm
Date/Time	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time

Distribution: White - Return to Originator; Yellow - Lab Copy; Pink - Retained by Client

SCOC-0402-40

Figure 7-2
Chain of Custody Form

8.0 SAMPLE CUSTODY

Standard Operating Procedures have been established for the receiving of samples into the laboratory. These procedures ensure that samples are received and properly logged into the laboratory, and that all associated documentation, including chain of custody forms, is complete and consistent with the samples received. See SOP, SMO-GEN for detailed information.

Sample Acceptance Policy:

Samples delivered to the CAS Sample Management Office (SMO) and are received by a Sample Custodian. The Chain of Custody (COC) is reviewed for completeness and accuracy and a Cooler Receipt and Preservation Form (CRPF) (Figure 8-1) is used to document the condition of the cooler and its contents as received by the sample custodian. Verification of sample integrity by the Sample Custodian includes the following activities:

- Assessment of custody seal presence/absence, location and signature.
- Temperature of sample containers upon receipt.
- Chain of custody documents present and properly completed.

  Entries should be made in blue or black ink and at a minimum, shall include sample identification, description, date, time, and location of sample collection, the name and signature(s) of the sample collector and intermediate sample custodian(s), date and time of each sample transfer, and signature of the CAS Sample Custodian upon receipt. For an example COC, see Figure 7-2.
- Sample containers checked for integrity (broken, leaking, etc...)
- Sample is clearly marked with the sample ID, date and time of collection.
- Appropriate containers (size, type) are received for the requested analyses.
- Sample container labels and/or tags agree with chain of custody entries (Identification, required analyses, etc...)
- Assessment of proper sample preservation (If inadequate, corrective action is employed).
- VOC containers are inspected for the presence/absence of bubbles. (No assessment of proper preservation is performed for VOC containers by SMO personnel).

Any anomalies or discrepancies observed during the initial assessment are recorded on the CRPF and/or chain of custody documents. All potential problems with a sample shipment are addressed by contacting the client and discussing the pertinent issues. When the Project Manager and client have reached a satisfactory resolution, the log-in process may commence. The laboratory has formally accepted the samples. If resolution cannot be reached with the

client or the samples do not comply with the requirements of the CRPF, these samples may be rejected by the laboratory.

Sample Log-in;

During the log-in process, each sample is given a unique laboratory code and an analytical request form is generated. The laboratory code consists of an order number and submission number. Each sample is given an order number by the LIMS system based upon the order of log-in. A submission number is assigned to a particular job in the same manner. The submission number is coded with the lab location and year as follows:

e.g. Submission No. R28001784 = R - Rochester
28 - Year 2008
001784 - Job Number (sequential number of jobs logged)

The analytical request contains client information, sample descriptions, sample matrix information, required analyses, sample collection dates, analysis due dates and other pertinent information. This analytical request is reviewed by the appropriate Project Manager for accuracy, completeness, consistency of requested analyses and for client project objectives and COC.

Each container received by the lab receives a unique barcode which is scanned by those handling the sample for storage, analysis, or disposal. The sample tracking information from the scan is put in a database which can create a complete Internal Chain of Custody for each sample container. This information is reported in package reports only.

Storage and Disposal:

All samples, except those designated for metals analyses, are kept in a refrigerated condition (0 to 6°C) until they undergo analysis. Samples are stored in one of three walk-in refrigerators, segregated by method of analysis. The volatiles refrigerator is designated for samples for volatiles analysis. Samples for semivolatile analysis share a refrigerator with samples for metals analysis. Samples for general chemistry analysis share a cooler with the Sample Management group. Sample extracts are stored in their own refrigerators or freezers within their own department. The temperature of each temperature controlled storage facility used at CAS is monitored daily and the data recorded in a logbook according to ADM-DALYCK.

Most aqueous and soil samples are retained at 0-6°C in refrigerators for at least 30 days from receipt (unless other arrangements have been made in advance). Sample are required to be held for at least 60 days for CLP/ASP package work. Samples removed from the refrigerators are moved to an ambient temperature storage room and stored for at least 30 more days. Upon expiration of these time limits, the samples are either returned to the client or disposed of according to approved disposal practices. All samples are characterized according to hazardous/non-hazardous waste criteria and are segregated accordingly. All hazardous waste samples are disposed of according to formal procedures outlined in the Sample Disposal SOP

(SMO-SPLDIS). It should be noted that all waste produced at the laboratory, including the laboratory's own various hazardous waste streams, is treated in accordance with all applicable local and Federal laws. The bar coding system used to track samples through the lab, including disposal, produces cradle to grave sample history for each sample aliquot.

Figure 8-1

Cooler Receipt And Preservation Check Form

Project/Client_____Submission Number_____.

Cooler received on_____ by:_____**COURIER:** CAS UPS FEDEX VELOCITY CLIENT

1.	Were custody seals on outside of cooler?			YES	NO	
2.	Were custody papers properly filled out (ink, signed, etc.)?			YES	NO	
3.	Did all bottles arrive in good condition (unbroken)?			YES	NO	
4.	Did any VOA vials have significant* air bubbles?			YES	NO	N/A
5.	Were **Ice** or **Ice packs** present?			YES	NO	
6.	Where did the bottles originate?			CAS/ROC,	CLIENT	
7.	Temperature of cooler(s) upon receipt:	_____	_____	_____	_____	_____
	Is the temperature within 0° - 6° C?:	Yes	Yes	Yes	Yes	Yes
	If No, Explain Below	No	No	No	No	No

Date/Time Temperatures Taken: _____

Thermometer ID: 161 / IR GUN#2 / IR GUN#3 Reading From: Temp Blank / Sample Bottle

If out of Temperature, note packing/ice condition, Client Approval to Run Samples:_____
PC Secondary Review: _____

Cooler Breakdown: Date :_____by:_____

1.	Were all bottle labels complete (*i.e.* analysis, preservation, etc.)?	YES	NO	
2.	Did all bottle labels and tags agree with custody papers?	YES	NO	
3.	Were correct containers used for the tests indicated?	YES	NO	
4.	Air Samples: Cassettes / Tubes Intact	Canisters Pressurized	Tedlar® Bags Inflated	N/A

Explain any discrepancies: _____

pH	Reagent	YES	NO	Lot Received	Exp	Sample ID	Vol. Added	Lot Added	Final pH
≥12	NaOH								
≤2	HNO_3								
≤2	H_2SO_4								
Residual Chlorine (-)	For TCN and Phenol			If present, contact PM to add ascorbic acid					
	$Na_2S_2O_3$	-	-						
	Zn Aceta	-	-						
	HCl	*	*						

*Not to be tested before analysis – pH tested and recorded by VOAs or GenChem on a separate worksheet

Yes = All samples OK

No = Samples were preserved at lab as listed

PM OK to Adjust: _____

Bottle lot numbers:_____
Other Comments:

PC Secondary Review: _____ *significant air bubbles are greater than 5-6 mm

9.0 QUALITY CONTROL OBJECTIVES (PRECISION, ACCURACY, SENSITIVITY, AND COMPLETENESS)

A primary focus of Columbia Analytical Services Quality Assurance (QA) Program is to ensure the accuracy, precision and comparability of all analytical results. CAS has established Quality Control (QC) objectives for precision and accuracy that are used to determine the acceptability of the data that is generated in its laboratories. These QC limits are either specified in the methodology or are statistically derived and are based on the laboratory's actual historical data obtained from control-charting the various QC measurements for each analytical method. The Quality Control objectives are defined below and the acceptable numeric values are shown in the table in Appendix C. The actual types of QC samples required for analysis is discussed in the specific analytical SOP.

9.1 Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of standard reference materials, standard solutions and laboratory-fortified blanks. In addition, laboratory-fortified (i.e. matrix-spiked) samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery (% REC) of the measured value, relative to the true or expected value. The acceptance limits for accuracy (shown in the table in Appendix C) originate from two different sources: Where acceptance limits are defined and stated in the individual methods, CAS has adopted the limits without modification. If no acceptance limits are given in a method, CAS adopts the limits derived from control charts that are generated for each appropriate method. These control charts are updated once a year for the appropriate Surrogate, Laboratory Control Sample, and Matrix Spike compounds.

$$\text{Accuracy (\%REC)} = \frac{A - B}{C} \times 100$$

Where A = Analyte total concentration from spiked sample
B = Analyte concentration from unspiked sample
C = Concentration of spike added

9.2 Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling and in laboratory analysis.

Precision is measured through the use of replicate sample analyses within the same batch and is expressed as the relative percent difference (RPD) between the replicate measurements.

$$RPD = \frac{D1 - D2}{(D1+D2)/2} \times 100$$

Where D1 = Original Result
D2 = Duplicate Result

9.3 Practical Quantitation Limits

The PQLs used at CAS are the routinely reported lower limits of quantitation which take into account day-to-day fluctuations in instrument sensitivity as well as other factors. These PQLs are the levels to which CAS routinely reports results in order to minimize false positive or false negative results. The PQL is normally two to ten times the method detection limit (MDL), which is determined by a procedure outlined in 40 CFR 136, Appendix B. MDLs for analytical methods routinely performed at CAS are determined annually.

9.4 Completeness

Completeness is a measure of the amount of valid data that is obtained, compared to the amount that is expected. It is expected that all analyses conducted in accordance with the approved analytical methods and standard laboratory operating procedures will meet QC acceptance criteria for 95% if the samples tested, however, the CAS objective for completeness is 100%.

$$\text{Completeness (\%)} = \frac{\text{valid data obtained}}{\text{total data planned}} \times 100$$

9.5 Representativeness

Representativeness is the degree to which a samples aliquot that is analyzed gives results identical to analysis of the whole. CAS has sample handling protocols to ensure that the sample given to the laboratory for analysis is thoroughly homogenized before the aliquot for analysis is removed. See SOP SMO-SPLPREP. Further, analytical SOPs specify appropriate sample sizes to further ensure the sample aliquot that is analyzed is representative of the whole.

9.6 Comparability

Comparability expresses the confidence with which one data set can be compared to another. To ensure comparability, SOPs are used for the preservation, handling, and analysis of all samples. Data is reported in units specified by the customer.

10.0 QUALITY CONTROL PROCEDURES

The specific types, frequencies, and processes for quality control sample analysis are described in detail in method-specific standard operating procedures. These sample types and frequencies have been adopted for each method and a definition of each type of QC sample is provided below. In addition, a number of other quality control processes which may impact analytical results are also described below.

10.1 Modified Procedures

CAS strives to perform published methods as described in the referenced documents. If there is a material deviation from the published method, the method is cited as a "Modified" method in the analytical report. Standard operating procedures are available to analysts and are also available to our clients for review. If the modification is such that the method becomes "Performance Based," client approval is obtained for the use of the method prior to the performance of the analysis.

10.2 Review of Requests, Tenders and Contracts (Procedures for Accepting New Work)

Requests for new work must be reviewed prior to signing any contracts or otherwise agreeing to perform the work. The specific methods to be used must be agreed upon between the laboratory and the client. A capability review is to be performed to determine if the laboratory has or needs to obtain certification to perform the work, and to determine if the laboratory has the resources (personnel, equipment, materials, capacity) to perform the work. The laboratory must inform the client of the results of this review if it indicates any potential conflict, deficiency, lack of appropriate accreditation status, or inability on the laboratory's part to complete the client's work. Any differences between the request or tender and the contract shall be resolved before any work commences. The client should be notified at this time if work is expected to be subcontracted. Each contract shall be acceptable both to the laboratory and the client. Records shall be maintained of pertinent discussions with a client relating to the client's requirements or the results of the work.

Due to the increase in analytes used in the industry and found in the environment, analytes are requested to be analyzed using existing methodologies and/or new methodologies. These requests must be reviewed prior to accepting new work and creating new methodologies. These requests typically include:

1. The addition of analytes to an existing scan.
2. Complete start-up of an established method.
3. Analyte(s) requested with no established method.
4. Specific Confidentiality requests

The addition of analytes to an existing scan.
The analytical method is reviewed to determine if its use is appropriate for the new analyte. The standards are purchased from a commercial vendor and prepared. If the analyte is available from more than one source, a second source is purchased and used to verify the calibration standard. A reference is spiked with a mid-level concentration of the appropriate standard and analyzed to determine retention time, resolution, etc. Temperature programs and instrument conditions may be modified to optimize resolution for the analyte. If the analyte may be resolved and detected by the method, an MDL study is performed to determine a detection limit suitable for the analyte. The in-house SOP may be written or modified to include the analyte. A demonstration of capability is performed for the analyte.

Complete start-up of an established method
The method is obtained and reviewed by the analyst, technical manager, and/or supervisor to determine if the instrumentation and reagents needed by the method are available. If the required instrumentation is available, then reagents, standards, equipment, and supplies are gathered and purchased. If the analyte(s) are available from more than one source, a second source is purchased and used to verify the calibration source. A qualified analyst performs the method, elution times are determined, temperature programs are optimized, and batch QC is performed to monitor accuracy and precision. An MDL study is performed per instrument to determine detection limit(s) and each analyst performing the method must complete an Initial Demonstration of Capability (IDOC) study. An SOP is written by a qualified analyst and the QAPM. The method, which allows for the acceptable precision and accuracy, shall be used. Proficiency testing should be used, if available, to verify the laboratory's procedures.

Analyte(s) requested with no established method.
The analyte to be analyzed is researched and reviewed by the technical manager for chemical nature, formula, and other related information. The Merck Index and CRC Handbook are reviewed for boiling point, vapor pressure to determine the type of compound. After determining the type of compound, it is assumed that it can be analyzed by an existing method. If not, a modification of an existing method or the creation of a new method may be tried. Differing approaches to testing the analyte may be tried, comparing the efficiency of the various approaches. Follow procedures outlined above. Precision and accuracy should be documented using the MDL and DOC studies where applicable.

Specific confidentiality requests
Investigate the confidentiality requests of the client. The client may have specific requests regarding the release of the report/data, the retention of the samples and the data, and the disposal of the samples.

Method Performance
Reporting limits are based upon an MDL study performed according to ADM-MDL. At Columbia Analytical Services, the MDL is equal to the limit of detection (LOD) which is used to determine the limit of quantitation (LOQ). See SOP, ADM-MDL.

10.3 Analytical Batch

The basic unit for analytical quality control is the analytical batch. In an analytical batch, all the samples, both field samples and quality control samples, are to be handled and processed in exactly the same way. All of the data from each analysis is to be manipulated in exactly the same manner.

The minimum requirements of an analytical batch are:

1. The number of field samples in a batch is not to exceed 20.

2. All field samples in a batch are of the same matrix.

3. The QC samples to be processed with the field samples include:
   - Method Blank - to determine possible laboratory contamination.
   - Laboratory Control Sample - to assess method performance.
   - Matrix Spike (field sample) - to assess possible matrix problems.
   - Duplicate Matrix Spike or Duplicate (field) Sample - to assess batch precision and possible matrix problems.

4. A single lot of reagents is used to process the batch of samples.

5. Refer to SOP, *Analytical Batches and Sequences* (ADM-BCHSQ), for additional batching requirements. Specific project, program or method requirements may create exceptions. The more stringent QC requirements shall be followed in most all cases.

10.4 Method Blank

The method blank is either analyte-free water or analyte-free soil (when available), subjected to the entire analytical process. When analyte-free soil is not available, anhydrous sodium sulfate, organic-free sand, or an acceptable substitute may be used instead. The method blank is analyzed to demonstrate that the analytical system itself is not contaminated with the analyte(s) being measured. The method blank results should be below the reporting limit for the analyte(s) being tested. A method blank is included with the analysis of every analytical batch, every 20 samples, or as stated in the SOP, whichever is more frequent.

10.5 Calibration Blanks

Calibration blanks are prepared along with calibration standards. Calibration blanks are free of the analyte of interest, and provide the zero point of the calibration curve.

10.6 Continuing Calibration Blanks

Continuing calibration blanks (CCBs) are solutions of either analyte-free water or solvent that are analyzed in order to verify the zero point of the analytical system. The frequency of CCB analysis is either once every ten samples or as indicated in the method, whichever is greater.

10.7 Calibration Standards

Calibration standards are solutions of known concentration prepared from primary standard solutions which are, in turn, prepared from stock standard materials. Calibration standards are used to calibrate the instrument response with respect to analyte concentration. Standards are analyzed in accordance with the requirements stated in the particular method being used.

10.8 Initial (or Independent) Calibration Verification Standards

Initial (or independent) calibration verification standards (ICVs) are standards that are analyzed *after* calibration but *prior to* sample analysis, in order to verify the calibration of the analytical system. They are prepared from materials obtained from a source independent of that used for preparing the calibration standards. ICVs are also analyzed in accordance with method-specific requirements.

10.9 Continuing Calibration Verification Standards

Continuing calibration verification standards (CCVs) are midrange standards that are analyzed in order to verify that the calibration of the analytical system is still acceptable. The frequency of CCV analysis is either once every ten samples, or as indicated in the method, whichever is greater.

10.10 Internal Standards

Internal standards consist of known amounts of specific compounds that are added to each sample following sample preparation or extraction. Internal standards are generally used for GC/MS and ICP-MS procedures to correct sample results that have been affected by changes in instrument conditions or changes caused by certain matrix effects. The integrated area of the internal standard compared to the continuing calibration check standard should vary by no more than the limits specified in each method.

10.11 Surrogates

Surrogates are organic compounds which are similar in chemical composition and chromatographic behavior to the analytes of interest, but which are not normally found in environmental samples. Depending on the analytical method, one or more of these compounds is added to method blanks, calibration and check standards, and samples (including duplicates, matrix spike samples, duplicate matrix spike samples and laboratory control samples) prior to extraction and analysis in order to monitor the method performance on each sample. The percent recovery is calculated for each surrogate, and the recovery is a measurement of the overall method performance. The acceptance criteria for these various analytes are listed in Appendix C, along with other data quality capabilities.

10.12 Matrix Spikes

Matrix spiked samples are aliquots of samples to which a known amount of the target analyte (or analytes) has been added. The samples are then prepared and analyzed in the same analytical batch, and in exactly the same manner as are routine samples. The spike recovery measures the effects of interferences caused by the sample matrix and reflects the accuracy of the method for the particular matrix in question. Spike recoveries are calculated as discussed in Section 9.1.

For the appropriate methods, matrix spiked samples are prepared and analyzed at a minimum frequency of one spiked sample (and one duplicate spiked sample, if appropriate) per twenty samples. Control limits are summarized in Appendix C.

Note: A sample identified as a field blank, equipment blank, or trip blank is <u>not</u> to be matrix spiked.

10.13 Laboratory Duplicates and Duplicate Matrix Spikes

Duplicates are additional replicates of samples that are subjected to the same preparation and analytical scheme as the original sample. Depending on the method of analysis, either a duplicate analysis (and/or a matrix spiked sample) or a matrix spiked sample and matrix spike duplicate sample (MS/MSD) are analyzed. The relative percent difference between duplicate analyses or between an MS and MSD is a measure of the precision for a given method and analytical batch. The relative percent difference (RPD) for these analyses is calculated as discussed in Section 9.2.

Depending on the method of analysis, either duplicate and/or matrix spike duplicate analyses are performed at a minimum frequency of one set per 20 samples. Control limits are summarized in Appendix C.

Note: A sample identified as a field blank, equipment blank, or trip blank is <u>not</u> to be duplicated.

10.14 Laboratory Control Samples

The laboratory control sample (LCS) is an aliquot of analyte-free water or analyte-free soil (or anhydrous sodium sulfate or equivalent) to which known amounts of the method analyte(s) is(are) added. A standard reference material (SRM) of known matrix type, containing certified amounts of target analytes, may also be used as an LCS. The LCS sample is prepared and analyzed in the same analytical batch, and in exactly the same manner, as the other routine samples. Stock solutions used for LCSs are purchased or prepared independently of calibration standards. The percent recovery (% REC.) of the target analytes in the LCS assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements at the required reporting limit. Comparison of batch-to-batch LCS analyses enables the laboratory to evaluate batch-to-batch precision and accuracy. An LCS is prepared and analyzed at a minimum frequency of one LCS per 20 samples, with every analytical batch or as stated in the method, whichever is more frequent. Acceptance criteria for LCS analyses are summarized in Appendix C.

10.15 Interference Check Samples

An interference check sample (ICS) is a solution containing both interfering and analyte elements of known concentration that can be analyzed to verify background and interelement correction factors in metals analyses. The ICS is prepared to contain known concentrations of interfering elements that will provide an adequate test of the correction factors. The ICS is spiked with the elements of interest at concentrations of approximately ten times the instrument detection limits. The ICS is analyzed at the beginning and end of an analytical run or every eight hours, whichever is more frequent, and the results must be within ± 20% of the true values.

10.16 Post Digestion Spikes

Post digestion spikes are samples prepared for metals analyses that have an analyte spike added to determine if matrix effects may be a factor in the results. The spike addition should produce a method-specified minimum concentration above the instrument detection limit. A post digestion spike is analyzed with each batch of samples and recovery criteria are specified for each method.

10.17 Source and Preparation of Standard Reference Materials

CAS relies on a primary vendor for the majority of its analytical supplies. Consumable primary stock standards are obtained from certified commercial sources All reference materials that are received at CAS are recorded by the technical staff in the appropriate notebook(s) and are stored under conditions that provide maximum protection against deterioration and contamination. The notebook entry includes such information as an assigned logbook identification code, the source of the material (i.e. vendor identification), solvent (if applicable) and concentration of analyte(s), reference to the certificate of analysis and an assigned expiration date. In addition, the date that the standard is received in the laboratory is marked on the container.

Stock solutions and/or calibration standard solutions are prepared fresh as often as necessary according to their stability. After preparation, all standard solutions are properly labeled with standard name, concentration, date, preparer, and expiration date; these entries are also recorded in the appropriate notebook. See SOP*, Making Entries onto Benchsheets and Logbooks* (ADM-DATANTRY). To ensure traceability, all standards are labeled with an in-house code that can be traced back to the original stock standard received by the vendor and thus, the certificate of analysis. Prior to introduction into the analytical system/process, some reference materials are verified for accuracy with a second, independent source of the material. In addition, the independent source of reference material is also used to check the calibration standards for signs of deterioration. All standards, reagents and reference materials shall be stored per analytical SOP requirements to ensure their integrity. Safe handling and transportation of these materials are discussed in the respective analytical SOP and/or Laboratory Safety Manual.

The laboratory produces its own Deionized Water. This water meets the specifications of ASTM Type II water. The conductivity and pH are checked by the laboratory every business day using meters calibrated according to GEN-150.1/9040 and GEN-120.1. Other checks are performed regularly by the subcontracted water system service. These checks are discussed further in ADM-DALYCK. The laboratory may use the results of laboratory method blanks for impromptu checks of TOC, TDS, and chloroform if a problem is suspected. The water in the volatiles department is further purified by a Millipore polishing system.

10.18 Control Charting

The generation of control charts is performed every 6 months. MS, LCS, and Surrogate recoveries are charted to monitor trends. Charts are used to determine new control limits as needed. The Quality Assurance Program Manager compares the newly generated statistical limits to the old and determines whether the new acceptance criteria is to replace the previous criteria. Investigative action may be taken if charts reveal a potential problem with data quality. See SOP for *Determination of Statistical Control Limits* (ADM-CRTL-LIM). Old charts are archived for a period of 5 years.

10.19 Proficiency Testing Participation

Each discipline and test method for most analytes are monitored using A2LA or NELAP approved vendors for Proficiency Testing on a semi-annual basis. Results of the proficiency samples are reviewed by the Laboratory Director, the QAPM, the Corporate QA Director and the laboratory staff. Any problems surfacing during the review are investigated, and corrective action is taken regarding any and all deficiencies.

Proficiency test results are often used to show continued acceptable performance per analyst.

10.20 Glassware Washing

Glassware washing and maintenance play an crucial role in the daily operation of a laboratory. The glassware used at CAS undergoes a rigorous cleansing procedure prior to every usage. Departmental specific glassware washing SOP's (GEN-GC, MET-GC and EXT-GC) have been generated that outline the various procedures used at CAS; each is specific to the end-use of the equipment as well as to the overall analytical requirements of the project.

11.0 CALIBRATION PROCEDURES AND FREQUENCY

All equipment and instruments used at CAS are operated, maintained and calibrated according to the manufacturer's guidelines and recommendations, as well as to criteria set forth in the applicable analytical methodology. Operation and calibration are performed by personnel who have been properly trained in these procedures. Documentation of calibration information is maintained in appropriate reference files. The frequency of calibration and concentration of calibration standards are determined by the manufacturers guidelines, the analytical method, or the requirements of special contracts. See specific analytical SOP's for frequency and criteria. Generally, purchased standards have a shelf life of 12-36 months and prepared standards have a shelf life of 1-12 months. Recalibration is required at anytime that the instrument is not operating correctly or functioning at the proper sensitivity. Brief descriptions of the calibration procedures for our major laboratory equipment and instruments are described below.

11.1 Temperature Control Devices

Temperatures are monitored and recorded for all of our temperature-regulating devices including ovens, incubators and refrigerators. Bound record books are kept which contain recorded temperatures, identification and location of equipment, and the initials of the technician who performed the checks. All thermometers have been identified and the calibration of these thermometers is checked annually (or quarterly for digital devices) against a National Institute of Standards and Technology (NIST) certified thermometer. The ice point of the reference thermometer is verified by the laboratory annually. The reference thermometers are sent out every two years for calibration verification by a thermometer calibration service at the temperatures of use. Calibration records are maintained by the QA PM. Temperatures of controlled devices are recorded daily. Refrigerators and freezers containing samples are monitored continuously with max/min thermometers or circle chart thermometers (See SOP SMO-DALYCK).

11.2 Analytical Balances

Analytical balances are serviced on an annual basis by a professional metrology organization. New certificates of calibration for each balance are issued to the laboratory on an annual basis. The calibration of each analytical balance is checked prior to use with Class-1 verified weights, which assess the accuracy of the balance at the working range. The reference weights are verified annually by the metrology organization. Bound record books are kept which contain the recorded measurements, identification and location of equipment, and the initials of the technician who performed the checks. (See SOP SMO-DALYCK).

11.3 Inductively Coupled Plasma (ICP) and ICP-Mass Spectrometry (ICP-MS)

Each emission line on the ICP is calibrated daily against a blank and three standards. Analyses of calibration standards, initial and continuing calibration verification standards, and inter-element interference check samples are carried out as specified in the applicable Standard Operating Procedures (SOPs) and/or appropriate USEPA method citations (see Section 18 for references).

11.4 Atomic Absorption Spectrophotometers (AAS)

These instruments are calibrated daily using a minimum of four standards and a blank. Calibration is validated using reference standards, and is verified at a minimum frequency of once every ten samples.

11.5 GC/MS Systems

All GC/MS instruments are calibrated at a minimum of five different concentration levels for the analytes of interest or at a number of levels as prescribed by the method (e.g. The 600 numbered methods require a minimum of three levels), using procedures outlined in Standard Operating Procedures (SOPs) and/or appropriate USEPA method citations. All SRMs used for this function are "EPA-Certified." Compounds selected as system performance check compounds (SPCCs) must show a method-specified response factor in order for the calibration to be considered valid. Calibration check compounds (CCCs) must also meet method specifications for percent difference from the multipoint calibration. Method-specific instrument tuning is regularly checked using bromofluorobenzene (BFB) for volatile organic chemical (VOC) analysis, or decafluorotriphenylphosphine (DFTPP) for semi-volatile analysis. Mass spectral peaks for the tuning compounds must conform both in mass numbers and in relative intensity criteria before analyses can proceed.

11.6 Gas Chromatographs

Calibration and standardization follow SOP guidelines and/or appropriate USEPA method citations. Initial calibration standards are prepared at three to five concentration levels for each analyte of interest. The lowest standard is near the method reporting limit; additional standards define the working range of the GC detector. Results are used to establish response factors and retention-time windows for each analyte. Calibration is verified at a minimum frequency of once every ten samples.

11.7 Infrared Analyzer

The instrument is calibrated using a blank and four standards. The calibration is validated at the beginning of each analysis, and continuing calibration is verified at a minimum frequency of once every ten samples.

11.8 UV-Visible Spectrophotometer (manual colorimetric analyses)

Routine calibrations for colorimetric and turbidimetric analyses involve generating a 5-point calibration curve including a blank. Correlation coefficients must meet method or SOP specifications before analysis can proceed. Independent calibration verification standards (ICVs) are analyzed with each batch of samples. Continuing calibration is verified at a minimum frequency of once every ten samples.

11.9 Flow Injection Analyzer (automated colorimetric analysis)

A minimum of five standards and a blank (unless otherwise specified in the applicable SOP) are used to calibrate the instrument daily. Standard CAS acceptance limits are used to evaluate the calibration curve prior to sample analysis. All linear regressions must have a correlation coefficient of 0.995 or better before analysis may proceed.

11.10 Ion Chromatographs

Calibration of the ion chromatograph (IC) involves generating a minimum of a 5-point calibration curve. A correlation coefficient of 0.995 or better for the curve is required before analysis can proceed. Quality Control (QC) samples that are routinely analyzed include blanks and laboratory control samples. The target analytes typically determined by the IC include nitrate, chloride, fluoride, and sulfate.

11.11 Turbidimeter

Calibration of the turbidimeter requires analysis of formazin and polymer standards measured as NTU. Quality Control samples that are routinely analyzed include blanks, and duplicates.

11.12 HPLC

Calibration and standardization follow SOP guidelines and/or appropriate USEPA method citations. Initial calibration standards are prepared with at least five concentration levels for each analyte of interest. Results are used to establish response factors and retention-time windows for each analyte. Calibration is verified at a minimum frequency of once every ten samples.

11.13 Other Instruments

Calibration for the total organic carbon (TOC) and other instruments is performed following manufacturer's recommendations and applicable SOPs.

12.0 DATA REDUCTION, VALIDATION, AND REPORTING

CAS reports the analytical data produced in its laboratories to the client via the certified analytical report. This report typically includes a transmittal letter, a case narrative, client project information, specific test results, quality control data, chain of custody information, and any other project-specific support documentation. The following procedures describe our data reduction, validation and reporting procedures.

12.1 Laboratory Information Management System (LIMS)

CAS/Rochester currently uses StarLIMS v.6.11a throughout the laboratory. This data management and retrieval system is the PC based StarLIMS that runs on a Novell Network. The LIMS is used for sample tracking, sample workload projections, sample result storage, reporting, and invoicing. The system allows you to acquire data from instrumentation and can generate ASCII, spreadsheet, database, and/or print files.
Periodically, historical data is checked on the LIMs for authenticity and ability to recreate data files. These files are reviewed for data integrity and possible corruption. See Software Quality Assurance Plan.

12.2 Data Reduction and Custody

All data is initially reviewed and processed by analysts using appropriate methods (e.g. chromatographic software, instrument printouts, hand calculation, etc.) The resulting data set is either manually entered (e.g. some general chemistry parameters) into the LIMS system or is electronically transferred into LIMS from the software used to process the original data set (e.g. chromatographic software). A file of all raw data is generated and given to the departmental supervisor or other certified analyst for secondary review (see SOP, ADM-DREV). Once the complete data set has been reviewed to be complete and correct by two analysts, the LIMs data is validated against the raw data which allows the data to be available to Project Managers and Report Writers. Upon approval of the data the supervisor relinquishes the raw data file to a Report Writer, who generates a final report from the LIMS system. The resulting final report is then reviewed by the Project Manager for accuracy. Typically, all data is reported in the units and MRLs listed in Appendix C. An estimation of the uncertainty of the measurements is available upon request using the procedures in the CAS SOP ADM-UNCERT. Assessment of the analytical data includes a check on data consistency by looking for comparability of duplicate analyses, comparability of previous data from the same sampling location (if available), adherence to accuracy and precision control limits, and anomalous low or high parameter values. Once the data has been checked for accuracy and acceptability, the final report and raw data is forwarded to the Lab Director or Quality Assurance Project Manager, who further reviews the data package for errors. When the entire data set has been found to be acceptable the report is signed, distributed, and the raw data is filed for approximately one year, then archived.

All hard copy and electronic backups are archived in a secured room for a period of at least 5 years from the date of the final report (as discussed in section 12.6.1). It is not unusual to have various clients require a 10-year retention of records, therefore, the archivist, project manager, and possibly the client are consulted prior to the destruction of the records.

12.3 Confirmation Analysis

12.3.1 Gas Chromatographic Analyses

For gas chromatographic (GC) analyses, most positive results are confirmed by a second column, a second detector, or by GC/MS analysis, unless exempted by one of the following situations:

- The analyte of interest produces a chromatogram containing "pattern" peaks which match appropriate standards. These analytes include polychlorinated biphenyls (PCBs) and hydrocarbon fuels (e.g., gasoline and diesel).

- The sample is analyzed for benzene, toluene, ethylbenzene and xylenes (BTEX), and the sample is found, by a separate analysis, to contain gasoline. In a sample containing no gasoline, the presence of BTEX compounds will be confirmed.

- The sample meets all of the following requirements:

    1. All samples (liquid or solid) come from the same source (e.g., groundwater samples from the same well) for continuous monitoring.

    2. All analytes have been previously analyzed, identified and confirmed by a second column or by GC/MS. The documents indicating previous confirmation must be available for review.

    3. The resulting chromatogram is relatively simple and does not contain complex or overlapping peaks.

    4. The chromatogram is largely unchanged from the one for which confirmation was carried out.

12.3.2 Confirmation Data

Confirmation data will be provided as specified in the method. Details regarding confirmation and acceptance criteria are in SOP, ADM-CONFIRM. Identification criteria for GC or GC/MS methods are summarized below:

- GC Methods – For The analyte must fall within plus or minus three times the standard deviation (SD) of the retention time of the daily midpoint standard in order to be qualitatively identified. The retention-time windows will be established and documented, as specified in the appropriate Standard Operating Procedure (SOP).

- GC/MS Methods - Two criteria are used to verify identification:

    1. Elution of the analyte in the sample will occur at the same relative retention time (RRT) as that of the analyte in the standard.

2. The mass spectrum of the analyte in the sample must, in the opinion of a qualified analyst or the department manager, correspond to the spectrum of the analyte in the standard or the current GC/MS reference library.

12.4 Data Validation

The integrity of the data generated in the laboratory is primarily assessed by the analyst, supervisor and project manager through the use of a variety of measures that may include reagent blanks, laboratory fortified blanks, duplicates, matrix spikes and QC samples. The numerical criteria for evaluation of these QC samples are listed in Appendix C; these various QC sample analyses are evaluated using the flow diagrams found in Figures 12-1 through 12-9. Other validation measures of the data include a check of the linearity of the calibration curve, an accuracy check of the QC standards and a check of the system sensitivity. Data transcriptions and calculations are also reviewed. Specific calculations used for determining the concentration or value of the measured parameters from the raw data are given in each of the analytical methods or CAS SOPs.
The QA department performs in-depth periodic monitoring of the data integrity program using data validation and electronic data audits (see ADM-IAUD and ADM-E DATA).

12.5 Data Reporting

When an analyst determines that the data has met the data quality objectives (and/or any client-specific data quality objectives) of the method and has qualified any anomalies in a clear, acceptable fashion, the data is validated by the supervisor. Validated data is reported from LIMS by report writers using specialized forms created by LIMS (see SOP, ADM-RG). Prior to release of the report to the client, the project manager must also review the entire body of data for completeness and to ensure that any and all client-specified objectives were successfully achieved. If required, samples exceeding any established state/federal maximum contaminant level or reportable concentration level, must be reported to the client. A case narrative may be written by the project manager to explain any unusual problems with a specific analysis or sample, client-specific objectives, exceedences, etc... The original raw data, along with a copy of the final report, is filed for archiving. CAS maintains control of analytical results by adhering to standard operating procedures and by observing sample custody requirements. All data are calculated and reported in units consistent with project specifications, to enable easy comparison of data from report to report. Typical qualifiers used to flag analytical results are listed in Appendix D.

12.6 Document Control

A document control system ensures that all documents are accounted for when the project is complete. A submission number is assign to each project for reporting and filing purposes. This number is associated with each order number (sample).

12.6.1 Documentation and Archiving of Routine Analysis Data

The archiving system includes all of the following items for each set of analyses performed:

- Benchsheets describing sample preparation (if appropriate)
- Instrument parameters
- Sample analysis sequence
- Analysis benchsheets and instrument printouts

- Chromatograms and peak integration reports for all samples, standards, blanks, spikes and reruns
- Log book ID number for the appropriate standards
- Copies of report submitted to the client

Individual sets of analyses are indexed by analysis date and/or submission number. Since many analyses are performed with computer-based data systems, the final sample concentrations can be automatically calculated. If additional calculations are needed, they are written on the integration report or securely stapled to the chromatogram, if done on a separate sheet. The archive room is a separte file room in which files shall be maintained for a period of at least five years (from date of report issue). It is not unusual to have various clients require a 10-year retention of records, such as NAVY and NYS Drinking Water Programs, therefore the archivist, project manager, and possibly the client are consulted prior to destruction of the records. The archive room is kept locked and access keys are controlled. All documents must be signed out if needed outside of the archive room and returned in a timely manner. A designated archivist monitors filing, incoming, and outgoing data from the archive. See SOP, ADM-ARCH for procedures for data archiving.

In the event that the laboratory transfer's ownership or goes out of business, laboratory records shall be maintained for the contracted period and clients shall be notified prior to early destruction / disposal of samples or data.

All related quality documentation such as the quality manual, standard operating procedures, temperature and balance records, maintenance logs, (see Section 4.2 QAM) etc. are controlled and retained by the laboratory for 5-10 years depending upon the program (See ADM-DOC_CTRL).

12.6.2 Reporting Deliverables

In order to meet individual project needs, CAS provides several levels of analytical reports. Basic specifications for each level of deliverable are described in Table 12-1. Turnaround time and package level are negotiable on a project to project basis.

12.6.3 Electronic Data Deliverables (EDD)

CAS/Rochester offers standard Excel format as well as a variety of custom developed EDDs such as ASCII, dBase, and GISKEY. EDDs are available upon request on a project to project basis.

Figure 12-1
Evaluation of Method Calibration

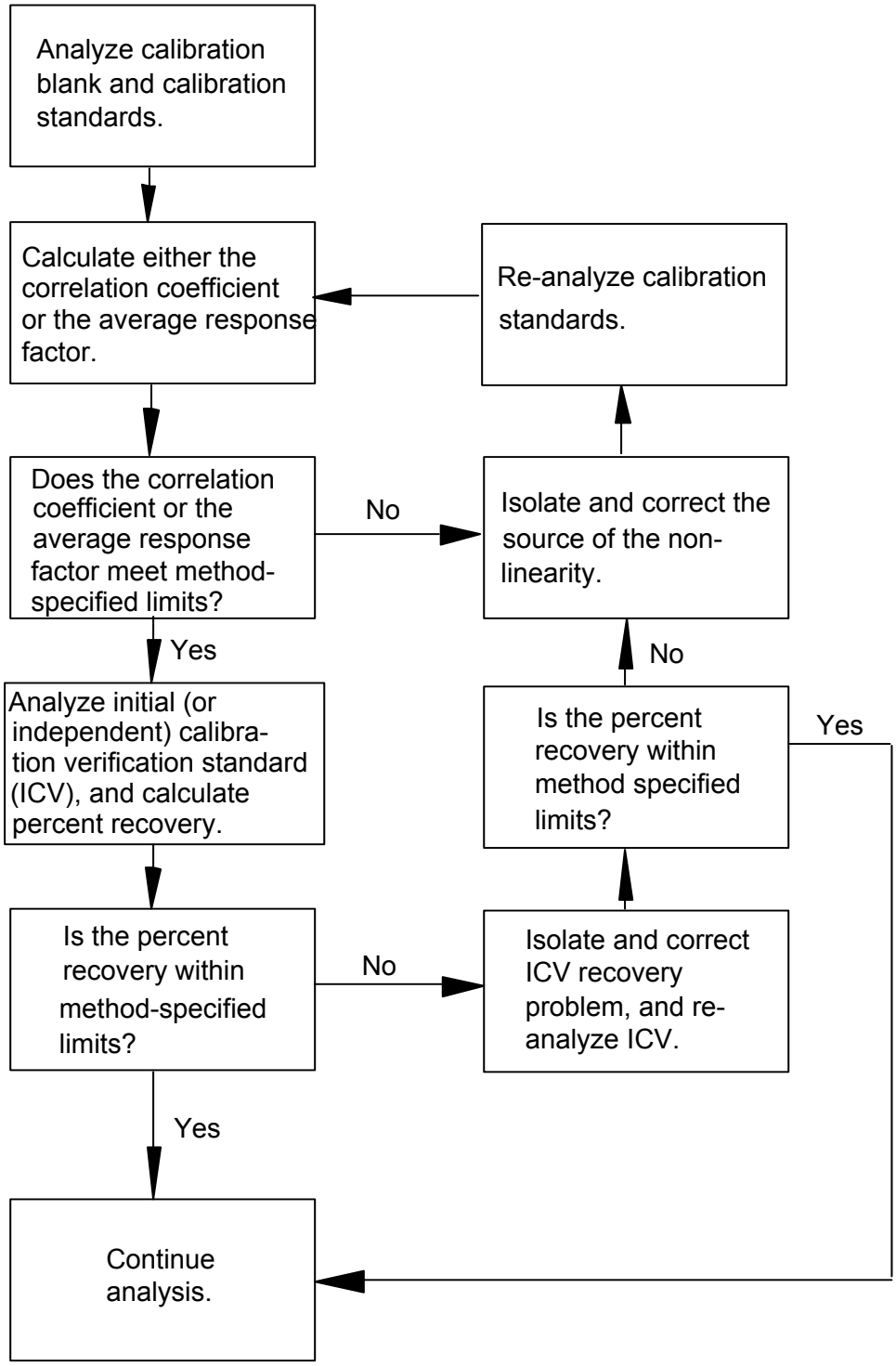


Figure 12-2
Evaluation of Continuing Calibration

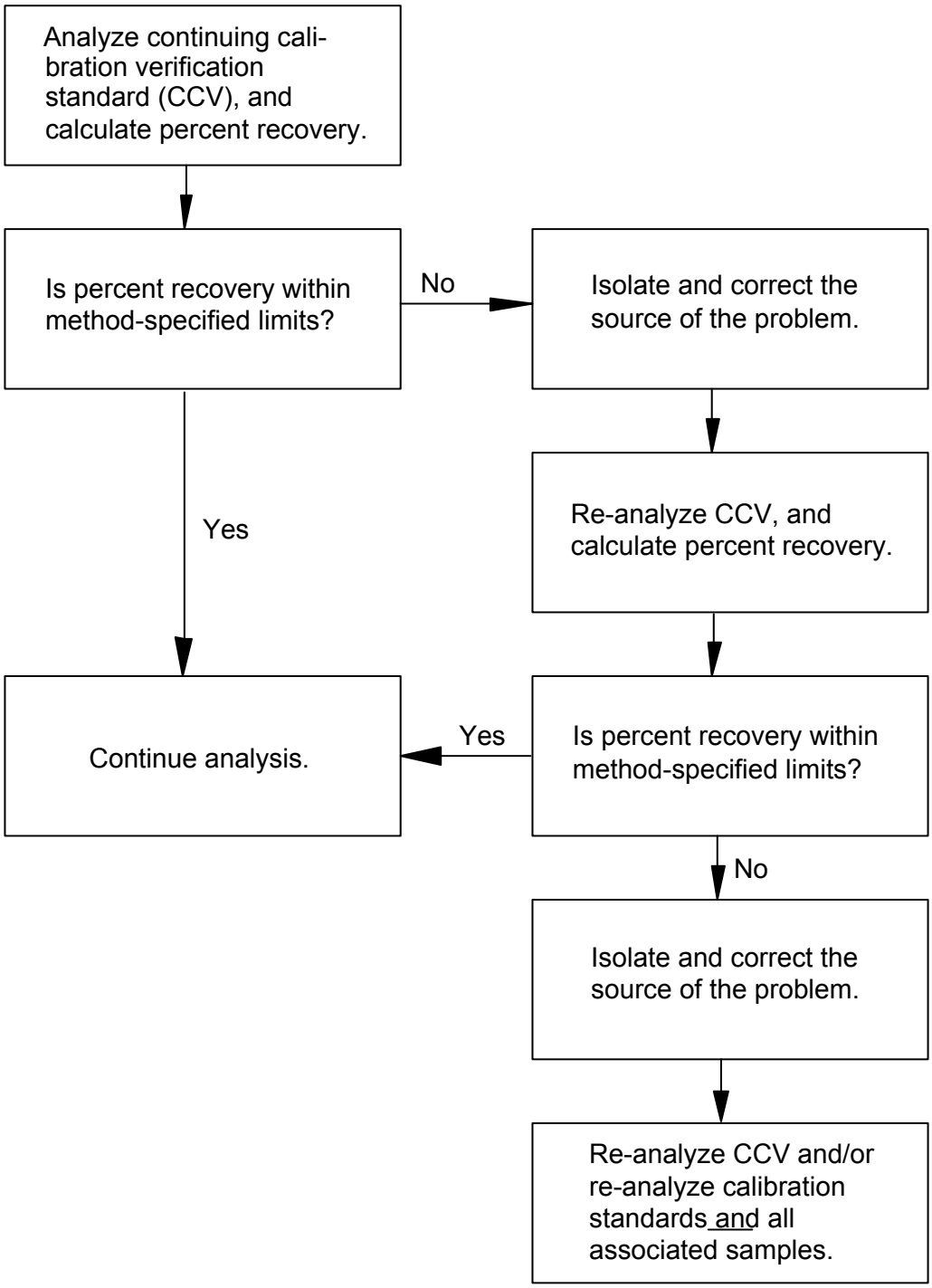


Figure 12-3
Evaluation of Method Blank and Instrument Blank Results

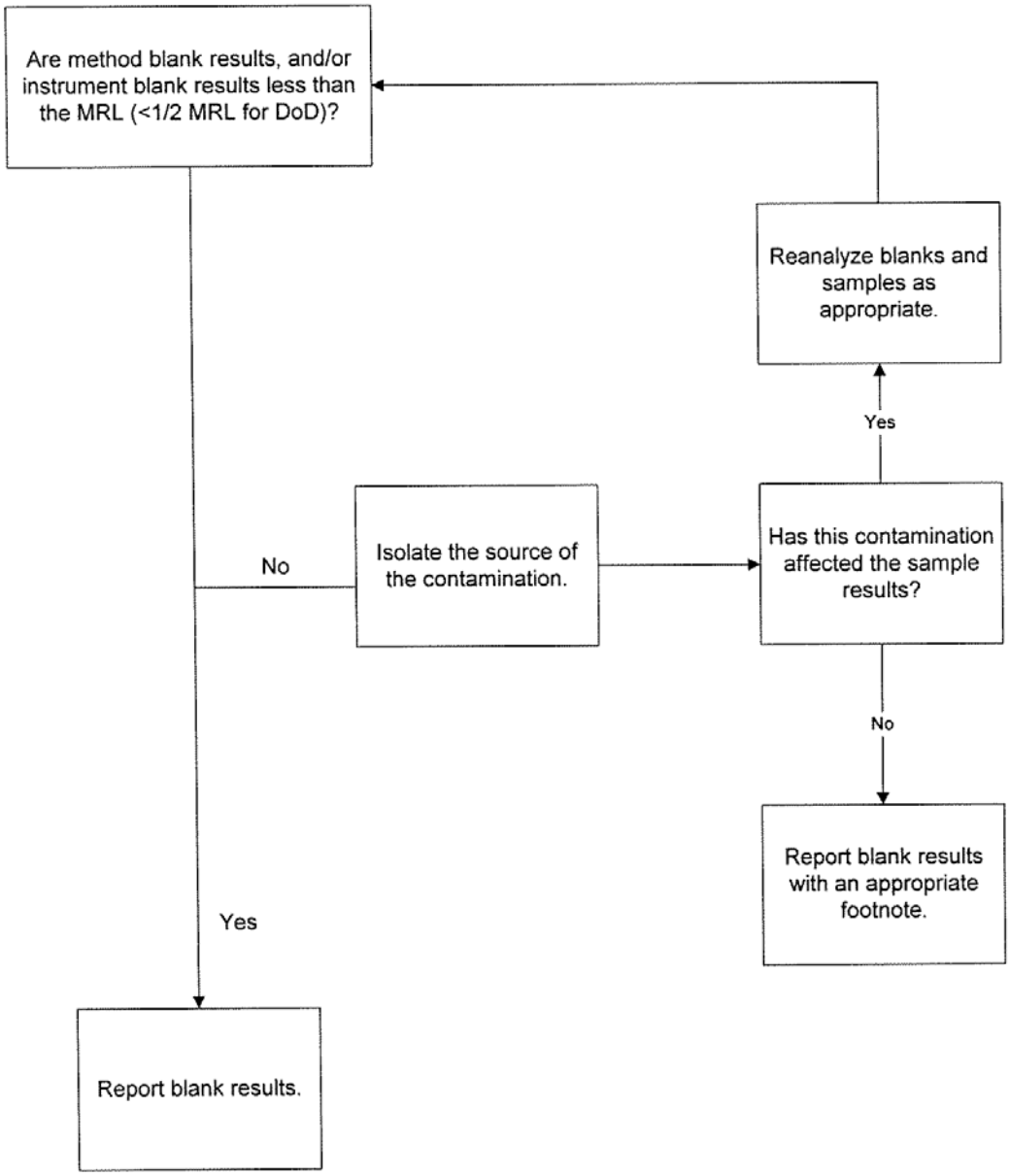


Figure 12-4
Evaluation of Sample Results for Inorganic Analyses

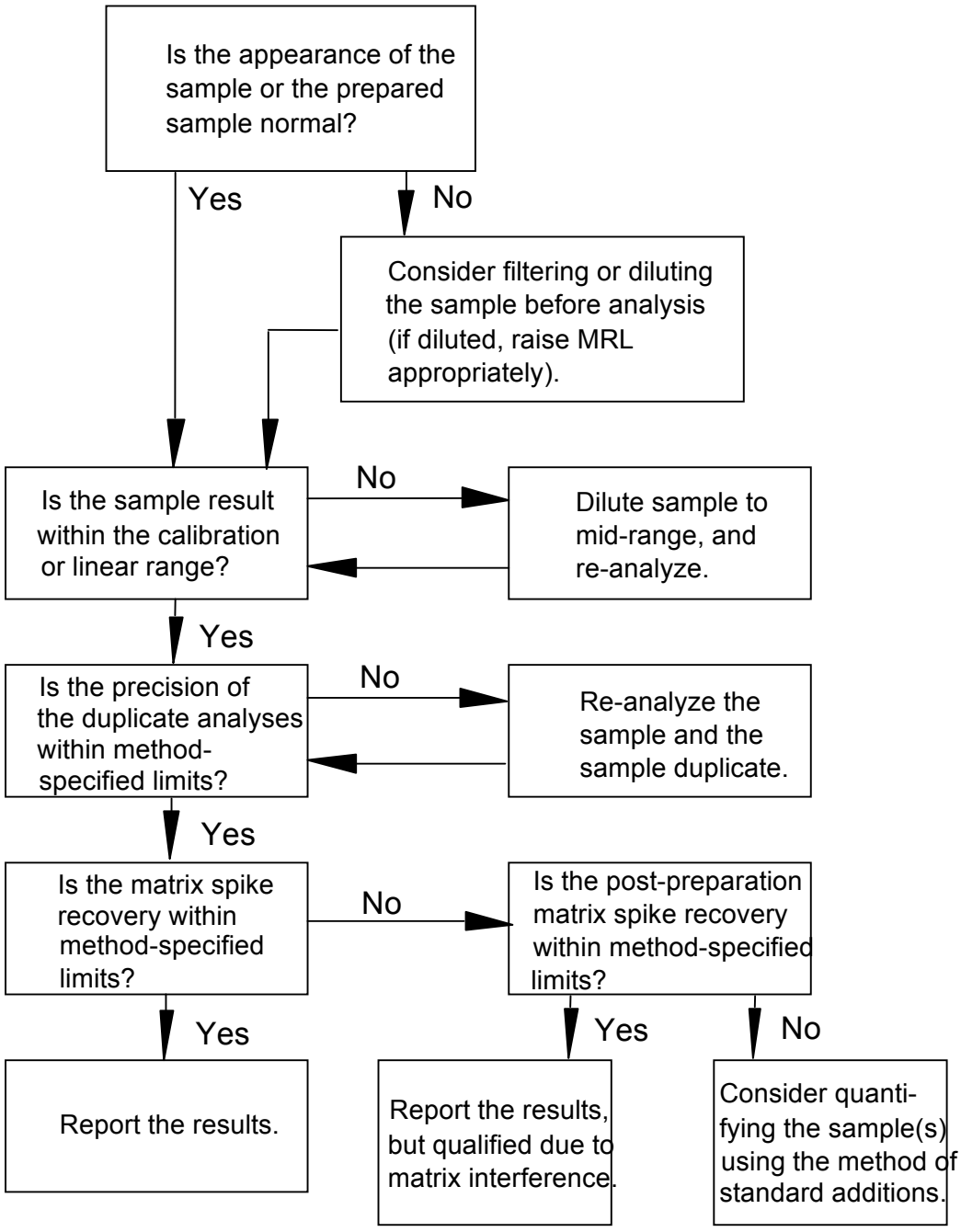


Figure 12-5
Evaluation of Sample Results for Organic Analyses

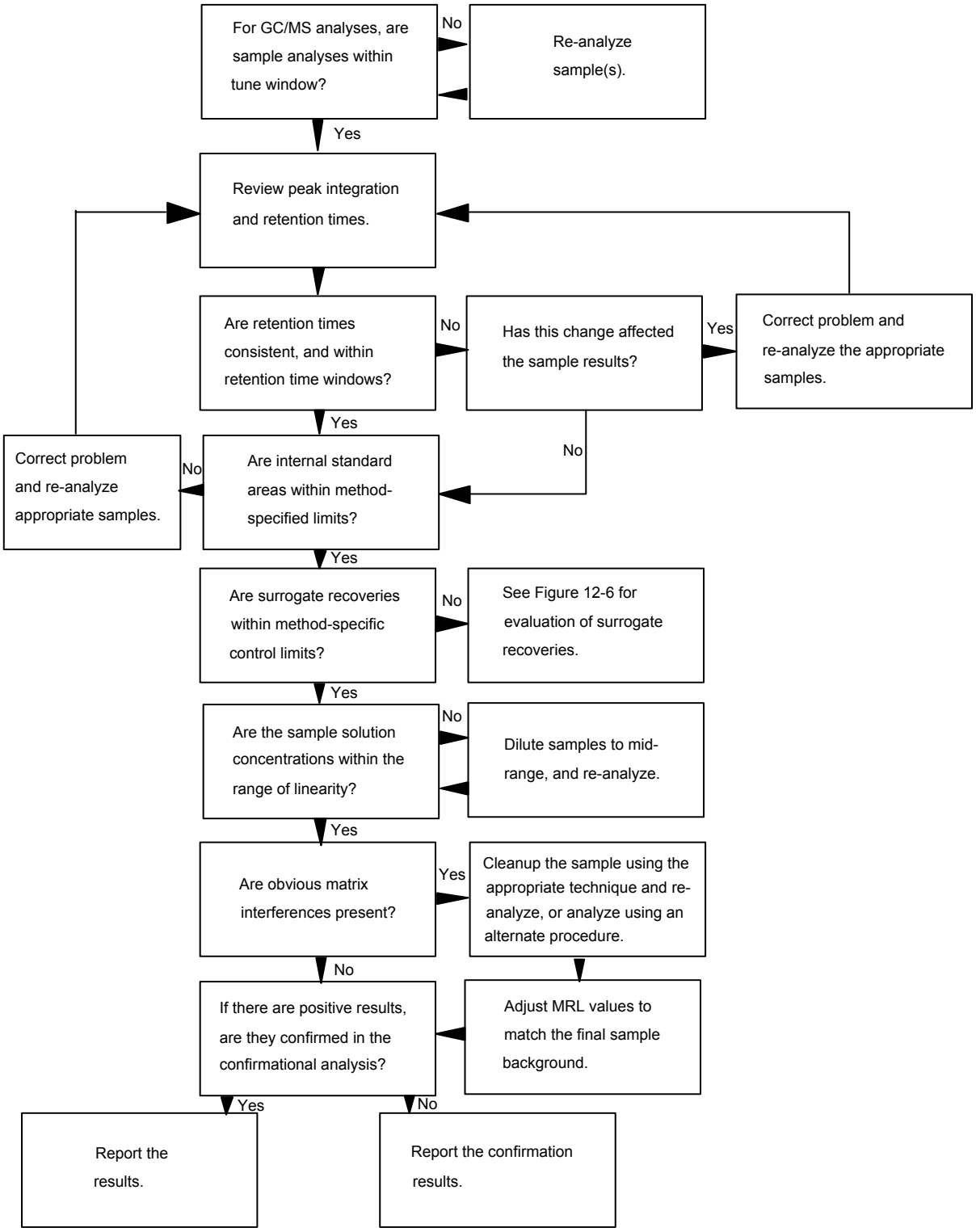


Figure 12-6
Evaluation of Surrogate Compound Recoveries

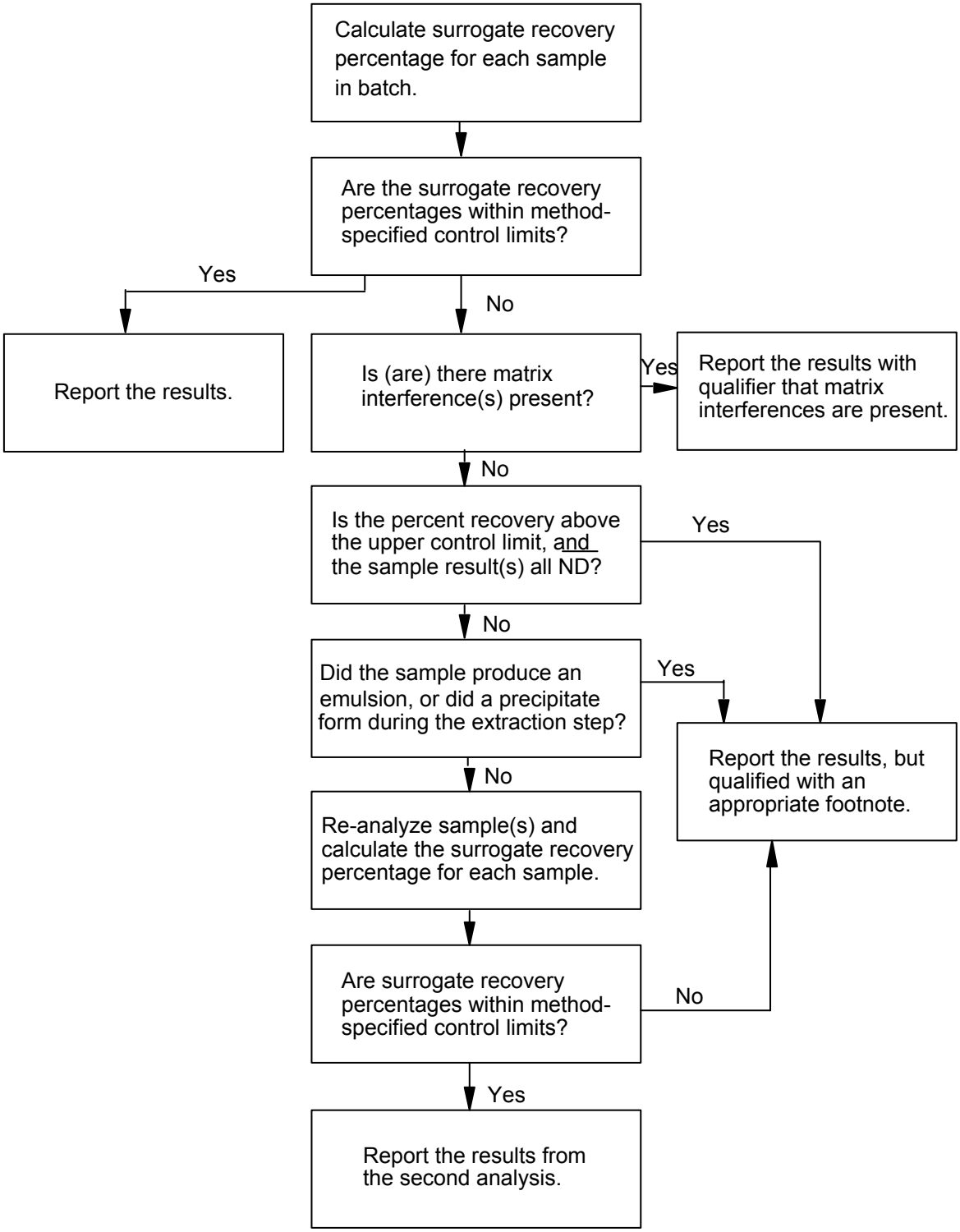


Figure 12-7
Evaluation of Duplicate Sample and/or Duplicate Matrix Spike Results

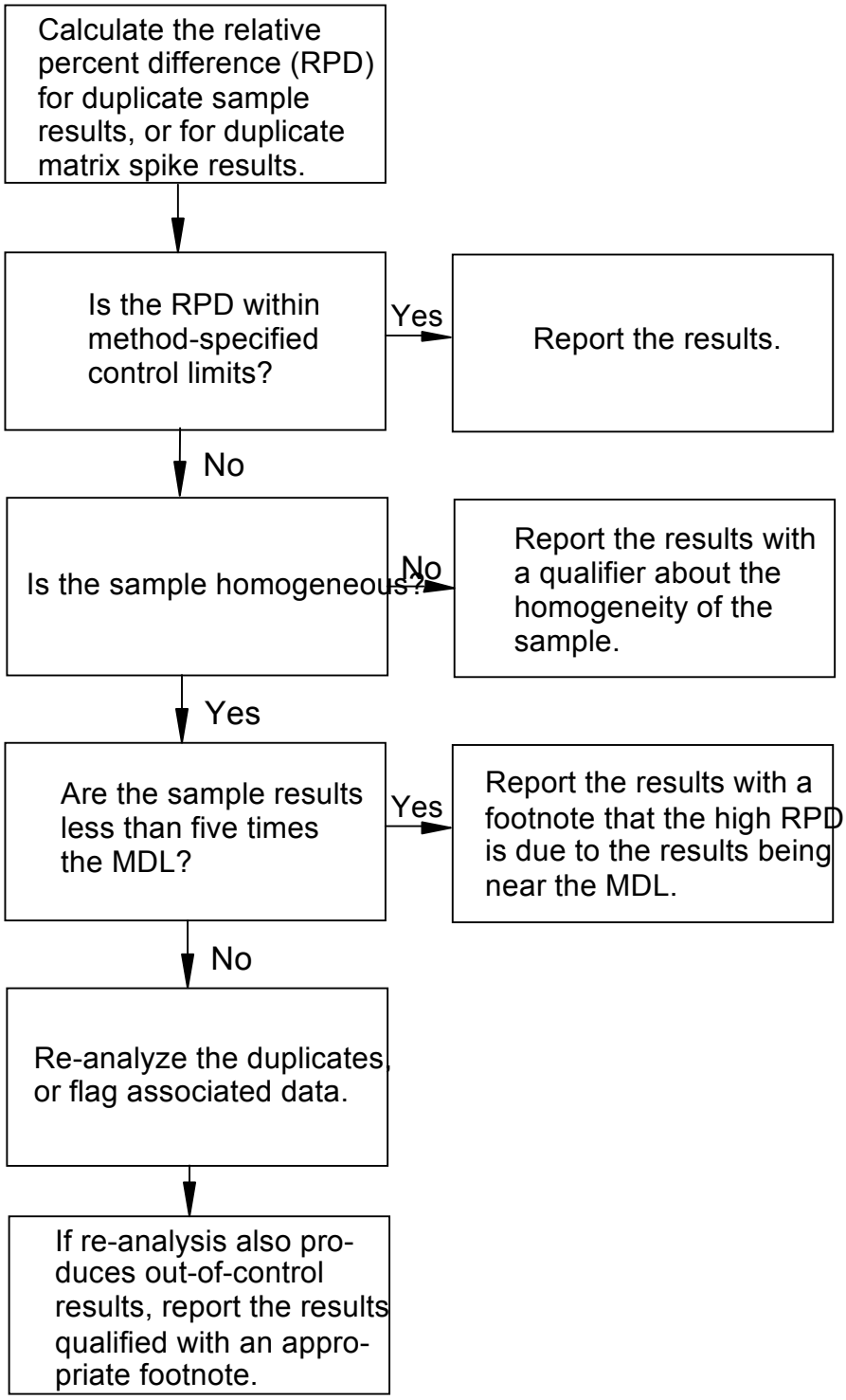


Figure 12-8
Evaluation of Matrix Spike Recoveries

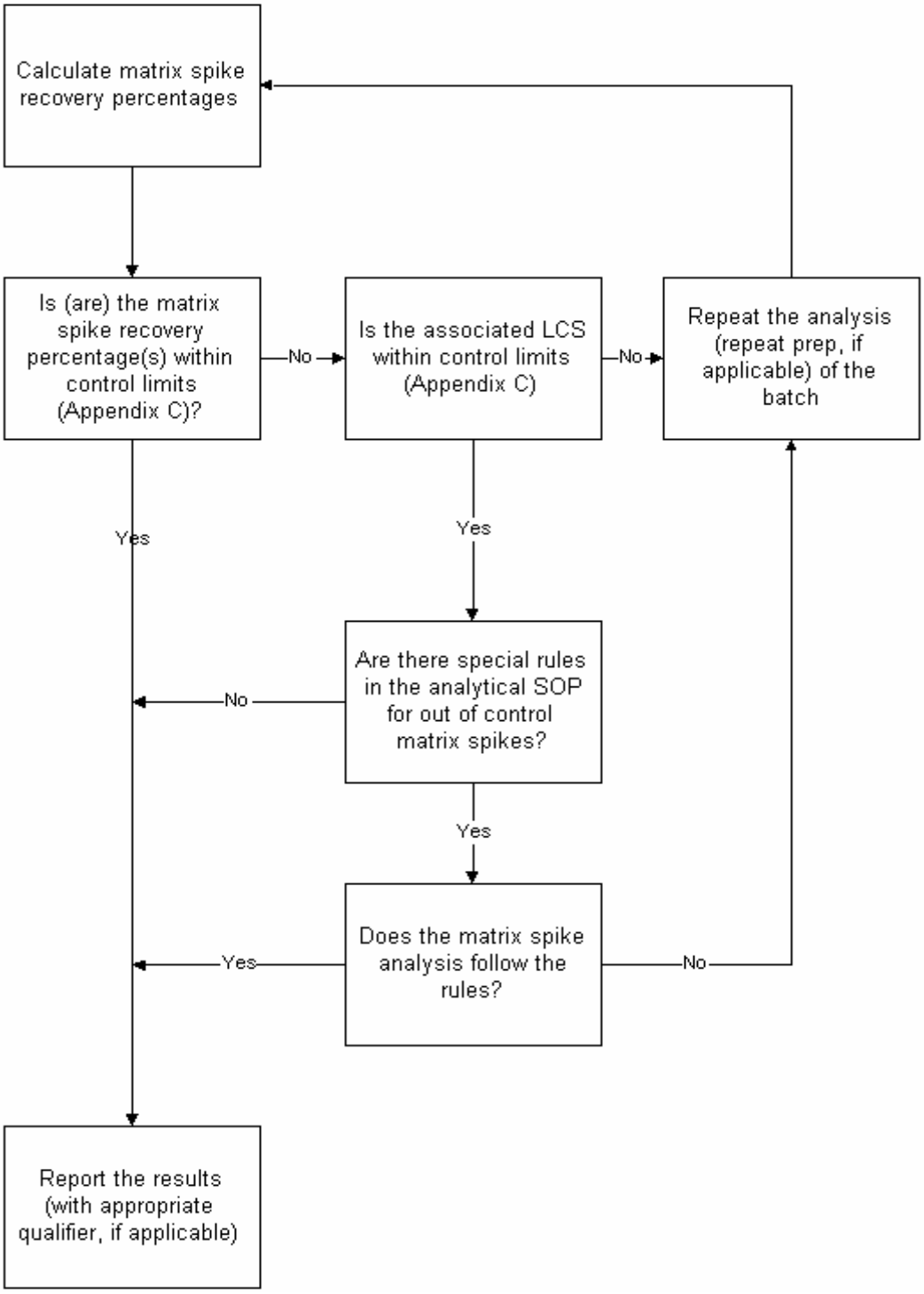


Figure 12-9
Evaluation of Laboratory Control Sample (LCS) Results

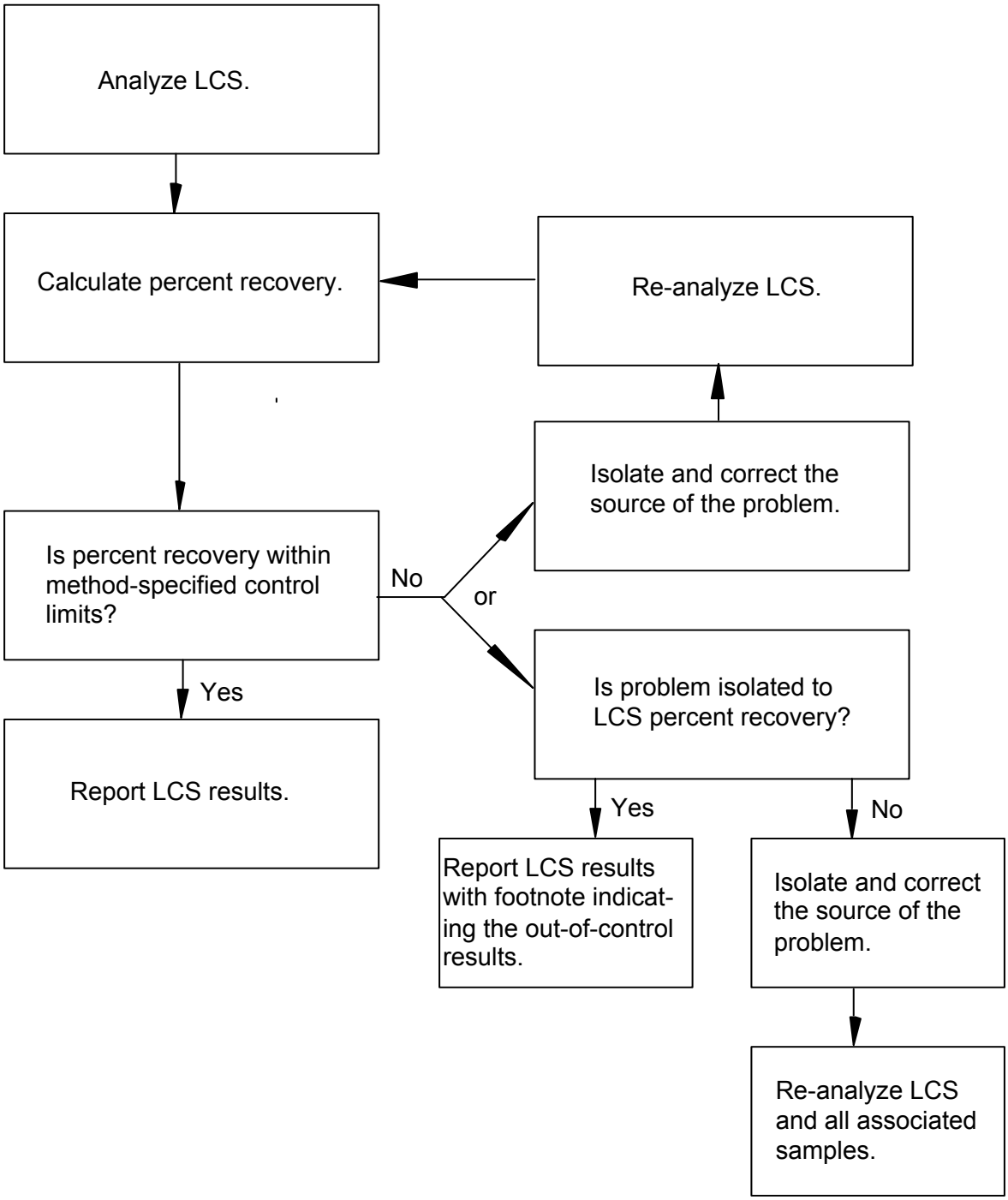


Table 12-1
Laboratory Data Deliverables

Package 1. A Routine Certified Analytical Report Includes the Following

1. Transmittal Letter
2. Sample Analytical Results
3. Method Blank Results
4. Surrogate Recovery Results for appropriate organic methods, including associated EPA or CAS acceptance criteria
5. Chain of Custody Documents

Package 2. In Addition to the Package 1 Deliverables, this Report Includes the Following:

1. Case Narrative

Package 3. In Addition to the Package 2 Deliverables, this Report Includes the Following:

1. Calibration Summaries and Results of initial and continuing calibration verification standards, with calculated recoveries
2. Method Blank Summaries

Package 4. In Addition to the Package 3 Deliverables, this Report Includes the Following:

1. Sample Quantitation Report
2. Standards Prepartation Information

Package 5. Full Data Packages

A complete validatable data package, fulfills all deliverable requirements, as specified in the EPA CLP Statement of Work. The data package may include diskette deliverables, upon request.

13.0 AUDITS AND VERIFICATION PRACTICES

Quality Control (QC) audits are an essential part of CAS's QA program. There are two types of audits used at the facility: System Audits are conducted to qualitatively evaluate the operational details of the field and laboratory QA program, while Performance Audits are conducted by analyzing performance evaluation samples in order to quantitatively evaluate the outputs of the various measurement systems.

The system audit examines the presence and appropriateness of laboratory systems. External system audits of CAS are conducted regularly by various regulatory agencies and clients. Appendix F summarizes some of the major programs in which CAS/Rochester participates. Additionally, internal system audits of CAS/Rochester are conducted regularly by the Quality Assurance Program Manager and by the CAS Quality Assurance Director. The internal system audits are scheduled as four to five auditing events:

- Comprehensive lab-wide system audit - annually
- Audits examining compliance with all QA program requirements as applied to selected projects - 2 per year.

The results of each audit are reported to the Laboratory Director and Supervisors for review and comment. Any deficiencies noted by the auditor are summarized in an audit report and corrective action is taken within a specified length of time to correct each deficiency. Should problems impacting data quality be found during an internal audit, any client whose data is adversely impacted will be given written notification if not already provided. (See SOP ADM-IAUD).

Additionally, CAS/Rochester participates in the analysis of performance evaluation (PE) samples. Results of the performance evaluation samples and audits are reviewed by the Laboratory Director, the QA Program Manager, the Corporate QA Director and the laboratory staff. Any problems surfacing during the audit are investigated, and corrective action is taken regarding any and all deficiencies. See SOP ADM-PTS.

14.0 PREVENTIVE MAINTENANCE

Preventive maintenance is a crucial element of Columbia Analytical Services Quality Assurance program. Instruments at CAS (e.g., GC/MS systems, atomic absorption spectrometers, analytical balances, gas and liquid chromatographs, etc...) are maintained under commercial service contracts or by qualified, in-house personnel. All instruments are operated and maintained according to the instrument operating manuals. All routine and special maintenance activities pertaining to the instruments are recorded in instrument maintenance logbooks. The maintenance logbooks used at CAS contain extensive information about the instruments used at the laboratory.

All preventive maintenance requires a reference to acceptable QC to verify instrument has returned to proper operating functions. An initial demonstration of analytical control is required on **every** instrument used at CAS before sample analyses may proceed. If an instrument is modified or repaired, a return to analytical control is **required** before subsequent sample analyses can continue. When an instrument is acquired at the laboratory, the following information is recommended to be noted in a bound maintenance notebook specifically associated with the new equipment:

- Instrument Name, manufacturer, make, model and type
- The equipment's serial number.
- Date the equipment was received.
- Date the equipment was placed into service.
- Condition of equipment when received (new, used, reconditioned, etc...)
- Prior history of damage, malfunction, modification or repair (if known).

Preventative maintenance procedures, frequencies, etc... are available for each instrument used at CAS. They may be found in the various SOPs for routine methods performed on an instrument and may also be found in the operating or maintenance manuals provided with the equipment at the time of purchase. Responsibility for ensuring that routine maintenance is performed lies with the section supervisor. Each laboratory section maintains a critical parts inventory. The parts inventories include the items needed to perform the preventative maintenance procedures listed in Appendix E. This inventory or "parts list" also includes the items needed to perform any other routine maintenance and certain in-house non-routine repairs.

When performing maintenance on an instrument (whether preventative or otherwise), additional information about the problem, attempted repairs, etc... is also recorded in the notebook. Typical logbook entries include the following information:

- Details and symptoms of the problem
- Repairs and/or maintenance performed
- Description and/or part number of replaced parts
- Source(s) of the replaced parts
- Analyst's signature and date
- Demonstration of return to analytical control

For most major equipment, back-up equipment is available to avoid downtime. All major analytical equipment is summarized in Appendix A. The section supervisor is responsible to coordinate repair with the manufacturer. The project manager shall assess the effect of the downtime on the samples in-house and notify the appropriate clients of any delays and/or the possibilities of subcontracting.

15.0 CORRECTIVE ACTION AND COMPLAINTS

Failure to meet established analytical controls, such as the quality control objectives outlined in Sections 9.0 and 12.0, prompts corrective action. In general, corrective action may take several forms and may involve a review of the calculations, a check of the instrument maintenance and operation, a review of analytical technique and methodology, and reanalysis of quality control and field samples. If a potential problem develops that cannot be solved directly by the responsible analyst, the supervisor, the department manager, and/or the QAPM may examine and pursue alternative solutions. In addition, the appropriate project manager may be notified in order to ascertain if contact with the client is necessary. If events cast doubt on the validity of test results, the client shall be notified within 3 business days of the discovery. This should give the laboratory time to ascertain the extent of the problem.

The QAPM initiates corrective action due to a performance audit or a check sample problem; the affected laboratory personnel are promptly informed, as are the laboratory supervisors and managers. If a problem is to be investigated due to suspected inappropriate actions or vulnerabilities related to data integrity, the investigation will be handled in a confidential manner until a follow up evaluation, full investigation, or other appropriate actions have been completed and the issues clarified. All investigations that result in finding of inappropriate activity shall be documented through Human Resources and shall include any disciplinary actions involved. The personnel files are kept on record for at least 5 years. In cases where data quality is or may be impacted, the client is notified.

A Nonconformity and Corrective Action Form is generated to document and notify the appropriate personnel of the nonconformity. Procedures for issuing and filing nonconformities are discussed in SOP, *Corrective Action* (ADM-CA). The form is in Figure 15-1.

In special cases, the Laboratory Director may give permission to the analyst, Supervisor, or Project Manager to deviate from CAS Policy. Typically, a Nonconformity form must be issued to the Director and signed off as being acceptable. Otherwise verbal instructions are given and documented on the raw data as being accepted by the Laboratory Director.

In cases were there are complaints from the clients, follow policy procedures outlined in the SOP, *Handling Customer Feedback* (ADM-FDBK).

Corrective actions may also be used to monitor continuous process improvements and tracking of missed proficiency test samples. Laboratory management is responsible for following through with the proficiency testing programs, ensuring that the corrective actions are implemented after testing, and evaluating the effectivness of the corrective action.

Figure 15-1

Nonconformity and Corrective Action Report

NONCONFORMITY

N&CA Report No. _____

PROCEDURE (SOP or METHOD): EVENT DATE: _____

EVENT: ☐ Missed Holding Time ☐ QC Failure ☐ Lab Error (spilled sample, spiking error, etc.)
☐ Method Blank Contamination ☐ Login Error ☐ Project Management Error
☐ Equipment Failure ☐ Unacceptable PT Sample Result ☐ Other (describe):

SAMPLES / PROJECTS / CUSTOMERS / SYSTEMS AFFECTED

DETAILED DESCRIPTION

ORIGINATOR: _____ DATE: _____

PROJECT CHEMIST(s): _____ NOTIFIED BY: _____ DATE: _____

CORRECTIVE ACTION AND OUTCOME

Re-establishment of conformity must be demonstrated and documented. Describe the steps that were taken, or are planned to be taken, to correct the particular Nonconformity and prevent its reoccurrence. Include Project Chemist instructions here.

Is the data to be flagged in the Analytical Report with an appropriate qualifier? ☐ **No** ☐ **Yes**

APPROVAL AND NOTIFICATION

Supervisor Verification and Approval of Corrective Action _____ Date: _____
Comments:

QA PM Verification and Approval of Corrective Action _____ Date: _____
Comments:

Customer Notified by ☐ Telephone ☐ Fax ☐ E-mail ☐ Narrative ☐ Not notified
Project Chemist Verification and Approval of Corrective Action _____ Date: _____
Comments: (Retain record)

16.0 QUALITY ASSURANCE REPORTS

Quality assurance requires an active, ongoing commitment by CAS personnel at all levels of the organization. Information flow and feedback mechanisms are designed so that analysts, supervisors and managers are aware of quality assurance issues in the laboratory.

Analysts performing routine tests in the laboratory are aware of the various method acceptance criteria and in-house control limits that must be met in order to generate acceptable results. Any non-conformities and corrective actions may also be attached to the data prior to review. Supervisors, or designee, review all of the completed analytical batches to ensure that all QC criteria have been examined and any deficiencies noted and corrected if possible.

It is the responsibility of each laboratory unit to provide the Project Manager with a final report of the data, accompanied by signature approval. Footnotes and/or narrative notes must also accompany any data package if problems were encountered that require further explanation to the client. Each data package is submitted to the appropriate project manager, who in turn reviews the entire collection of analytical data for completeness. The Project Manager must also review the entire body of data to ensure that any and all client-specified objectives were successfully achieved. A case narrative may be written by the project manager to explain any unusual problems with a specific analysis or sample, etc...

The Quality Assurance Program Manager provides overview support to the Project Manager if required to do so (e.g. contractually specified, etc...) The Quality Assurance Program Manager is also responsible for the oversight of all internal and external audits, for all performance evaluation sample and analysis programs, and for all laboratory certification/accreditation responsibilities.

The QAPM also prepares quarterly reports for the QA Director which summarizes the various QA/QC activities that have occurred during the previous quarter. These reports include a summary of the various audits performed during the last quarter, new accreditations/certifications received by the laboratory, scores of the most current performance evaluation studies, updates/revisions to controlled documents, etc...

On an annual basis, the lab director shall review the laboratory's quality system to introduce any necessary changes or improvements. The review will take into account the outcome of recent internal or external audits, proficiency results, changes in volume and type of work, feedback from clients or authorities, corrective action reports, complaints, etc. See SOP ADM-MGMTRVW.

17.0 PERSONNEL TRAINING

Technical position descriptions are available for all employees, regardless of position or level of seniority. These documents are maintained by the QA Program Manager and Human Resources. In order to assess the technical capabilities and qualifications of a potential employee, all candidates for employment at CAS are evaluated, in part, against the appropriate technical description.

Training begins the first day of employment at CAS when the administrative, quality assurance, and health and safety policies are presented and discussed. Each new employee is presented with example ethical dilemmas and resolutions as an initial Ethics training. Within 12 months, each employee shall participate in an 8-hour company Ethics Training Seminar. Thereafter, ethics training is on-going throughout the tenure of each employee.

Technical training is documented following SOP requirements discussed in *Documentation of Technical Training* (ADM-TRANDOC). Training for analytical procedures typically begins with the reading of the analytical SOP. Hands-on training begins with the observation of an experienced analyst performing the method, followed by the trainee performing the method under close supervision, and culminating with independent performance of the method on quality control samples. Successful completion of the analysis must include an Initial Demonstration of Capability Study of four replicate quality control samples. If quality control samples are not available (tests such as Paint Filter, Settleable Solids, Cation Exchange Capacity, Chlorophyll a, Chlorine Demand, Open Cup Ignitability, Dissolved Oxygen, Odor, SPLP extraction, TCLP extraction, and Dry Weight Percent Solids), a supervisor may sign an acknowledgment of the analyst's proficiency, as referenced in ADM-TRANDOC as Critical Job Function Authorization Statement.

Continued demonstration of capability is performed at least annually using a PT sample, a 4-replicate accuracy and precision study, or signing of a Critical Job Function Authorization Statement as a supervisor's acknowledgement of proficiency (for tests without quality control samples). Copies of all training forms and certifications (demonstrations of capability) are reviewed and maintained by the QA department.

Safety training begins with the reading of the *Safety Manual*. All employees are recommended to attend quarterly safety meetings during which the safety programs discussed and safety training is presented by the Environmental, Health and Safety Officer.

CAS encourages its personnel to continue to learn and develop new skills that will enhance their performance and value to the company. Ongoing training occurs for all employees through a variety of mechanisms. The "CAS University" education system, external and internal technical seminars and training courses, laboratory-specific training exercises and performance of external PE samples analysis are all used to provide employees with professional growth opportunities.

Safety and QA/QC requirements are integral parts of all technical SOPs and, consequently, are integral parts of all processes at CAS.

18.0 REFERENCES FOR ANALYTICAL PROCEDURES

The analytical methods used at CAS generally depend upon the end-use of the data. Since most of our work involves the analysis of environmental samples for regulatory purposes, specified federal and/or state testing methodologies are used and followed closely. Several factors are involved with the selection of analytical methods to be used in the laboratory. These include the method detection limit, the concentration of the analyte being measured, method selectivity, accuracy and precision of the method, the type of sample being analyzed, and the regulatory compliance objectives. Typical methods used at CAS are taken from the following references:

- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, 1986 and Updates I (7/92), II (9/94), IIA (8/93), IIB (1/95), and III (12/96). See Chapters 1, 2, 3, and 4.

- *Methods for Chemical Analysis of Water and Wastes*, EPA 600/4-79-020, Revised March 1983.

- *Methods for the Determination of Metals in Environmental Samples*, EPA 600/4-91-010, June 1991 and Supplement I, EPA/600/R-94/111, May, 1994.

- *Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater*, EPA 600/4-82-057, July 1982 and 40 CFR Part 136, Appendix A.

- *Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA 600/R-93/100, August 1993.

- *Methods for the Determination of Organic Compounds in Drinking Water*, EPA 600/4-88-039, December 1988 and Supplement I (7/90) and Supplement II (8/92).

- *Standard Methods for the Examination of Water and Wastewater*, 16th Edition, 1985; 17th Edition, 1989; 18th Edition, 1992, and 19th Edition, 1995.

- 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act.

- 40 CFR Part 141, National Primary Driniking Water Regulations.

- State-specific total petroleum hydrocarbon methods for the analysis of samples for gasoline, diesel, and other petroleum hydrocarbon products.

- Annual Book of ASTM Standards.

- EPA Contract Laboratory Program, Statement of Work for Organics Analysis, OLM04.2. May 1999 and OLM04.3.

- EPA Contract Laboratory Program, Statement of Work for Inorganics Analysis, ILM04.1 and ILM05.1.

- G*ood Automated Laboratory Practices, Priciples and Guidance to Regulations For Ensuring Data Integrity In Automated Laboratory Operations*, EPA 2185, August 1995.

- *National Environmental Laboratory Accreditation Conference*, *Quality Standards, Chapters 1-5*, July 2003.

APPENDIX A

MAJOR ANALYTICAL EQUIPMENT

March 29, 2006

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
MASS SPECTROMETERS - VOAs					
GC/MS #3	Gas Chromatograph	HP 5890II	3133A37456	VOAs	2001
	Mass Spec Detector	HP 5971A	3118A02764		
	AutoSampler	Archon	13070		
	Concentrator	Tekmar 2000	91227014		
	Computer Workstation	Gateway P5-133	5360356		
	Analytical Software	Enviroquant Chemstation G1032C v.C.01.00			
GC/MS #5	Gas Chromatograph	HP 5890II	3121A35679	VOAs	1991
	Mass Spec Detector	HP 5971	3118A02532		
	AutoSampler	Archon	12727		
	Concentrator	Tekmar 3000	98125008		
	Computer Workstation	Gateway P5-133	5360357		
	Analytical Software	Enviroquant Chemstation G1032C v.c.01.00			
GC/MS #6	Gas Chromatograph	HP 6890	US00023178	VOAs	1998
	Mass Spec Detector	HP 5973	US82311143		
	AutoSampler	Archon			
	Concentrator	EST Encon	261043003		
	Computer Workstation	HP Kayak XA	US3T653217		
	Analytical Software	Enviroquant Chemstation G1701BA v.B.00.00			
GC/MS #7	Gas Chromatograph	HP 5890II	3235A43994	VOAs	2001
	Mass Spec Detector	HP 5971	323A03964		
	AutoSampler	Archon	13589		
	Concentrator	Tekmar 2000	91267022		
	Computer Workstation	Compaq DeskPro	6124FR4ZD257		
	Analytical Software	Enviroquant Chemstation G1701BA v.B.01.00			

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
GC/MS #8	Gas Chromatograph	HP 5890II	3126A36850	VOAs	2004
	Mass Spec Detector	HP 5972	3435A01975		
	AutoSampler	EST Centurion	CENT145061104		
	Concentrator	EST Encon	374062504		
	Computer Workstation	Compaq DeskPro	6946CJM7M878		
	Analytical Software	Enviroquant Chemstation G1701BA v.B.01.00			
GC/MS #9	Gas Chromatograph	HP 6890	US00029263	VOAs in air TO-15	2004
	Mass Spec Detector	HP 5973	US91922619		
	AutoSampler	Enteck 7016CA	00156		
	Concentrator	Enteck 7100	0088		
	Computer Workstation	HP Kayak XA	92181198		
	Analytical Software	Enviroquant Chemstation G1701BA v.B.01.00 Enteck Smart Lab 2000 v3.32			
GC/MS #10	Gas Chromatograph	Agilent 6890N	CN10633045	VOAs	2006
	Mass Spec Detector	Agilent 5975B	US62723782		
	Purge and Trap	EST-Varian Archon	14702		
	Concentrator	EST Encon	ELEC-523103006E PATH-523103006P		
	Computer Workstation	Dell E520	8PT52C1		
	Analytical Software	Chemstation	D.03.00.552		
GC/MS #11	Instrument	EST Markelou HS9000	HS137042108	VOAs	2008
	Gas Chromatograph	Agilent 6890N	US00033857		
	Mass Spec Detector	Agilent 5973	US94212218		
	Concentrator				
	Computer Workstation	HP Kayak xA	FR94720557		
	Analytical Software	HP Enviroquant 61701BA	B.0100		

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
Digital Display 1-Channel	Mass Flow Controller Digital Display	MKS Instruments 247C	92290101A	VOAs	2006
Digital Display 4-Channel		MKS Instruments 246B	94200203A	VOAs	2006
Flow Controller #1	Mass Flow Controllers	Model 1359C-10000SK	0258C10583442	VOAs	2006
Flow Controller #2		Model 1359C-00200SK	0258C10598442	VOAs	2006
Flow Controller #3		Model 1359C-000205SK	0258C15231304	VOAs	2006
Flow Controller #4		Model 1359C-00010SK	0258C10581442	VOAs	2006

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
MASS SPECTROMETERS -SVOAs					
GC/MS 5973A	Gas Chromatograph	HP 6890	US00024148	SemiVOAs/CLP	1998
	Mass Spec Detector	HP 5973	US82311266		
	AutoSampler	HP 7683	CN23021382		
	Injector	Agilent 7683	US10301831		
	Computer Workstation	Gateway GP7-600	17904248		
	Analytical Software	HP Chemstation B.02.05 EnviroQuant G1701BA v.B.01.00			
GC/MS 5973B	Gas Chromatograph	HP 6890	US00029105	SemiVOAs/CLP	1999
	Mass Spec Detector	HP 5973	US91911849		
	AutoSampler	HP7683	US81501041		
	Injector	HP7683	US93408790		
	Computer Workstation	HP Kayak XA6/400	US92280466		
	Analytical Software	HP Chemstation B.02.05 EnviroQuant G1701BA v.B.01.00			
GC/MS 5973C	Gas Chromatograph	Agilent 6890N (G1530N)	US10232036	SemiVOAs	2002
	Mass Spec Detector	Agilent 5973 (G2578A)	US21853642		
	AutoSampler	Agilent 7683 (G2614A)	US00307019		
	Injector	Agilent 7683 (G2613A) Agilent LVI being installed	CN23126455		
	Computer Workstation	Gateway P7-450	13645026		
	Analytical Software	HP Chemstation Enviroquant G1701 v.D.00.00.38			

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
GAS CHROMATOGRAPHS - EXTRACTABLES					
HP5890(II)-B	Gas Chromatograph	HP 5890	2728A14298	Petroleum Hydrocarbons	1988
	Detector	FID	(integrated)		
	Autosampler	HP7673	3417A35264		
	Injector	HP7673	3120A26909		
	Controller	HP7673	3416A35332		
	Computer Workstation	Gateway P5-133	5360538		
	Analytical Software	HPChemstation G1034C v.03.00			
HP6890- D	Gas Chromatograph	HP 6890	22174	Pest/PCB/8011	1998
	Detector	Dual ECD			
	Injector	HP7683	US93408790		
	Autosampler	G2614A	US81800809		
	Computer Workstation	DELL	7BQRS71		
	Analytical Software	Enviroquant MSD Chemstation D.01.02.16 15 June 2001			
HP5890(II)- F	Gas Chromatograph	HP 5890II	2950A26574	8011	1989
	Detector	Dual ECD			
	Autosampler	18596B	3032A22303		
	Injector	HP7673	3205A29661		
	Computer Workstation	HP Vectra XA 5/233	US81450241		
	Analytical Software	HP Chemstation v.B.02.05 EnviroQuant G1701BA v.B.01.00			
6890N- G	Gas Chromatograph	Agilent 6890N	US10520018	Herb/PCB	2005
	Detector	Micro ECD			
	Injector	Agilent G2913A	CN51624717		
	Autosampler	Agilent G2614A	CN51032422		
	Computer Workstation	DELL	7BQRS71		
	Analytical Software	Enviroquant MSD Chemstation D.01.02.16 15 June 2001			

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
HP5890(II)-H	Gas Chromatograph	HP 5890II	3336A56596	Alcohols/ WAPA	2005
	Detector	FID	(integrated)		
	Autosampler	18596C	US22508151		
	Injector	Agilent 6890	CN34222775		
	Controller	G1512A	CN00005087		
	Computer Workstation	HP KAYAK XA	US8345093		
	Analytical Software	HP Chemstation B.02.05 EnviroQuant G1701BA v.B.01.00			
6890N- I	Gas Chromatograph	Agilent 6890N	US10552066	Petroleum Hydrocarbons	2008
	Detector	FID			
	Injector	Agilent G2913A_7683B	CN60931630		
	Autosampler	Agilent G2614A	CN60738562		
	Computer Workstation	DELL	818W761		
	Analytical Software	Chemstation D.02.00.275			
HP5890(II)-L	Gas Chromatograph	HP 5890II	2950A27718	Herb/PCB	1989
	Detector	Dual ECD			
	Autosampler	18596C	US4008144		
	Injector	Agilent 6890	CN22321966		
	Computer Workstation	HP Vectra XA 5/233	US81450241		
	Analytical Software	HP Chemstation v.B.02.05 EnviroQuant G1701BA v.B.01.00			

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
EXTRACTABLES SUPPORT EQUIPMENT					
GPC	GPC	OI Analytical AP2000	A122330318	Cleanups	2002
RapidVap #1	Nitrogen Evaporation System	LabConco RapidVap	11296345E	Concentrations	2001
RapidVap #2	Nitrogen Evaporation System	LabConco RapidVap	20998065F	Concentrations	2002
RapidVap #3	Nitrogen Evaporation System	LabConco RapidVap	70975713	Concentrations	2007
N-EVAP	Organomation N-EVAP	Model 112	7531	Concentrations	
Hot Orbital Shaker		Armalab OR200	3560	Extractions	2004
Automated Soxhlet #1	Automated Soxhlet	Gerhardt SOX416	1/8465080006	Extractions	2008
Automated Soxhlet #2	Automated Soxhlet	Gerhardt SOX416	1/8465080007	Extractions	2008
Autoshaker#1	Lab-Line Extraction Mixer	Model 6000	0904-3735	Extractions	2004
Autoshaker#2	Lab-Line Extraction Mixer	Model 6000	0904-3736	Extractions	2004
Autoshaker#3	Lab-Line Extraction Mixer	Model 6000	0904-3737	Extractions	2004
SPE-DEX 4790#1	Solid Phase Extractor	Horizon	05-0593	Extractions	2005
SPE-DEX 4790#2	Solid Phase Extractor	Horizon	05-0595	Extractions	2005
SPE-DEX 4790#3	Solid Phase Extractor	Horizon	05-0594	Extractions	2005
Tekmar 500		TM-500	7460E	Sonication	
Tekmar 600		TM-600	13232	Sonication	
VibraCell #1		VC375	15144E	Sonication	
VibraCell#2		VC505	37629G	Sonication	

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
GAS CHROMATOGRAPHS - VOLATILES					
V1	Gas Chromatograph	Varian 3400	4808	VOAs	1998
	PID Detector	OI 4430	OI 1009		
	PID Controller	OIA 5200	A240213		
	ELCD Detector	OIA 4420	2942-8-686		
	AutoSampler	Tekmar 2016	89016001		
	Concentrator	Tekmar 2000	91063007		
	Computer Workstation	GP6-233	9767125		
	Analytical Software	Varian System Control v.4.5.2	D57543610		
V2	Gas Chromatograph	Varian 3300	4130	Alcohols/Gases	1999
	Detector	FID	(integrated)		
	Computer Workstation	PowerFlex	120518		
	Analytical Software	Varian System Control v.4.51	D57543610		
V3	Gas Chromatograph	Varian 3400	10989	VOAs	1999
	PID Controller	OIA 5200	B509500481		
	PID Detector	OI 4430			
	ELCD Detector	OIA 5300	B05223456		
	AutoSampler	Varian Archon	13316		
	Concentrator	Tekmar 3000	98124003		
	Computer Workstation	Gateway 2000	10221502		
	Analytical Software	Varian System Control v.4.51	D57543610		
V4	Gas Chromatograph	Varian 3400	15248	VOAs	2001
	PID Detector	OI 4436	OI1000		
	ELCD Detector	OI 5300	C449553665		
	PID Controller		A218047		
	AutoSampler	Archon	13596		
	Concentrator	Encon	130122900 E/P		
	Computer Workstation	GP6-233	9767125		
	Analytical Software	Varian System Control v.4.5.2	D57543610		

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
HP1	Gas Chromatograph	HP5890II	3121A35575	VOAs	2001
	PID Detector	OIA 4430	31030		
	FID Detector	(integrated)	-		
	AutoSampler	Tekmar 2016	89220008		
	Concentrator	Tekmar 2000	89013002		
	Sample Heater	Tekmar	91065008		
	Computer Workstation	Gateway GP5-233	9352344		
	Analytical Software	Varian System Control v.4.5.2	00159-1908-cd1-22bd		
T6	Gas Chromatograph	Varian 3400	4143	VOAs/VPH/GRO	1998
	PID Detector	OI 4430	OI1006		
	FID Detector	Integrated	-		
	AutoSampler	Tekmar 2016	91298028		
	Concentrator	Tekmar 2000	91331001		
	Sample Heater	Tekmar	88264001		
	Computer Workstation	Gateway GP5-233	9352344		
	Analytical Software	Varian System Control v.4.5.2	00159-1a08-cd1-22bd		

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
HPLC					
HPLC02 (LC/MS)	Binary Pump	Agilent 1100	DE11108496	Perchlorate	2005
	Column Thermostat	Agilent 1100	DE11120893		
	Wellplate Autosampler	Agilent 1100	DE11300879		
	Sample Thermostat	Agilent 1100	DE82207519		
	MSD	Agilent G1946D	US12411208		
	Computer Workstation	HP Vectra	US12475439		
	Analytical Software	Chemstation for HPLC Rev.A.10.02			
HPLC03	Binary Pumps	Shimadzu LCD10ADVP	1(A) C20963851348US 2(B) C20963851344US	Metabolic Acids Hydroquinone Tolytriazole PAHs	2005
	UV/VIS Detector	Shimadzu SPD10AVVP	C21004050470US		
	Fluorescence Detector	Waters 470	470-00067		
	Electrochemical Detector	BAS LC4C/CC5	LC-4C 7014		
	AutoSampler	Shimadzu SIL10ADVP	C21053850511US		
	System Controller	Shimadzu SCL10AVP	C21013851302US		
	Degasser	Shimadzu DGU 14A	101076		
	Temperature Control Module	Waters	TCM-001304		
	Computer Workstation				
	Analytical Software				
HPLC04	Solvent Delivery System	HP1050	3019A00475	Formaldehyde UV-MISC	2007
	Variable Wavelength UV Detector	HP1050	3225J01126		
	Scanning Fluorescence Detector	HP1046A			
	AutoSampler	HP1050	LR47359C		
	Quaternary Pump	HP1050			
	Column Thermostat	HP1050			
	Analytical Software	Chemstation for HPLC Rev A.09.0E1206	Data Acquisition and Instrument Control		

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
HPLC05	Degasser	Degasser G1322A	JP 7305035	To Be Determined	2007
	Binary Pump	Agilent 1100/G1312A	US70600653		
	Diode Array Detector	Agilent 1100/G1315B	DE11112376		
	AutoSampler	Agilent 1100/G1313A ALS	DE72003859		
	Analytical Software	Chemstation for HPLC Rev A 09.0S1206	Data Acquisition and Instrument Control		

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
METALS					
FIMS	CVAA-FIMS	Perkin Elmer	1258	Mercury	1997
	Computer Workstation	Soyata			
	Analytical Software	PE AA WinLab for Windows v.2.50			
4100ZL #1	AA	Perkin Elmer AA 4100ZL	6066	Furnace Metals	1991
	Computer Workstation	Gateway GP5-233			
	Analytical Software	PE AA WinLab for Windows v.2.50			
4100ZL #2	AA	Perkin Elmer AA 4100ZL	6245	Furnace Metals	1998
	Computer Workstation	Gateway GP6-400			
	Analytical Software	PE AA WinLab for Windows v.2.50			
Leeman Hydra AFG+	CVAF	Leeman Hydra AFG+	112-00067-1	Low Level Mercury (Method 1631)	2004
	Computer Workstation	Dell Dimension 2400	35180912881		
	Analytical Software	WinHg Runner 1.5 CT Rev0.286	-		
ICP #1	Instrument	Perkin Elmer Optima 3000XL	069N4060401	Metals - Low Level	1994
	Computer Workstation	Gateway GP5-233	10221500		
	Analytical Software	PE ICP WinLab v.1.42			
ICP #2	Instrument	Perkin Elmer Optima 3000XL	069N6062602	Metals - Low Level	1999
	Computer Workstation	Gateway GP5-233	9352702		
	Analytical Software	PE ICP WinLab v.1.42			
ICP #3	Instrument	Perkin Elmer 5300DV	077N5112802	Metals	2006
	Computer Workstation	Dell Optiplex GX620			
	Analytical Software	PE ICP WinLab v.3.1			
ICPMS	SCIEX ICP/MS	Perkin Elmer Elan 9000	PO370203	Metals	2002
	Autosampler	PE AS93Plus			
	Computer Workstation	Dell Optiplex GX150			
	Analytical Software	ELAN v.2.4			

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
HOTBLOCKS - METALS					
Hotblock #1		Environmental Express		Metals Digestions	2001
Hotblock #2		Environmental Express		Metals Digestions	2001
Hotblock #3		Environmental Express		Metals Digestions	2005
Hotblock #4		Environmental Express		Metals Digestions	2005
ModBlock A		CPI		Metals Digestions	2003
ModBlock B		CPI		Metals Digestions	2003

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
GENERAL CHEMISTRY					
TOC#1	TOC Analyzer	OI Model 1010	J245710349	TOC - waters	2003
	Autosampler	OI Model 1051	B247751184		
	Computer Workstation	Gateway GP6-300	10709094		
	Analytical Software	OI WinTOC for 1010 v.01 Rev 225	-		
TOC#2	TOC Analyzer	Dohrman DC190	9507646	TOC - soils	2001
	Boat Sampler	Dohrman 183 s/s1	9507610		
Lachat 8000	Flow Injection System	Lachat 8000		Chloride, TKN, NO2/NO3, NH3, Alkalinity, Hardness, Phosphorus, Silica, Cr6+	1999
	Colorimeter	Lachat	A83000-1286		
	Pump	Lachat	A82000-525		
	Autosampler	Lachat	A81010-168		
	Computer Workstation	Gateway GP6-233	9767124		
	Analytical Software	Omnion FIA v.2	-		
Technicon #2	Flow Injection System	Technicon		Phenol	Pre-1982
	Colorimeter	Technicon	199-006701D		
	Pump	Technicon	PR0276		
	Chart Recorder	Technicon	82A3321		
	Autosampler	Technicon	681-Rest worn off		
	Module	Technicon	83035		
AquaKem	Instrument	AquaKem 200	A0419913	Nitrite, Ammonia, Phosphate, Chloride, Hexavalent Chromium, Cyanide	2005
	Computer Workstation	Sell SX280	3KSDF1J		
	Analytical Software	6.5.AQ1 rc4			

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
IC#1	Ion Chromatograph	Dionex Series 4000i		Anions	Pre-1982
	Basic Chromatography Module	Dionex	871602		
	Gradient Pump	Dionex	871608		
	Conductivity Detector	Dionex	871242		
	Controller Pump	Dionex	31528		
	Autosampler	Dionex	931526		
	Integrator	4270	037/24782		
	Computer Workstation	Gateway GP6-400	11809650		
	Analytical Software	Dionex PeakNet v.5.1	116-987-2806		
IC#3	Ion Chromatograph	Metrohm 861 Advanced Compact IC		Anions	2005
	Basic Chromatography Module	Metrohm	861-02114		
	Pump	Metrohm	62824100s20		
	Conductivity Detector	Metrohm	integrated		
	Autosampler	Metrohm	838-04105		
	Computer Workstation	Dell OptiPlex GX520	6VRC581		
	Analytical Software	IC NET 2.3 SR2	A.701.0016		
IC # 4	Ion Chromatograph	Dionex 500DX		ANIONS	2007
	Basic Chromatography Module	LC20-1	97110393		
	Gradient Pump	GP40-1	97110534		
	Conductivity Detector	ED40-1	97110074		
	Autosampler	AS40-1	97110671		
	Computer Workstation	Gateway 2000 GP6-266	10239250		
	Analytical Software	Peaknet 5.21	192-994-1564		

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
IC # 5	Ion Chromatograph	Dionex ICS-1000	7090145	Cr6+ ANIONS	2007
	Gradient Pump	GP40			
	Conductivity Detector	DS6	7081071		
	Autosampler	AS40	7090325		
	Computer Workstation	Dell Optiplex 745	1441DAA99		
	Analytical Software	Chromeleon 6.80	56276		
Adiabatic Calorimeter	Adiabatic Calorimeter	Parr 1241	3744	BTU, Combustion Prep	1997
Isoperibol Calorimeter	Isoperibol Calorimeter	Parr 6300	27187	BTU, Combustion Prep	2004
Autoclave	Autoclave	Amsco	none	Micro/TPO4	Pre-1970
Midi A	Midi Cyanide Distillation System	BSL Co	none	Cyanide/Phenol/ Sulfide Distillation	1997
Midi B	Midi Cyanide Distillation System	BSL Co	none	Cyanide/Phenol/ Sulfide Distillation	1997
Midi C	Midi Cyanide Distillation System			Cyanide/Phenol/ Sulfide Distillation	2004

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
Bullwinkle	pH Meter	Orion SA520	2305	pH	1990
Rocky	pH Meter	Orion 720A	5012		1992
	pH Electrode	Orion 915600			
	Fluoride Electrode	Orion 9409			
	Reference Electrode	Orion 90-01-00			
Jenway	pH/Conductivity Meter	Jenway 4330	1344	pH/Conductivity	2000
SympHony	pH/Conductivity Meter	SympHony SB80PC	D00582	ph/Conductivity	2008
Turbidimeter	Turbidimeter	HF Scientific Micro 100	609246	Turbidity	2000
MR 21	Spectro-photometer	Milton Roy Spectronic 21	1225601	COD, MBAS, Cr6+, Ferrous Iron	1989
Buck IR	IR Spec / TPH Analyzer	Buck Scientific HC404	492	TPH	1994
DO Meter #1	Dissolved Oxygen Meter	YSI Model 54A	D8024621	DO, BOD	Pre-1990
DO Meter #2	Dissolved Oxygen Meter	YSI Model 57	A9016921	DO, BOD	Pre-1990
Open Cup	Open Cup Flashpoint Tester	Koehler Instru.Co. Model 420	none	Ignitability - solids	1989
Closed Cup	Closed Cup Flashpoint Tester	Boekel Model 152800	none	Ignitability - liquids	1993
Aquameter	Aquameter	Beckman KF4	none	% Water	1988
Density Meter	Density Meter	DE40	MPJ17625	Density	2007
Autotitrator	Robotic Titrosampler	Metrohm 855		Photoprocessing Samples	2007
	Pump Unit	Metrohm 772			
	Dosing Interface	Metrohm 846			
	Dosino	(7) Metrohm 800			
	Computer Workstation	Dell Optiplex 745			
	Analytical Software				

EQUIPMENT LIST

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
TKN Digestion Blocks	Technicon	Technicon block	206	TKN digest	<1997
		Omega CN 2110 Temperature Controller	-		
	AIM600	Al Scientific Pty Ltd AIM600	4726A12136	TKN digest	2007
Vacuum Pumps		Gast DOL-101-AA	787	1664	
		Gast DOA-P704-AA		1664	
		Gast 0522-U31-G18DX	687	General Filtration	
		Gast 0522-U31-G18DX	987	General Filtration	
Mettler Toledo PB602-1	**Top Loading Balances**	Mettler Toledo PB602-1	1118331281	Wetchem/Metals	
American Scientific PTL2500-1		American Scientific PTL2500-1	20466	Wetchem	
Denver S-400		Denver S-400	25232	Extractables	
Fisher		Fisher	7384	Metals	
Fisher Scientific 7303 OA		Fisher Scientific 7303 OA	13556	Volatiles	
Fisher Analytical Balance	**Analytical Balances**	Fisher Analytical Balance	8887	Volatiles	1990
Mettler AG204		Mettler Toledo Balance	120330501	Wetchem	2001
Mettler AE240		Mettler Analytical Balance	F96727	Wetchem	1996 used
Thermolyne 48000	**Muffle Furnace**	Thermolyne 48000		Volatile/Fixed Solids	

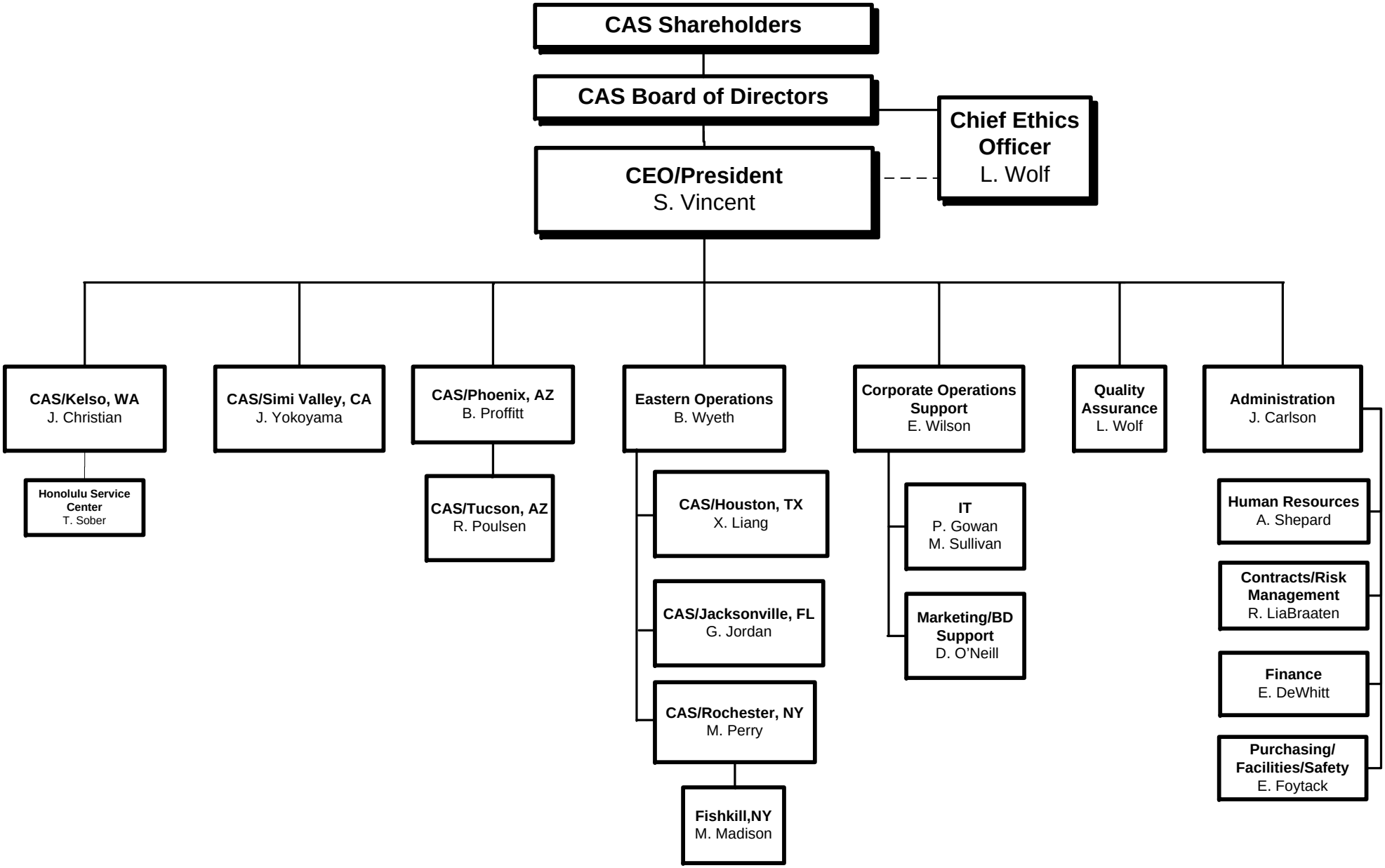
Note that the computers listed with the instruments are dedicated to that instrument for data aquisition, but the data files are saved to a lab-wide network and data may be accessed by any computer with the correct software - provided the user is authorized to do so.

APPENDIX B

ORGANIZATIONAL CHART and RESUMES OF KEY PERSONNEL

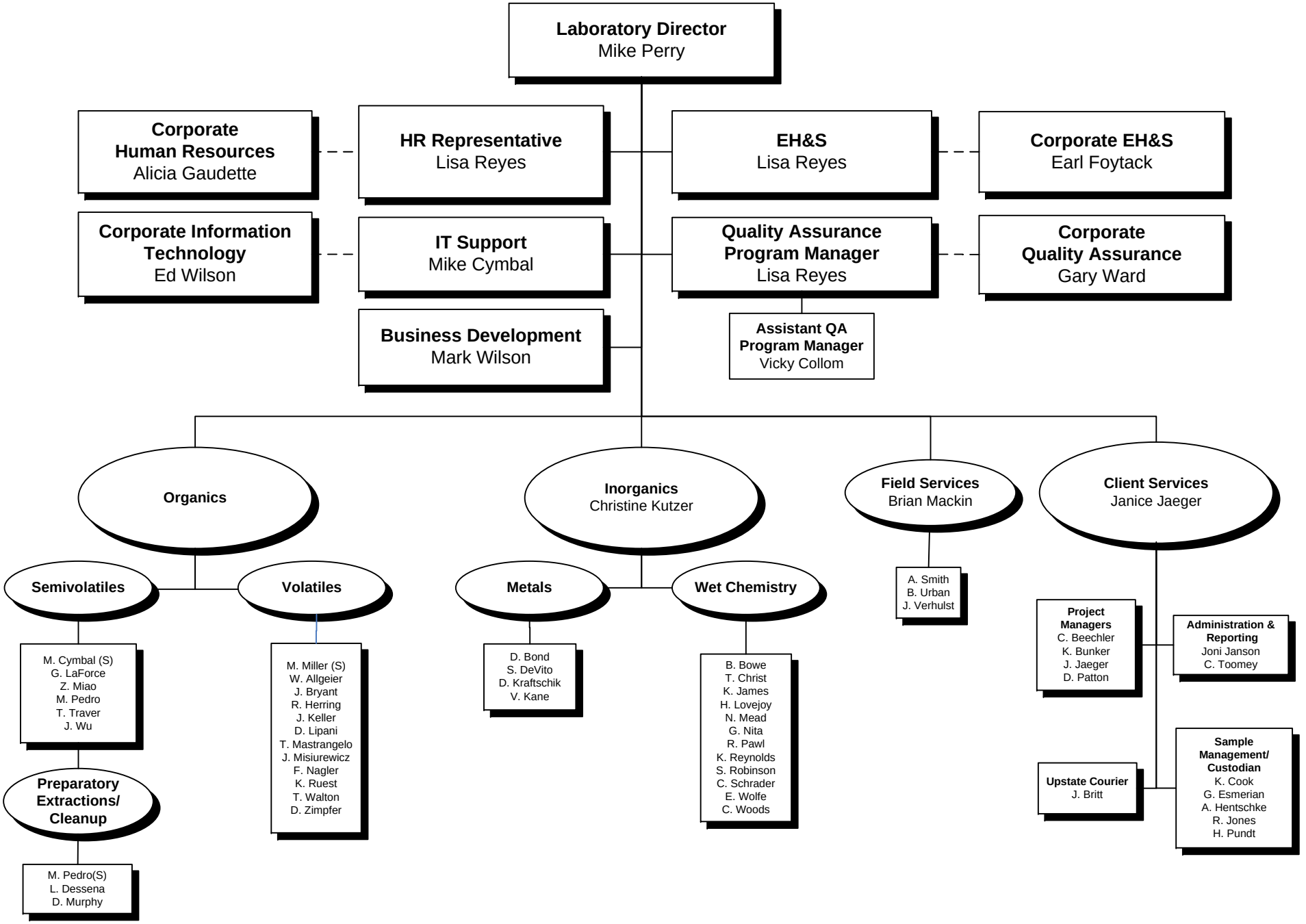
March 29, 2006

Columbia Analytical Services, Inc.
Laboratory Division Organization



Revised 09/03/08

Columbia Analytical Services, Inc.
Rochester, New York Laboratory Organization



Revised 7/7/08 do

MICHAEL K. PERRY

1996 TO PRESENT

Columbia Analytical Services, Inc., 1 Mustard St., Suite 250, Rochester, NY 14609 (585) 228-5380

Current Position Responsibilities

LABORATORY DIRECTOR – 1996 to Present

Primary responsibilities include management of all laboratory departments, scheduling, productivity, reporting and evaluation of analytical methodologies, project planning and Quality Assurance/Quality Control protocols. In addition, other responsibilities include direct responsibility for contracts and consultants relating to the EPA SITE program, ACOE remediation program and the technical interface for the New York State ASP CLP program and other large national based clients.

Documentation of Demonstration of Capabilities is available for review.

Experience

Project Chemist, *General Testing Corporation, Rochester, New York,* 1995-1996. In addition to the duties of Laboratory Director listed below, responsibilities expanded to include the supervision of four teams of Project Chemists. Production management was shifted to the Laboratory Supervisors in order to increase client contact. Directly responsible for contracts and consultants relating to the EPA SITE program, ACOE remediation program and the New York State ASP CLP program.

Laboratory Director, *General Testing Corporation, Rochester, New York,* 1985-1995. Primary responsibilities included management of all laboratory departments, scheduling, productivity, reporting and evaluation of analytical methodologies and Quality Assurance/Quality Control protocols.

Instrument Manager, *General Testing Corporation, Rochester, New York,* 1979-1985. Responsibilities included operation and maintenance of all laboratory instruments and supervision of personnel associated with the instrumentation laboratory. Analyses included metals, volatile organics, pesticides/PCBs, and semi-volatile organics.

Senior Quality Assurance Technician, *Coca-Cola Corporation, Atlanta, Georgia*, 1976-1979. Responsible for analysis of raw materials and finished product using both wet chemistry and instrumentation techniques.

Laboratory Technician, *Penwalt Pharmaceutical Company, Rochester, New York,* 1975. Worked in the Quality Control Department.

Education

Coursework toward MS, Chemistry, *Rochester Institute of Technology, Rochester, New York,* 1983-1986
GC/MS, *ACS Short Course,* 1986
Effective Management of Chemical Analysis Laboratories, *ACS Short Course,* 1985
BS, Chemistry, *Georgia State University, Atlanta, Georgia,* 1979
AAS, Chemistry, *State University of New York at Alfred, Alfred, New York,* 1975

Affiliations

American Chemical Society

LISA M. REYES

1997 TO PRESENT

Columbia Analytical Services, Inc., 1 Mustard St., Suite 250, Rochester, NY 14609 (585) 2285380

Current Position Responsibilities

QUALITY ASSURANCE/QUALITY CONTROL PROGRAM MANAGER – 1997 to Present

Responsible for the overall coordination of the laboratory QA program and for ensuring that established quality objectives are met. Responsible for Quality Assurance functions including the Quality Assurance Manual, certifications, documenting standard operating procedures, and maintaining performance evaluation records. Oversees balance calibration and sample storage temperature control. Maintains certifications/accreditations for regulatory agencies and client certifications or approval programs. Acts as primary point of contact during laboratory audits. Provides audit responses and initiates any changes in procedures resulting from an audit. Coordinates the analysis of performance evaluation samples required for certification/accreditation programs. Reports and reviews results for these analyses. Conducts internal audits and makes recommendations for corrective action.

Provides technical assistance to laboratory staff on QA/QC issues, project feasibility, and methods interpretation/development.

Documentation of Demonstration of Capabilities is available for review.

Experience

Environmental Chemist, *TreaTek-CRA Company/Conestoga-Rovers & Associates, Niagara Falls, New York*, 1992-1997. Data quality, assessments and validations of ASP, CLP, and SW-846 organic and inorganic analytical data. Liaison with analytical contract laboratories, CRA field personnel, and state and federal agencies. Prepared QAPPs, laboratory bidding documents, and contracts. Also responsible for performance of laboratory audits

Manager of Quality Management Office, *Huntingdon Analytical Services, Middleport, New York*, 1989-1992. Manager of QA for Environmental, Agrochemical, Asbestos, and Engineering Soil laboratories. Responsible for in-house QA/QC programs, inspections, and instrument maintenance. Also responsible for employee safety and hazardous waste training, as well as manifesting hazardous waste. Routinely performed inorganic analyses, and reviewed analytical data, reports, and CLP packages.

Research Assistant, *Research Foundation, State University of New York College at Brockport, Brockport, New York*, 1986-1989. Performed routine sampling of surface water and lakes. Also did inorganic analyses on water and soil matrices. Assisted in graduate projects dealing with fish, plankton, water chemistry, and crayfish.

Education

CLP Inorganic Data Validation, *US EPA Region II, Westchester Community, Westchester, New York,* 1993.
CLP Organic Data Validation, *US EPA Region II, Westchester Community, Westchester, New York,* 1992.
BS, Biology, *State University of New York at Brockport, Brockport, New York,* 1988

Affiliations

American Chemical Society

MARK WILSON

1996 TO PRESENT

Columbia Analytical Services, Inc., 1 Mustard St., Suite 250, Rochester, NY 14609 (585) 228-5380

Current Position

Responsibilities

DIRECTOR OF BUSINESS DEVELOPMENT II – 2004 to Present

Responsible for sales maintenance for the Rochester laboratory territory including coordination of marketing and sales with national sales team.

Documentation of Demonstration of Capabilities is available for review.

Experience

Client Services Manager*, Columbia Analytical Services, Rochester, NY*, 1996-2004. Responsible for supervision of Project Chemists, sales staff, Sample Management Office (SMO) and reporting departments. Responsible for project management and client interface regarding analytical services.

Laboratory Manager, *Columbia Analytical Services, Rochester, New York*, 1996. Responsible for supervision of laboratory staff, scheduling of projects, evaluations of analytical QC procedures, and review of all analytical data.

Laboratory Manager, *General Testing Corporation, Rochester, New York,* 1992-1996. Responsibilities were primarily same as above.

Assistant Laboratory Director, *General Testing Corporation, Rochester, New York,* 1988-1992. Was responsible for assisting lab director with supervision of lab staff, scheduling of projects, evaluations of analytical and QC procedures, and review of all analytical data.

Organics Department Manager, *General Testing Corporation, Rochester, New York,* 1986-1996. Responsible for supervising all organics analyses including GC/MS, GC volatile organics, and GC extractables, and coordinating production and method development.

Organic Extractables Manager, *General Testing Corporation, Rochester, New York*, 1985-1992. Was responsible for GC operation and analysis, GC maintenance, trouble shooting, development, and GC/MS operation and start up.

Staff Technician II, *Medical Center University of Kentucky, Lexington, Kentucky,* 1979-1985. Was responsible for GC and AA analysis on biological fluids, drug screening and monitoring, heavy metals analysis, thin-layer chromatography, HPLC, and water testing.

Education

BS, Medical Technology with 32 hours of Chemistry, *State University of New York at Buffalo, Buffalo, New York,* 1978.

JANICE M. JAEGER

1996 TO PRESENT

Columbia Analytical Services, Inc., 1 Mustard St., Suite 250, Rochester, NY 14609 (585) 288-5380

Current Position

Responsibilities

CLIENT SERVICES MANAGER I, 2004-Present

Responsible for the supervision of Project Managers, Sample Management Office (SMO) and Reporting Departments. Assist clients to determine what analyses are required. Oversee projects from quote initiation to final report submission. Act as liaison between client requirements and laboratory capabilities for projects. Update clients on progress if their project and answer any questions they may have. Respond promptly to client requests and develop new client contacts within and outside of our current client base.

Documentation of Demonstration of Capabilities is available for review.

Experience

Project Manager III, *Columbia Analytical Services, Rochester, NY*. 1996-2004. Assist clients to determine what analyses are required. Responsibilities primarily as above without the supervisory role.

Customer Service Representative/Sample Receiving, *General Testing Corporation, Rochester, New York,* 1989-1996. Primary responsibilities included client services as listed above. Also responsible for sample receipt, log in and distribution as well as bottle preparation.

Surgical Assistant, *Penfield Veterinary Hospital Rochester, New York,* 1984-1989. Primary responsibilities included preparation of instruments, surgical area, and animal for surgery. Also responsible for monitoring the animal before and after surgery.

Education

BA, Pre-Veterinary Medicine and Pre-Professional Zoology (double Major), *Ohio Wesleyan University, Delaware, Ohio,* 1983.

CHRISTINE M. KUTZER

1996 TO PRESENT

Columbia Analytical Services, Inc., 1 Mustard St., Suite 250, Rochester, NY 14609 (585) 288-5380

Current Position

Responsibilities

TECHNICAL MANAGER II, INORGANICS LABORATORY – 2004 to Present

Plans and manages all activities in the Inorganics Department, including Metals and General Chemistry. Responsible for coordinating the workload and scheduling employees' daily activities. Assist in the operation, troubleshooting, and maintenance of instrumentation. Responsible for scheduling samples. Accountable for analytical data entry, analytical data approval and High Level metals package generation through MARRS.

Documentation of Demonstration of Capabilities is available for review.

Experience

Technical Manager II, Metals and Organics Prep Laboratories, *Columbia Analytical Services, Inc., Rochester, New York,* 2002-2004. Duties as above for Metals Department. Responsible for coordinating the workload and scheduling employees' daily activities and troubleshooting in the organics preparation laboratory.

Technical Manager I, Metals Laboratory, *Columbia Analytical Services, Inc., Rochester, New York,* 1996-2002. Duties as above for Metals Department.

Analyst III, *Columbia Analytical Services, Rochester, New York*, 1996. Responsible for instrument troubleshooting and maintenance, digestion of samples, and TCLP extractions. Also responsible for data entry, approval, and package review.

Chemist, *General Testing Corporation, Rochester, New York,* 1992-1996. Duties were as listed above.

Education

BS, Chemistry, *St. Bonaventure University, Olean, New York,* 1992

MICHAEL W. CYMBAL

1996 TO PRESENT

Columbia Analytical Services, Inc., 1 Mustard St., Suite 250, Rochester, NY 14609 (585) 288-5380

Current Position

TECHNICAL MANAGER I – Information Technology 1998 to Present

- Extractables Department 2004 to Present

Responsibilities

Responsible for computer systems (Novel Lan, Starlims) and instrument analysis of software. Also responsible for client spreadsheets and disk deliverables, computer maintenance and upgrades.

Responsible for the oversight of the extractables department including extactions and instrumental analysis (HPLC, GC, and GC/MS).

Documentation of Demonstration of Capabilities is available for review.

Experience

Systems Analyst III, *Columbia Analytical Services, Inc., Rochester, New York,* 1997-1998. Duties primarily as above.

Systems Analyst I, *Columbia Analytical Services, Inc., Rochester, New York,* 1996-1997. Duties primarily as above.

Computer Administration, *General Testing Corporation, Rochester, New York,* 1995-1996. Oversaw computer systems (Novel Lan, StarLIMS, Seven Reporting Systems) and created client spreadsheets and disk deliverables.

Analyst, *General Testing Corporation, Rochester, New York,* 1990-1995. Responsible for Organic Analyses (Volatile and Semi-Volatile Pesticides) for GC and GC/MS. Also responsible for Instrument Maintenance and Sample Preparation.

Education

BS, Chemistry, *Robert's Wesleyan College, Rochester, New York,* 1990.

MATTHEW "MATT" M. MILLER

1996 TO PRESENT

Columbia Analytical Services, Inc., 1 Mustard St., Ste. 250, Rochester, NY 14609 585.288.5380

Current Position	**TECHNICAL MANAGER I, VOALATILES LABORATORY** – 1999 to Present
Responsibilities	Responsible for the daily operations of the GC and GC/MS laboratories, including the scheduling of department analyses, instrument calibration, and troubleshooting/maintenance activities. Accountable for personnel training, data approval, quality program support. **Documentation of Demonstration of Capabilities is available for review.**
Experience	**Scientist II, GC/VOA Laboratory,** *Columbia Analytical Services, Rochester, New York,* 1996-1999. Responsible for scheduling analyses, training new analysts, supervising analysts' work, reviewing and validating data, and performing various analyses. I was also responsible for maintaining a QA/QC database for departmental parameters and writing/updating departmental SOP's. Also responsible for VPH method development and putting together instrumentation for VPH and for PRECEPTII evaluation. **Analyst II, Wet Chemistry Laboratory,** *Columbia Analytical Services, Rochester, New York*, 1996. Duties as listed above, except for VPH method development and instrumentation. **GC/VOA Analyst**, *General Testing Corporation, Rochester, New York,* 1994-1996. Responsibilities included analyzing soils and waters on a GC by methods 8010/8020, 601/602, and 8021. Was also responsible for TOC waters and TOX waters, soils, and oils. **Metals Analyst,** *General Testing Corporation, Rochester, New York*, 1993-1994. Was responsible for digestion of waters and soils for analysis by GFAA, ICP, and Flame AA. Analysis of digested samples by above mentioned methods. Also responsible for performing TCLP extractions and Hg analysis. **Wet Chemistry Analyst,** *General Testing Corporation, Rochester, New York,* 1991-1993. As microbiology manager, I was responsible for scheduling analyses, and for analyzing waters and sludge for total and fecal coliform, and SPC by MF, MPN and Colilert methods. I was also responsible for tracking and documenting QA/QC for all micro parameters. In wet chemistry, was responsible for analyzing soils and waters for wet chemistry parameters.
Education	**BS, Aquatic Biology,** *State University of New York at Brockport, Brockport, New York,* 1991. **AAS, Science/Math Curriculum,** *Jefferson Community College, Watertown, New York,* 1989.

APPENDIX C

DATA QUALITY CAPABILITIES

March 29, 2006

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
504.1	1,2-DIBROMOETHANE	WATER	0.06		UG/L	0.0060	30	60-140	50-150
504.1	1,2-DIBROMO-3-CHLOROPROPANE	WATER	0.06		UG/L	0.0040	30	60-140	50-150
524.2	1,1,1,2-TETRACHLOROETHANE	WATER	0.50		UG/L	0.12	20	70-130	70-130
524.2	1,1,1-TRICHLOROETHANE	WATER	0.50		UG/L	0.082	20	70-130	70-130
524.2	1,1,2,2-TETRACHLOROETHANE	WATER	0.50		UG/L	0.078	20	70-130	70-130
524.2	1,1,2-TRICHLOROETHANE	WATER	0.50		UG/L	0.12	20	70-130	70-130
524.2	1,1-DICHLOROETHANE	WATER	0.50		UG/L	0.11	20	70-130	70-130
524.2	1,1-DICHLOROETHENE	WATER	0.50		UG/L	0.094	20	70-130	70-130
524.2	1,1-DICHLOROPROPENE	WATER	0.50		UG/L	0.15	20	70-130	70-130
524.2	1,2,3-TRICHLOROBENZENE	WATER	0.50		UG/L	0.15	20	70-130	70-130
524.2	1,2,3-TRICHLOROPROPANE	WATER	0.50		UG/L	0.15	20	70-130	70-130
524.2	1,2,4-TRICHLOROBENZENE	WATER	0.50		UG/L	0.12	20	70-130	70-130
524.2	1,2,4-TRIMETHYLBENZENE	WATER	0.50		UG/L	0.13	20	70-130	70-130
524.2	1,2-DIBROMO-3-CHLOROPROPANE	WATER	0.50		UG/L	0.29	20	70-130	70-130
524.2	1,2-DIBROMOETHANE	WATER	0.50		UG/L	0.11	20	70-130	70-130
524.2	1,2-DICHLOROBENZENE	WATER	0.50		UG/L	0.14	20	70-130	70-130
524.2	1,2-DICHLOROETHANE	WATER	0.50		UG/L	0.13	20	70-130	70-130
524.2	1,2-DICHLOROPROPANE	WATER	0.50		UG/L	0.097	20	70-130	70-130
524.2	1,3,5-TRIMETHYLBENZENE	WATER	0.50		UG/L	0.12	20	70-130	70-130
524.2	1,3-DICHLOROBENZENE	WATER	0.50		UG/L	0.13	20	70-130	70-130
524.2	1,3-DICHLOROPROPANE	WATER	0.50		UG/L	0.12	20	70-130	70-130
524.2	1,4-DICHLOROBENZENE	WATER	0.50		UG/L	0.14	20	70-130	70-130
524.2	2,2-DICHLOROPROPANE	WATER	0.50		UG/L	0.075	20	70-130	70-130
524.2	2-CHLOROTOLUENE	WATER	0.50		UG/L	0.13	20	70-130	70-130
524.2	4-CHLOROTOLUENE	WATER	0.50		UG/L	0.11	20	70-130	70-130
524.2	BENZENE	WATER	0.50		UG/L	0.099	20	70-130	70-130
524.2	BROMOBENZENE	WATER	0.50		UG/L	0.13	20	70-130	70-130
524.2	BROMOCHLOROMETHANE	WATER	0.50		UG/L	0.15	20	70-130	70-130
524.2	BROMODICHLOROMETHANE	WATER	0.50		UG/L	0.085	20	70-130	70-130
524.2	BROMOFORM	WATER	0.50		UG/L	0.12	20	70-130	70-130
524.2	BROMOMETHANE	WATER	0.50		UG/L	0.14	20	70-130	70-130
524.2	CARBON TETRACHLORIDE	WATER	0.50		UG/L	0.19	20	70-130	70-130
524.2	CHLOROBENZENE	WATER	0.50		UG/L	0.13	20	70-130	70-130
524.2	CHLOROETHANE	WATER	0.50		UG/L	0.17	20	70-130	70-130
524.2	CHLOROFORM	WATER	0.50		UG/L	0.10	20	70-130	70-130
524.2	CHLOROMETHANE	WATER	0.50		UG/L	0.22	20	70-130	70-130
524.2	CIS-1,2-DICHLOROETHENE	WATER	0.50		UG/L	0.081	20	70-130	70-130
524.2	CIS-1,3-DICHLOROPROPENE	WATER	0.50		UG/L	0.077	20	70-130	70-130
524.2	DIBROMOCHLOROMETHANE	WATER	0.50		UG/L	0.14	20	70-130	70-130
524.2	DIBROMOMETHANE	WATER	0.50		UG/L	0.11	20	70-130	70-130
524.2	DICHLORODIFLUOROMETHANE	WATER	0.50		UG/L	0.13	20	70-130	70-130
524.2	ETHYLBENZENE	WATER	0.50		UG/L	0.089	20	70-130	70-130
524.2	HEXACHLOROBUTADIENE	WATER	0.50		UG/L	0.076	20	70-130	70-130
524.2	ISOPROPYLBENZENE	WATER	0.50		UG/L	0.16	20	70-130	70-130
524.2	M+P-XYLENE	WATER	1.0		UG/L	0.29	20	70-130	70-130
524.2	METHYLENE CHLORIDE	WATER	0.50		UG/L	0.15	20	70-130	70-130
524.2	NAPHTHALENE	WATER	0.50		UG/L	0.085	20	70-130	70-130

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
524.2	N-BUTYLBENZENE	WATER	0.50		UG/L	0.14	20	70-130	70-130
524.2	N-PROPYLBENZENE	WATER	0.50		UG/L	0.14	20	70-130	70-130
524.2	O-XYLENE	WATER	0.50		UG/L	0.16	20	70-130	70-130
524.2	P-ISOPROPYLTOLUENE	WATER	0.50		UG/L	0.14	20	70-130	70-130
524.2	SEC-BUTYLBENZENE	WATER	0.50		UG/L	0.14	20	70-130	70-130
524.2	STYRENE	WATER	0.50		UG/L	0.11	20	70-130	70-130
524.2	TERT-BUTYLBENZENE	WATER	0.50		UG/L	0.16	20	70-130	70-130
524.2	TETRACHLOROETHENE	WATER	0.50		UG/L	0.11	20	70-130	70-130
524.2	TOLUENE	WATER	0.50		UG/L	0.085	20	70-130	70-130
524.2	TRANS-1,2-DICHLOROETHENE	WATER	0.50		UG/L	0.11	20	70-130	70-130
524.2	TRANS-1,3-DICHLOROPROPENE	WATER	0.50		UG/L	0.14	20	70-130	70-130
524.2	TRICHLOROETHENE	WATER	0.50		UG/L	0.16	20	70-130	70-130
524.2	TRICHLOROFLUOROMETHANE	WATER	0.50		UG/L	0.14	20	70-130	70-130
524.2	VINYL CHLORIDE	WATER	0.50		UG/L	0.20	20	70-130	70-130
524.2	BROMOFLUOROBENZENE -SURR	WATER	NA		UG/L	NA	NA	70-130	70-130
524.2	1,2-DICHLOROBENZENE-D4 -SURR	WATER	NA		UG/L	NA	NA	70-130	70-130
524.2 ADDITIONAL COMPOUNDS BY REQUEST									
	TERT-BUTYL ALCOHOL	WATER	20		UG/L	3.7	20	70-130	70-130
	METHYL-TERT-BUTYL-ETHER	WATER	0.50		UG/L	0.097	20	70-130	70-130
	2-BUTANONE (MEK)	WATER	5.0		UG/L	1.7	20	70-130	70-130
	2-HEXANONE	WATER	5.0		UG/L	1.8	20	70-130	70-130
	4-METHYL-2-PENTANONE (MIBK)	WATER	5.0		UG/L	1.6	20	70-130	70-130
	ACETONE	WATER	5.0		UG/L	1.9	20	70-130	70-130

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
601	BROMODICHLOROMETHANE	WATER	1.0		UG/L	0.34	30	42-172	42-172
601	BROMOFORM	WATER	1.0		UG/L	0.18	30	13-159	13-159
601	BROMOMETHANE	WATER	1.0		UG/L	0.13	30	d-144	d-144
601	CARBON TETRACHLORIDE	WATER	1.0		UG/L	0.41	30	43-143	43-143
601	CHLOROBENZENE	WATER	1.0		UG/L	0.21	30	38-150	38-150
601	CHLOROETHANE	WATER	1.0		UG/L	0.47	30	46-137	46-137
601	2-CHLOROETHYLVINYL ETHER	WATER	1.0		UG/L	0.26	30	14-186	14-186
601	CHLOROFORM	WATER	1.0		UG/L	0.33	30	49-133	49-133
601	CHLOROMETHANE	WATER	1.0		UG/L	0.38	30	42-172	42-172
601	DIBROMOCHLOROMETHANE	WATER	1.0		UG/L	0.25	30	13-159	13-159
601	DICHLORODIFLUOROMETHANE	WATER	1.0		UG/L	0.31	30	70-130	50-150
601	1,2-DICHLOROBENZENE	WATER	1.0		UG/L	0.12	30	d-144	d-144
601	1,3-DICHLOROBENZENE	WATER	1.0		UG/L	0.15	30	43-143	43-143
601	1,4-DICHLOROBENZENE	WATER	1.0		UG/L	0.15	30	38-150	38-150
601	1,1-DICHLOROETHANE	WATER	1.0		UG/L	0.32	30	46-137	46-137
601	1,2-DICHLOROETHANE	WATER	1.0		UG/L	0.30	30	14-186	14-186
601	1,1-DICHLOROETHENE	WATER	1.0		UG/L	0.32	30	49-133	49-133
601	TRANS-1,2-DICHLOROETHENE	WATER	1.0		UG/L	0.36	30	d-193	d-193
601	1,2-DICHLOROPROPANE	WATER	1.0		UG/L	0.29	30	d-208	d-208
601	CIS-1,3-DICHLOROPROPENE	WATER	1.0		UG/L	0.27	30	7-187	7-187
601	TRANS-1,3-DICHLOROPROPENE	WATER	1.0		UG/L	0.19	30	42-143	42-143
601	METHYLENE CHLORIDE	WATER	1.0		UG/L	0.39	30	47-132	47-132
601	1,1,2,2-TETRACHLOROETHANE	WATER	1.0		UG/L	0.25	30	51-147	51-147
601	TETRACHLOROETHENE	WATER	1.0		UG/L	0.31	30	28-167	28-167
601	1,1,1-TRICHLOROETHANE	WATER	1.0		UG/L	0.50	30	38-155	38-155
601	1,1,2-TRICHLOROETHANE	WATER	1.0		UG/L	0.28	30	39-136	39-136
601	TRICHLOROETHENE	WATER	1.0		UG/L	0.45	30	35-146	35-146
601	TRICHLOROFLUOROMETHANE	WATER	1.0		UG/L	0.42	30	21-156	21-156
601	VINYL CHLORIDE	WATER	1.0		UG/L	0.40	30	28-163	28-163
601	BROMOCHLOROMETHANE -SURR	WATER	NA		UG/L	NA	NA	60-117	60-117
601	1,2,3 -TRICHLOROPROPANE -SURR	WATER	NA		UG/L	NA	NA	70-124	70-124
601	CHLOROFLUOROBENZENE -SURR	WATER	NA		UG/L	NA	NA	61-120	61-120
602	BENZENE	WATER	1.0		UG/L	0.20	30	39-150	39-150
602	CHLOROBENZENE	WATER	1.0		UG/L	0.21	30	55-135	55-135
602	1,3-DICHLOROBENZENE (M)	WATER	1.0		UG/L	0.36	30	50-141	50-141
602	1,2-DICHLOROBENZENE (O)	WATER	1.0		UG/L	0.15	30	37-154	37-154
602	1,4-DICHLOROBENZENE (P)	WATER	1.0		UG/L	0.39	30	42-143	42-143
602	ETHYLBENZENE	WATER	1.0		UG/L	0.23	30	32-160	32-160
602	TOLUENE	WATER	1.0		UG/L	0.18	30	46-148	46-148
602	M+P-XYLENE	WATER	2.0		UG/L	0.36	30	70-130	50-150
602	O-XYLENE	WATER	1.0		UG/L	0.17	30	70-130	50-150
602	CHLOROFLUOROBENZENE (PID) -SURR	WATER	NA		UG/L	NA	NA	73-110	73-110
601/602 ADDITIONAL COMPOUNDS BY REQUEST									
	CIS-1,2-DICHLOROETHENE	WATER	1.0		UG/L	0.30	30	24-191	24-191
	FREON 113	WATER	1.0		UG/L	0.36	30	70-130	50-150
	METHYL-TERT-BUTYL ETHER (MTBE)	WATER	1.0		UG/L	0.25	30	70-130	50-150
	TOTAL XYLENES	WATER	3.0		UG/L	0.52	30	70-130	50-150

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
624 PPL	ACROLEIN	WATER	10		UG/L	4.0	30	36-124	36-124
624 PPL	ACRYLONITRILE	WATER	10		UG/L	1.2	30	71-111	71-111
624 PPL	BENZENE	WATER	1.0		UG/L	0.18	30	37-151	37-151
624 PPL	BROMODICHLOROMETHANE	WATER	1.0		UG/L	0.24	30	35-155	35-155
624 PPL	BROMOFORM	WATER	1.0		UG/L	0.57	30	45-169	45-169
624 PPL	BROMOMETHANE	WATER	1.0		UG/L	0.75	30	d-242	d-242
624 PPL	CARBON TETRACHLORIDE	WATER	1.0		UG/L	0.44	30	70-140	70-140
624 PPL	CHLOROBENZENE	WATER	1.0		UG/L	0.20	30	37-160	37-160
624 PPL	CHLOROETHANE	WATER	1.0		UG/L	0.33	30	14-230	14-230
624 PPL	2-CHLOROETHYLVINYL ETHER	WATER	10		UG/L	0.31	30	d-305	d-305
624 PPL	CHLOROFORM	WATER	1.0		UG/L	0.17	30	51-138	51-138
624 PPL	CHLOROMETHANE	WATER	1.0		UG/L	0.33	30	d-273	d-273
624 PPL	DIBROMOCHLOROMETHANE	WATER	1.0		UG/L	0.26	30	53-149	53-149
624 PPL	1,1-DICHLOROETHANE	WATER	1.0		UG/L	0.30	30	59-155	59-155
624 PPL	1,2-DICHLOROETHANE	WATER	1.0		UG/L	0.14	30	49-155	49-155
624 PPL	1,1-DICHLOROETHENE	WATER	1.0		UG/L	0.31	30	d-234	d-234
624 PPL	TRANS-1,2-DICHLOROETHENE	WATER	1.0		UG/L	0.22	30	54-156	54-156
624 PPL	1,2-DICHLOROPROPANE	WATER	1.0		UG/L	0.25	30	d-210	d-210
624 PPL	CIS-1,3-DICHLOROPROPENE	WATER	1.0		UG/L	0.36	30	d-227	d-227
624 PPL	TRANS-1,3-DICHLOROPROPENE	WATER	1.0		UG/L	0.23	30	17-183	17-183
624 PPL	ETHYLBENZENE	WATER	1.0		UG/L	0.17	30	37-162	37-162
624 PPL	METHYLENE CHLORIDE	WATER	1.0		UG/L	0.20	30	d-221	d-221
624 PPL	1,1,2,2-TETRACHLOROETHANE	WATER	1.0		UG/L	0.27	30	46-157	46-157
624 PPL	TETRACHLOROETHENE	WATER	1.0		UG/L	0.27	30	64-148	64-148
624 PPL	TOLUENE	WATER	1.0		UG/L	0.11	30	47-150	47-150
624 PPL	1,1,1-TRICHLOROETHANE	WATER	1.0		UG/L	0.13	30	52-162	52-162
624 PPL	1,1,2-TRICHLOROETHANE	WATER	1.0		UG/L	0.47	30	52-150	52-150
624 PPL	TRICHLOROETHENE	WATER	1.0		UG/L	0.26	30	71-157	71-157
624 PPL	VINYL CHLORIDE	WATER	1.0		UG/L	0.18	30	d-251	d-251
624	4-BROMOFLUOROBENZENE -SURR	WATER	NA		UG/L	NA	NA	77-117	77-117
624	DIBROMOFLUOROMETHANE-SURR	WATER	NA		UG/L	NA	NA	86-126	86-126
624	1,2-DICHLOROETHANE-D4 -SURR	WATER	NA		UG/L	NA	NA	85-122	85-122
624	TOLUENE-D8 -SURR	WATER	NA		UG/L	NA	NA	85-115	85-115

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
624 ADDITIONAL COMPOUNDS BY REQUEST									
624	1,1,1,2-TETRACHLOROETHANE	WATER	1.0		UG/L	0.37	30	70-130	50-150
624	1,2,3-TRICHLOROPROPANE	WATER	5.0		UG/L	0.10	30	70-130	50-150
624	1,2-DIBROMO-3-CHLOROPROPANE	WATER	1.0		UG/L	0.17	30	70-130	50-150
624	1,2-DIBROMOETHANE	WATER	1.0		UG/L	0.27	30	70-130	50-150
624	1,2-DICHLOROBENZENE	WATER	1.0		UG/L	0.31	30	18-190	18-190
624	1,3-DICHLOROBENZENE	WATER	1.0		UG/L	0.35	30	59-156	59-156
624	1,4-DICHLOROBENZENE	WATER	1.0		UG/L	0.20	30	18-190	18-190
624	1-BROMO-2-CHLOROETHANE	WATER	10		UG/L	1.9	30	70-130	50-150
624	2-BUTANONE (MEK)	WATER	10		UG/L	0.75	30	70-130	50-150
624	2-HEXANONE	WATER	10		UG/L	0.73	30	70-130	50-150
624	4-CHLOROBENZOFLUORIDE	WATER	10		UG/L	1.80	30	50-150	50-150
624	4-METHYL-2-PENTANONE (MIBK)	WATER	10		UG/L	0.54	30	70-130	50-150
624	ACETONE	WATER	10		UG/L	1.3	30	50-150	50-150
624	BROMOCHLOROMETHANE	WATER	1.0		UG/L	0.082	30	70-130	50-150
624	CARBON DISULFIDE	WATER	10		UG/L	0.99	30	70-130	50-150
624	CIS-1,2-DICHLOROETHENE	WATER	1.0		UG/L	0.33	30	70-130	50-150
624	DIBROMOMETHANE	WATER	1.0		UG/L	0.10	30	70-130	50-150
624	DICHLORODIFLUOROMETHANE	WATER	1.0		UG/L	0.29	30	70-130	50-150
624	IODOMETHANE	WATER	5.0		UG/L	1.2	30	70-130	50-150
624	ISOBUTYL ALCOHOL	WATER	100		UG/L	18	30	70-130	50-150
624	M+P XYLENE	WATER	2.0		UG/L	0.25	30	70-130	50-150
624	METHYL-TERT-BUTYL ETHER	WATER	1.0		UG/L	0.17	30	70-130	50-150
624	NAPHTHALENE	WATER	5.0		UG/L	0.14	30	70-130	50-150
624	O-XYLENE	WATER	1.0		UG/L	0.27	30	70-130	50-150
624	STYRENE	WATER	1.0		UG/L	0.33	30	70-130	50-150
624	TERT-BUTYL ALCOHOL	WATER	100		UG/L	3.9	30	50-150	50-150
624	TETRAHYDROFURAN	WATER	10		UG/L	1.1	30	50-150	50-150
624	TRANS-1,4-DICHLORO-2-BUTENE	WATER	1.0		UG/L	0.17	30	70-130	50-150
624	TRICHLOROFLUOROMETHANE	WATER	1.0		UG/L	0.42	30	17-181	17-181
624	TRICHLOROTRIFLUOROETHANE	WATER	1.0		UG/L	0.35	30	70-130	50-150
624	VINYL ACETATE	WATER	5.0		UG/L	0.45	30	50-150	50-150

Columbia Analytical Services

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
625 PPL	1,2,4-TRICHLOROBENZENE	WATER	5.0		UG/L	0.65	30	44-142	44-142
625 PPL	1,2-DICHLOROBENZENE	WATER	5.0		UG/L	0.67	30	32-129	32-129
625 PPL	1,2-DIPHENYLHYDRAZINE	WATER	5.0		UG/L	0.48	30	59-113	59-113
625 PPL	1,3-DICHLOROBENZENE	WATER	5.0		UG/L	0.50	30	d-172	d-172
625 PPL	1,4-DICHLOROBENZENE	WATER	5.0		UG/L	0.58	30	20-124	20-124
625 PPL	2,2-OXYBIS(1-CHLOROPROPANE)	WATER	5.0		UG/L	0.78	30	36-166	36-166
625 PPL	2,4,6-TRICHLOROPHENOL	WATER	5.0		UG/L	0.59	30	37-144	37-144
625 PPL	2,4-DICHLOROPHENOL	WATER	5.0		UG/L	0.37	30	39-135	39-135
625 PPL	2,4-DIMETHYLPHENOL	WATER	5.0		UG/L	1.8	30	39-135	39-135
625 PPL	2,4-DINITROPHENOL	WATER	50		UG/L	14	30	d-191	d-191
625 PPL	2,4-DINITROTOLUENE	WATER	5.0		UG/L	0.53	30	39-139	39-139
625 PPL	2,6-DINITROTOLUENE	WATER	5.0		UG/L	0.55	30	50-158	50-158
625 PPL	2-CHLORONAPHTHALENE	WATER	5.0		UG/L	0.55	30	60-118	60-118
625 PPL	2-CHLOROPHENOL	WATER	5.0		UG/L	0.69	30	23-134	23-134
625 PPL	2-NITROPHENOL	WATER	5.0		UG/L	0.61	30	29-182	29-182
625 PPL	3,3'-DICHLOROBENZIDINE	WATER	5.0		UG/L	0.73	30	d-262	d-262
625 PPL	4,6-DINITRO-2-METHYLPHENOL	WATER	50		UG/L	0.51	30	d-181	d-181
625 PPL	4-BROMOPHENYL-PHENYLETHER	WATER	5.0		UG/L	0.67	30	53-127	53-127
625 PPL	4-CHLORO-3-METHYLPHENOL	WATER	5.0		UG/L	0.50	30	22-147	22-147
625 PPL	4-CHLOROPHENYL-PHENYLETHER	WATER	5.0		UG/L	0.49	30	25-158	25-158
625 PPL	4-NITROPHENOL	WATER	50		UG/L	6.7	30	d-132	d-132
625 PPL	ACENAPHTHENE	WATER	5.0		UG/L	0.48	30	47-145	47-145
625 PPL	ACENAPHTHYLENE	WATER	5.0		UG/L	0.33	30	33-145	33-145
625 PPL	ANTHRACENE	WATER	5.0		UG/L	0.60	30	27-133	27-133
625 PPL	BENZIDINE	WATER	100		UG/L	43	30	10-113	10-113
625 PPL	BENZO(A)ANTHRACENE	WATER	5.0		UG/L	0.54	30	33-143	33-143
625 PPL	BENZO(A)PYRENE	WATER	5.0		UG/L	0.42	30	17-163	17-163
625 PPL	BENZO(B)FLUORANTHENE	WATER	5.0		UG/L	0.54	30	24-159	24-159
625 PPL	BENZO(G,H,I)PERYLENE	WATER	5.0		UG/L	0.62	30	d-219	d-219
625 PPL	BENZO(K)FLUORANTHENE	WATER	5.0		UG/L	0.53	30	11-162	11-162
625 PPL	BIS(-2-CHLOROETHOXY)METHANE	WATER	5.0		UG/L	0.86	30	33-184	33-184
625 PPL	BIS(2-CHLOROETHYL)ETHER	WATER	5.0		UG/L	0.74	30	12-158	12-158
625 PPL	BIS(2-ETHYLHEXYL)PHTHALATE	WATER	5.0		UG/L	0.48	30	8-158	8-158
625 PPL	BUTYL BENZYL PHTHALATE	WATER	5.0		UG/L	0.59	30	d-152	d-152
625 PPL	CHRYSENE	WATER	5.0		UG/L	0.53	30	17-168	17-168
625 PPL	DIBENZO(A,H)ANTHRACENE	WATER	5.0		UG/L	0.63	30	d-227	d-227
625 PPL	DIETHYLPHTHALATE	WATER	5.0		UG/L	0.31	30	d-114	d-114
625 PPL	DIMETHYL PHTHALATE	WATER	5.0		UG/L	0.53	30	d-112	d-112
625 PPL	DI-N-BUTYLPHTHALATE	WATER	5.0		UG/L	0.39	30	1-118	1-118
625 PPL	DI-N-OCTYL PHTHALATE	WATER	5.0		UG/L	0.45	30	4-146	4-146
625 PPL	FLUORANTHENE	WATER	5.0		UG/L	0.32	30	26-137	26-137
625 PPL	FLUORENE	WATER	5.0		UG/L	0.47	30	59-121	59-121
625 PPL	HEXACHLOROBENZENE	WATER	5.0		UG/L	0.43	30	d-152	d-152
625 PPL	HEXACHLOROBUTADIENE	WATER	5.0		UG/L	0.69	30	24-116	24-116
625 PPL	HEXACHLOROCYCLOPENTADIENE	WATER	5.0		UG/L	1.1	30	10-130	10-130
625 PPL	HEXACHLOROETHANE	WATER	5.0		UG/L	0.48	30	40-113	40-113
625 PPL	INDENO(1,2,3-CD)PYRENE	WATER	5.0		UG/L	0.49	30	d-171	d-171
625 PPL	ISOPHORONE	WATER	5.0		UG/L	0.61	30	21-196	21-196
625 PPL	NAPHTHALENE	WATER	5.0		UG/L	0.62	30	21-133	21-133
625 PPL	NITROBENZENE	WATER	5.0		UG/L	0.78	30	35-180	35-180
625 PPL	N-NITROSODIMETHYLAMINE	WATER	5.0		UG/L	0.79	30	27-130	27-130
625 PPL	N-NITROSO-DI-N-PROPYLAMINE	WATER	5.0		UG/L	1.19	30	d-230	d-230
625 PPL	N-NITROSODIPHENYLAMINE	WATER	5.0		UG/L	0.75	30	70-130	70-130
625 PPL	PENTACHLOROPHENOL	WATER	50		UG/L	0.60	30	14-176	14-176
625 PPL	PHENANTHRENE	WATER	5.0		UG/L	0.45	30	54-120	54-120
625 PPL	PHENOL	WATER	5.0		UG/L	0.54	30	5-112	5-112
625 PPL	PYRENE	WATER	5.0		UG/L	0.65	30	52-115	52-115
625	TERPHENYL-d14 -SURR	WATER	NA		UG/L	NA	NA	45-135	45-135
625	NITROBENZENE-d5 -SURR	WATER	NA		UG/L	NA	NA	41-129	41-129
625	PHENOL-d6 -SURR	WATER	NA		UG/L	NA	NA	15-58	15-58
625	2-FLUOROBIPHENYL -SURR	WATER	NA		UG/L	NA	NA	51-111	51-111
625	2-FLUOROPHENOL -SURR	WATER	NA		UG/L	NA	NA	27-78	27-78
625	2,4,6-TRIBROMOPHENOL -SURR	WATER	NA		UG/L	NA	NA	44-146	44-146
625 ADDITIONAL COMPOUNDS BY REQUEST									
625	1,1-BIPHENYL	WATER	5.0		UG/L	0.55	30	50-130	50-130

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
625	1-METHYLNAPHTHALENE	WATER	5.0		UG/L	0.62	30	50-130	50-130
625	2,4,5-TRICHLOROPHENOL	WATER	5.0		UG/L	0.84	30	40-110	40-110
625	2-CHLOROPYRIDINE	WATER	10		UG/L	0.42	30	58-130	50-130
625	2-METHYLNAPHTHALENE	WATER	5.0		UG/L	0.45	30	42-107	42-107
625	2-METHYLPHENOL	WATER	5.0		UG/L	0.79	30	16-102	16-102
625	2-NITROANILINE	WATER	50		UG/L	0.59	30	63-112	63-112
625	3-CHLOROPYRIDINE	WATER	10		UG/L	0.67	30	56-130	50-130
625	3-NITROANILINE	WATER	50		UG/L	0.43	30	56-111	56-111
625	4-CHLOROANILINE	WATER	5.0		UG/L	0.72	30	39-107	39-107
625	4-METHYLPHENOL	WATER	5.0		UG/L	1.5	30	26-99	26-99
625	4-NITROANILINE	WATER	50		UG/L	0.59	30	50-130	50-130
625	ACETOPHENONE	WATER	5.0		UG/L	1.35	30	40-130	40-130
625	ANILINE	WATER	5.0		UG/L	0.78	30	13-123	13-123
625	ATRAZINE	WATER	5.0		UG/L	1.3	30	50-130	50-130
625	BENZALDEHYDE	WATER	5.0		UG/L	1.3	30	50-130	50-130
625	BENZOIC ACID	WATER	50		UG/L	15	30	30-130	30-130
625	BENZYL ALCOHOL	WATER	5.0		UG/L	1.1	30	31-109	31-109
625	CAPROLACTAM	WATER	50		UG/L	1.0	30	50-130	50-130
625	CARBAZOLE	WATER	5.0		UG/L	0.47	30	70-130	70-130
625	DIBENZOFURAN	WATER	5.0		UG/L	0.41	30	70-130	70-130
625	PYRIDINE	WATER	5.0		UG/L	1.0	30	10-130	10-130
680	MONOCHLOROBIPHENYLS, TOTAL	WATER	0.005		UG/L	0.0017	30	50-125	50-125
680	DICHLOROBIPHENYLS, TOTAL	WATER	0.006		UG/L	0.0014	30	50-125	50-125
680	TRICHLOROBIPHENYLS, TOTAL	WATER	0.006		UG/L	0.0015	30	50-125	50-125
680	TETRACHLOROBIPHENYLS, TOTAL	WATER	0.010		UG/L	0.0023	30	50-125	50-125
680	PENTACHLOROBIPHENYLS, TOTAL	WATER	0.010		UG/L	0.0045	30	50-125	50-125
680	HEXACHLOROBIPHENYLS, TOTAL	WATER	0.020		UG/L	0.0032	30	50-125	50-125
680	HEPTACHLOROBIPHENYLS, TOTAL	WATER	0.020		UG/L	0.0033	30	50-125	50-125
680	OCTACHLOROBIPHENYLS, TOTAL	WATER	0.040		UG/L	0.0054	30	50-125	50-125
680	NONACHLOROBIPHENYLS, TOTAL	WATER	0.025		UG/L	0.0057	30	50-125	50-125
680	DECACHLOROBIPHENYLS, TOTAL	WATER	0.040		UG/L	0.0085	30	50-125	50-125
680	GAMMA-BHC -SURR	WATER	NA		UG/L	NA	30	59-128	59-128
680	4-4'-DDT -SURR	WATER	NA		UG/L	NA	30	45-155	45-155
680	MONOCHLOROBIPHENYLS, TOTAL	SOIL			UG/KG		30	30-130	30-130
680	DICHLOROBIPHENYLS, TOTAL	SOIL			UG/KG		30	30-130	30-130
680	TRICHLOROBIPHENYLS, TOTAL	SOIL			UG/KG		30	30-130	30-130
680	TETRACHLOROBIPHENYLS, TOTAL	SOIL			UG/KG		30	30-130	30-130
680	PENTACHLOROBIPHENYLS, TOTAL	SOIL			UG/KG		30	30-130	30-130
680	HEXACHLOROBIPHENYLS, TOTAL	SOIL			UG/KG		30	30-130	30-130
680	HEPTACHLOROBIPHENYLS, TOTAL	SOIL			UG/KG		30	30-130	30-130
680	OCTACHLOROBIPHENYLS, TOTAL	SOIL			UG/KG		30	30-130	30-130
680	NONACHLOROBIPHENYLS, TOTAL	SOIL			UG/KG		30	30-130	30-130
680	DECACHLOROBIPHENYLS, TOTAL	SOIL			UG/KG		30	30-130	30-130
680	GAMMA-BHC -SURR	SOIL	NA		UG/KG	NA	NA	30-150	30-150
680	4-4'-DDT -SURR	SOIL	NA		UG/KG	NA	NA	30-150	30-150
8011	1,2-DIBROMOETHANE	WATER	0.06		UG/L	0.0062	30	70-130	50-150
8011	1,2-DIBROMO-3-CHLOROPROPANE	WATER	0.06		UG/L	0.0057	30	70-130	50-150
8011	TETRACHLORO-META-XYLENE (TCMX) -SU	WATER	NA		UG/L	NA	NA	70-130	50-150

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8015B-SVOA-SILOX	N,N-DIMETHYLFORAMIDE	WATER	2000		UG/L	411	30	50-150	50-150
8015B-SVOA-SILOX	HEXAMETHYLCYCLOTRISILOXANE	WATER	2000		UG/L	447	30	50-150	50-150
8015B-SVOA-SILOX	OCTAMETHYLCYCLOTRISILOXANE	WATER	2000		UG/L	460	30	50-150	50-150
8015B-SVOA-SILOX	OCTAMETHYLTETRASILOXANE	WATER	2000		UG/L	473	30	50-150	50-150
8015B-SVOA(WAPA)	1,4-DIOXANE	WATER	1000		UG/L	310	30	70-130	70-130
8015B-SVOA(WAPA)	2-PROPANOL (ISOPROPANOL)	WATER	1000		UG/L	339	30	70-130	70-130
8015B-SVOA(WAPA)	ETHYL ACETATE	WATER	1000		UG/L	320	30	70-130	70-130
8015B-SVOA(WAPA)	ISOBUTYL ALCOHOL (ISOBUTANOL)	WATER	1000		UG/L	275	30	50-150	50-150
8015B-SVOA(WAPA)	METHANOL	WATER	1000		UG/L	260	30	70-130	50-150
8015B-SVOA(WAPA)	N-BUTANOL (1-BUTANOL)	WATER	1000		UG/L	322	30	70-130	70-130
8015B-SVOA	1-BUTANOL (N-BUTANOL)	WATER	1000		UG/L	320	30	70-130	70-130
8015B-SVOA	1-METHOXY-2-PROPANOL	WATER	1000		UG/L	190	30	70-130	70-130
8015B-SVOA	1-PROPANOL (N-PROPANOL)	WATER	1000		UG/L	215	30	65-143	65-143
8015B-SVOA	2-ETHOXYETHANOL (CELLOSOLVE)	WATER	1000		UG/L	130	30	70-130	50-150
8015B-SVOA	2-ETHYLHEXANOL	WATER	1000		UG/L	464	30	70-130	50-150
8015B-SVOA	2-PROPANOL (ISOPROPANOL)	WATER	1000		UG/L	340	30	70-130	70-130
8015B-SVOA	DIMETHYLSULFOXIDE	WATER	1000		UG/L		30	50-150	50-150
8015B-SVOA	ETHANOL	WATER	1000		UG/L	440	30	70-130	50-150
8015B-SVOA	ETHER (DIETHYL ETHER)	WATER	1000		UG/L	296	30	50-150	50-150
8015B-SVOA	ETHYL ACETATE	WATER	1000		UG/L	320	30	70-130	70-130
8015B-SVOA	ISOPROPYL ETHER	WATER	1000		UG/L	135	30	50-150	50-150
8015B-SVOA	METHANOL	WATER	1000		UG/L	260	30	70-130	50-150
8015B-SVOA	METHYL CELLOSOLVE (2-METHOXYETHANO	WATER	1000		UG/L	79	30	50-150	70-130
8015B-SVOA	METHYL-TERT-BUTYL ETHER	WATER	1000		UG/L		30	70-130	70-130
8015B-SVOA	N-BUTYL ACETATE	WATER	1000		UG/L		30	40-150	40-150
8015B-SVOA	N-PROPYL ACETATE	WATER	1000		UG/L		30	40-150	40-150
8015B-SVOA	SEC-BUTANOL (2-BUTANOL)	WATER	1000		UG/L	260	30	70-130	50-150
8015B-SVOA	TETRAHYDROFURAN	WATER	1000		UG/L		30	50-150	50-150
8015B-SVOA	1-PROPANOL-OPTIONAL SURR	WATER	NA		UG/L	NA	NA	50-150	50-150
8015B-SVOA	2-HEXANONE-OPTIONAL SURR	WATER	NA		UG/L	NA	NA	50-150	50-150
8015B-SVOA	n-BUTANOL-OPTIONAL SURR	WATER	NA		UG/L	NA	NA	50-150	50-150
8015B -VOA	METHANOL	WATER	1000		UG/L	488	30	70-130	50-150
8015B -VOA	ETHANOL	WATER	1000		UG/L	267	30	70-130	50-150
8015B -VOA	ISOPROPANOL	WATER	1000		UG/L	164	30	70-130	50-150
8015B -VOA	N-PROPANOL	WATER	1000		UG/L	279	30	70-130	50-150
8015B -VOA	SEC-BUTANOL	WATER	1000		UG/L	214	30	70-130	50-150
8015B -VOA	N-BUTANOL	WATER	1000		UG/L	172	30	70-130	50-150
8015B -VOA	N-PROPANOL -SURR/TARGET	WATER	NA		UG/L	NA	NA	65-143	65-143
8015B -VOA	MINERAL SPIRITS	WATER	100		UG/L	35	30	41-145	41-145
8015B -VOA	1,4-DIFLUOROBENZENE -SURR	WATER	NA		UG/L	NA	NA	59-122	59-122
8015B -VOA	MINERAL SPIRITS	SOIL	100		UG/KG		30	70-130	50-150
8015B -VOA	1,4-DIFLUOROBENZENE -SURR	SOIL	NA		UG/KG	NA	NA	85-115	85-115
8015B	GASOLINE RANGE ORGANICS	WATER	50		UG/L	10	30	70-130	50-150
8015B	CHLOROFLUOROBENZENE (FID) -SURR	WATER	NA		UG/L	NA	NA	65-136	65-136
8015B	GASOLINE RANGE ORGANICS	SOIL	50		UG/KG	7.7	50	70-130	50-150
8015B	CHLOROFLUOROBENZENE (FID) -SURR	SOIL	NA		UG/KG	NA	NA	44-131	44-131
8015B	DIESEL RANGE ORGANICS	WATER	100		UG/L	61	30	10-154	10-154
8015B	O-TERPHENYL -SURR	WATER	NA		UG/L	NA	NA	56-128	56-128
8015B	DIESEL RANGE ORGANICS	SOIL	40000		UG/KG	13000	50	51-114	51-114
8015B	O-TERPHENYL -SURR	SOIL	NA		UG/KG	NA	NA	68-138	68-138

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8015B ETPH-CT	ETPH	WATER	75		UG/L	14	30	50-150	50-150
8015B ETPH-CT	FUEL OIL #2	WATER	100		UG/L	11	30	50-150	50-150
8015B ETPH-CT	FUEL OIL #4	WATER	100		UG/L	NA	30	50-150	50-150
8015B ETPH-CT	FUEL OIL #6	WATER	100		UG/L	NA	30	50-150	50-150
8015B ETPH-CT	KEROSENE	WATER	100		UG/L	NA	30	50-150	50-150
8015B ETPH-CT	MOTOR OIL	WATER	1000		UG/L	NA	30	50-150	50-150
8015B ETPH-CT	O-TERPHENYL-SURR	WATER	NA		UG/L	NA	NA	44-148	44-148
8015B ETPH-CT	ETPH	SOIL	2500		UG/KG		30	50-150	50-150
8015B ETPH-CT	FUEL OIL #2	SOIL	3300		UG/KG		30	50-150	50-150
8015B ETPH-CT	FUEL OIL #4	SOIL	3300		UG/KG		30	50-150	50-150
8015B ETPH-CT	FUEL OIL #6	SOIL	3300		UG/KG		30	50-150	50-150
8015B ETPH-CT	KEROSENE	SOIL	3300		UG/KG		30	50-150	50-150
8015B ETPH-CT	MOTOR OIL	SOIL	33000		UG/KG		30	50-150	50-150
8015B ETPH-CT	O-TERPHENYL-SURR	SOIL	NA		UG/KG	NA	NA	25-148	25-148
8015B FINGERPRINT	FUEL OIL #2	WATER	1000		UG/L	220	30	50-150	50-150
8015B FINGERPRINT	GASOLINE	WATER	1000		UG/L	190	30	50-150	50-150
8015B FINGERPRINT	KEROSENE	WATER	1000		UG/L	290	30	50-150	50-150
8015B FINGERPRINT	MINERAL SPIRITS	WATER	1000		UG/L		30	50-150	50-150
8015B FINGERPRINT	MOTOR OIL	WATER	10000		UG/L		30	50-150	50-150
8015B FINGERPRINT	FUEL OIL #2	SOIL	100		MG/KG	29	30	50-150	50-150
8015B FINGERPRINT	GASOLINE	SOIL	100		MG/KG	23	30	50-150	50-150
8015B FINGERPRINT	KEROSENE	SOIL	100		MG/KG	66	30	50-150	50-150
8015B FINGERPRINT	MINERAL SPIRITS	SOIL	100		MG/KG		30	50-150	50-150
8015B FINGERPRINT	MOTOR OIL	SOIL	1000		MG/KG		30	50-150	50-150
8015B RSK	ETHANE	WATER	1.0		UG/L	0.11	30	50-150	50-150
8015B RSK	ETHYLENE	WATER	1.0		UG/L	0.11	30	50-150	50-150
8015B RSK	METHANE	WATER	2.0		UG/L	0.18	30	50-150	50-150
8015B RSK	PROPANE	WATER	1.0		UG/L	0.34	30	50-150	50-150
8015B RSK	ACETYLENE	WATER	3.0		UG/L	0.13	30	50-150	50-150
NY 310-13	FUEL OIL #2	WATER	1000		UG/L	220	30	46-150	46-150
NY 310-13	FUEL OIL #4	WATER	1000		UG/L	410	30	50-150	50-150
NY 310-13	FUEL OIL #6	WATER	1000		UG/L	400	30	50-150	50-150
NY 310-13	GASOLINE	WATER	1000		UG/L	190	30	50-150	50-150
NY 310-13	KEROSENE	WATER	1000		UG/L	290	30	50-150	50-150
NY 310-13	LUBE OIL	WATER	1000		UG/L	250	30	50-150	50-150
NY 310-13	N-DODECANE	WATER	1000		UG/L	120	30	50-150	50-150
NY 310-13	FUEL OIL #2	SOIL	100		MG/KG	29	30	70-155	70-155
NY 310-13	FUEL OIL #4	SOIL	100		MG/KG	22	30	50-150	50-150
NY 310-13	FUEL OIL #6	SOIL	100		MG/KG	26	30	50-150	50-150
NY 310-13	GASOLINE	SOIL	100		MG/KG	23	30	50-150	50-150
NY 310-13	KEROSENE	SOIL	100		MG/KG	66	30	50-150	50-150
NY 310-13	LUBE OIL	SOIL	100		MG/KG	29	30	50-150	50-150
NY 310-13	N-DODECANE	SOIL	100		MG/KG	8.5	30	50-150	50-150

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8021	1,1,2,2-TETRACHLOROETHANE	WATER	1.0		UG/L	0.25	30	70-130	70-130
8021	1,1,2-TRICHLOROETHANE	WATER	1.0		UG/L	0.17	30	70-130	70-130
8021	1,1-DICHLOROETHANE	WATER	1.0		UG/L	0.21	30	70-130	70-130
8021	1,1-DICHLOROETHENE	WATER	1.0		UG/L	0.27	30	70-130	70-130
8021	1,2-DICHLOROBENZENE	WATER	1.0		UG/L	0.17	30	70-130	70-130
8021	1,2-DICHLOROETHANE	WATER	1.0		UG/L	0.15	30	70-130	70-130
8021	1,2-DICHLOROPROPANE	WATER	1.0		UG/L	0.16	30	70-130	70-130
8021	1,3-DICHLOROBENZENE	WATER	1.0		UG/L	0.17	30	70-130	70-130
8021	1,4-DICHLOROBENZENE	WATER	1.0		UG/L	0.16	30	70-130	70-130
8021	2-CHLOROETHYLVINYL ETHER	WATER	1.0		UG/L	0.14	30	50-150	50-150
8021	BENZENE	WATER	1.0		UG/L	0.31	30	70-130	70-130
8021	BROMODICHLOROMETHANE	WATER	1.0		UG/L	0.34	30	70-130	70-130
8021	BROMOFORM	WATER	1.0		UG/L	0.17	30	70-130	70-130
8021	BROMOMETHANE	WATER	2.0		UG/L	0.12	30	50-150	50-150
8021	CARBON TETRACHLORIDE	WATER	1.0		UG/L	0.42	30	70-130	70-130
8021	CHLOROBENZENE	WATER	1.0		UG/L	0.22	30	70-130	70-130
8021	CHLOROETHANE	WATER	1.0		UG/L	0.48	30	50-150	50-150
8021	CHLOROFORM	WATER	1.0		UG/L	0.30	30	70-130	70-130
8021	CHLOROMETHANE	WATER	1.0		UG/L	0.39	30	50-150	50-150
8021	CIS-1,2-DICHLOROETHENE	WATER	1.0		UG/L	0.23	30	70-130	70-130
8021	CIS-1,3-DICHLOROPROPENE	WATER	1.0		UG/L	0.21	30	70-130	70-130
8021	DIBROMOCHLOROMETHANE	WATER	1.0		UG/L	0.11	30	70-130	70-130
8021	DICHLORODIFLUOROMETHANE	WATER	1.0		UG/L	0.29	30	50-150	50-150
8021	ETHYLBENZENE	WATER	1.0		UG/L	0.23	30	70-130	70-130
8021	FREON 113	WATER	1.0		UG/L	0.38	30	70-130	70-130
8021	M+P-XYLENE	WATER	2.0		UG/L	0.36	30	70-130	70-130
8021	METHYLENE CHLORIDE	WATER	1.0		UG/L	0.24	30	70-130	70-130
8021	O-XYLENE	WATER	1.0		UG/L	0.17	30	70-130	70-130
8021	TETRACHLOROETHENE	WATER	1.0		UG/L	0.30	30	70-130	70-130
8021	TOLUENE	WATER	1.0		UG/L	0.18	30	70-130	70-130
8021	TRANS-1,2-DICHLOROETHENE	WATER	1.0		UG/L	0.26	30	70-130	70-130
8021	TRANS-1,3-DICHLOROPROPENE	WATER	1.0		UG/L	0.19	30	70-130	70-130
8021	TRICHLOROETHENE	WATER	1.0		UG/L	0.15	30	70-130	70-130
8021	TRICHLOROFLUOROMETHANE	WATER	1.0		UG/L	0.42	30	50-150	50-150
8021	VINYL CHLORIDE	WATER	1.0		UG/L	0.41	30	50-150	50-150
8021	1,2,3 TRICHLOROPROPANE -SURR	WATER	NA		UG/L	NA	NA	61-117	61-117
8021	BROMOCHLOROMETHANE -SURR	WATER	NA		UG/L	NA	NA	70-114	70-114
8021	CHLOROFLUOROBENZENE-SURR	WATER	NA		UG/L	NA	NA	72-116	72-116
8021	CHLOROFLUOROBENZENE (PID) -SURR	WATER	NA		UG/L	NA	NA	77-113	77-113

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8021	1,1,1-TRICHLOROETHANE	SOIL	1.0		UG/KG	0.33	30	70-130	70-130
8021	1,1,2,2-TETRACHLOROETHANE	SOIL	1.0		UG/KG	0.10	30	70-130	70-130
8021	1,1,2-TRICHLOROETHANE	SOIL	1.0		UG/KG	0.25	30	70-130	70-130
8021	1,1-DICHLOROETHANE	SOIL	1.0		UG/KG	0.27	30	70-130	70-130
8021	1,1-DICHLOROETHENE	SOIL	1.0		UG/KG	0.29	30	70-130	70-130
8021	1,2-DICHLOROBENZENE	SOIL	1.0		UG/KG	0.22	30	70-130	70-130
8021	1,2-DICHLOROETHANE	SOIL	1.0		UG/KG	0.29	30	70-130	70-130
8021	1,2-DICHLOROPROPANE	SOIL	1.0		UG/KG	0.20	30	70-130	70-130
8021	1,3-DICHLOROBENZENE	SOIL	1.0		UG/KG	0.23	30	70-130	70-130
8021	1,4-DICHLOROBENZENE	SOIL	1.0		UG/KG	0.20	30	70-130	70-130
8021	2-CHLOROETHYLVINYL ETHER	SOIL	1.0		UG/KG	0.12	30	50-150	50-150
8021	BENZENE	SOIL	1.0		UG/KG	0.20	30	70-130	70-130
8021	BROMODICHLOROMETHANE	SOIL	1.0		UG/KG	0.20	30	70-130	70-130
8021	BROMOFORM	SOIL	1.0		UG/KG	0.12	30	70-130	70-130
8021	BROMOMETHANE	SOIL	2.0		UG/KG	0.26	30	50-150	50-150
8021	CARBON TETRACHLORIDE	SOIL	1.0		UG/KG	0.34	30	70-130	70-130
8021	CHLOROBENZENE	SOIL	1.0		UG/KG	0.23	30	70-130	70-130
8021	CHLOROETHANE	SOIL	1.0		UG/KG	0.29	30	50-150	50-150
8021	CHLOROFORM	SOIL	1.0		UG/KG	0.26	30	70-130	70-130
8021	CHLOROMETHANE	SOIL	1.0		UG/KG	0.64	30	50-150	50-150
8021	CIS-1,2-DICHLOROETHENE	SOIL	1.0		UG/KG	0.25	30	70-130	70-130
8021	CIS-1,3-DICHLOROPROPENE	SOIL	1.0		UG/KG	0.23	30	70-130	70-130
8021	DIBROMOCHLOROMETHANE	SOIL	1.0		UG/KG	0.23	30	70-130	70-130
8021	ETHYLBENZENE	SOIL	1.0		UG/KG	0.21	30	70-130	70-130
8021	FREON 113	SOIL	1.0		UG/KG	0.28	30	70-130	70-130
8021	M+P-XYLENE	SOIL	2.0		UG/KG	0.39	30	70-130	70-130
8021	METHYLENE CHLORIDE	SOIL	1.0		UG/KG	0.63	30	70-130	70-130
8021	O-XYLENE	SOIL	1.0		UG/KG	0.19	30	70-130	70-130
8021	TETRACHLOROETHENE	SOIL	1.0		UG/KG	0.27	30	70-130	70-130
8021	TOLUENE	SOIL	1.0		UG/KG	0.17	30	70-130	70-130
8021	TRANS-1,2-DICHLOROETHENE	SOIL	1.0		UG/KG	0.27	30	70-130	70-130
8021	TRANS-1,3-DICHLOROPROPENE	SOIL	1.0		UG/KG	0.21	30	70-130	70-130
8021	TRICHLOROETHENE	SOIL	1.0		UG/KG	0.25	30	70-130	70-130
8021	TRICHLOROFLUOROMETHANE	SOIL	1.0		UG/KG	0.26	30	50-150	50-150
8021	VINYL CHLORIDE	SOIL	1.0		UG/KG	0.80	30	50-150	50-150
8021	1,2,3-TRICHLOROPROPANE -SURR	SOIL	NA		UG/KG	NA	NA	57-141	57-141
8021	CHLOROFLUOROBENZENE -SURR	SOIL	NA		UG/KG	NA	NA	41-146	41-146
8021	CHLOROFLUOROBENZENE (PID) -SURR	SOIL	NA		UG/KG	NA	NA	20-155	20-155
8021	BROMOCHLOROMETHANE -SURR	SOIL	NA		UG/KG	NA	NA	64-130	64-130

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8021 STARS	1,2,4-TRIMETHYLBENZENE	WATER	1.0		UG/L	0.27	30	70-130	70-130
8021 STARS	1,3,5-TRIMETHYLBENZENE	WATER	1.0		UG/L	0.24	30	70-130	70-130
8021 STARS	BENZENE	WATER	0.7		UG/L	0.18	30	70-130	70-130
8021 STARS	ETHYLBENZENE	WATER	1.0		UG/L	0.21	30	70-130	70-130
8021 STARS	ISOPROPYLBENZENE	WATER	1.0		UG/L	0.18	30	70-130	70-130
8021 STARS	M+P-XYLENE	WATER	2.0		UG/L	0.41	30	70-130	70-130
8021 STARS	METHYL-TERT-BUTYLETHER	WATER	1.0		UG/L	0.29	30	70-130	70-130
8021 STARS	NAPHTHALENE	WATER	1.0		UG/L	0.73	30	70-130	70-130
8021 STARS	N-BUTYLBENZENE	WATER	1.0		UG/L	0.24	30	70-130	70-130
8021 STARS	N-PROPYLBENZENE	WATER	1.0		UG/L	0.21	30	70-130	70-130
8021 STARS	O-XYLENE	WATER	1.0		UG/L	0.28	30	70-130	70-130
8021 STARS	P-ISOPROPYLTOLUENE	WATER	1.0		UG/L	0.25	30	70-130	70-130
8021 STARS	SEC-BUTYLBENZENE	WATER	1.0		UG/L	0.20	30	70-130	70-130
8021 STARS	TERT-BUTYLBENZENE	WATER	1.0		UG/L	0.19	30	70-130	70-130
8021 STARS	TOLUENE	WATER	1.0		UG/L	0.20	30	70-130	70-130
8021 STARS	CHLOROFLUOROBENZENE (PID) -SURR	WATER	NA		UG/L	NA	NA	77-113	77-113
8021 STARS	1,2,4-TRIMETHYLBENZENE	SOIL	1.0		UG/KG	0.29	30	70-130	70-130
8021 STARS	1,3,5-TRIMETHYLBENZENE	SOIL	1.0		UG/KG	0.23	30	70-130	70-130
8021 STARS	BENZENE	SOIL	1.0		UG/KG	0.19	30	70-130	70-130
8021 STARS	ETHYLBENZENE	SOIL	1.0		UG/KG	0.19	30	70-130	70-130
8021 STARS	ISOPROPYLBENZENE	SOIL	1.0		UG/KG	0.21	30	70-130	70-130
8021 STARS	M+P-XYLENE	SOIL	2.0		UG/KG	0.44	30	70-130	70-130
8021 STARS	METHYL-TERT-BUTYLETHER	SOIL	1.0		UG/KG	0.25	30	70-130	70-130
8021 STARS	NAPHTHALENE	SOIL	1.0		UG/KG	0.27	30	70-130	70-130
8021 STARS	N-BUTYLBENZENE	SOIL	1.0		UG/KG	0.25	30	70-130	70-130
8021 STARS	N-PROPYLBENZENE	SOIL	1.0		UG/KG	0.23	30	70-130	70-130
8021 STARS	O-XYLENE	SOIL	1.0		UG/KG	0.19	30	70-130	70-130
8021 STARS	P-ISOPROPYLTOLUENE	SOIL	1.0		UG/KG	0.23	30	70-130	70-130
8021 STARS	SEC-BUTYLBENZENE	SOIL	1.0		UG/KG	0.20	30	70-130	70-130
8021 STARS	TERT-BUTYLBENZENE	SOIL	1.0		UG/KG	0.24	30	70-130	70-130
8021 STARS	TOLUENE	SOIL	1.0		UG/KG	0.17	30	70-130	70-130
8021 STARS	CHLOROFLUOROBENZENE (PID) -SURR	SOIL	NA		UG/KG	NA	NA	20-155	20-155

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8081A TCL	4,4'-DDD	WATER	0.10		UG/L	0.0051	30	63-107	63-107
8081A TCL	4,4'-DDE	WATER	0.10		UG/L	0.0032	30	30-127	30-127
8081A TCL	4,4'-DDT	WATER	0.10		UG/L	0.0079	30	39-154	39-154
8081A TCL	ALDRIN	WATER	0.05		UG/L	0.0034	30	24-122	24-122
8081A TCL	ALPHA-BHC	WATER	0.05		UG/L	0.0023	30	70-130	50-150
8081A TCL	ALPHA-CHLORDANE	WATER	0.05		UG/L	0.0022	30	36-127	36-127
8081A TCL	ALPHA-ENDOSULFAN	WATER	0.05		UG/L	0.0019	30	39-125	39-125
8081A TCL	BETA-BHC	WATER	0.05		UG/L	0.0046	30	63-107	63-107
8081A TCL	BETA-ENDOSULFAN	WATER	0.10		UG/L	0.0049	30	64-107	64-107
8081A TCL	DELTA-BHC	WATER	0.05		UG/L	0.0026	30	49-116	49-116
8081A TCL	DIELDRIN	WATER	0.10		UG/L	0.0051	30	37-151	37-151
8081A TCL	ENDOSULFAN SULFATE	WATER	0.10		UG/L	0.0022	30	17-134	17-134
8081A TCL	ENDRIN	WATER	0.10		UG/L	0.0052	30	39-146	39-146
8081A TCL	ENDRIN ALDEHYDE	WATER	0.10		UG/L	0.0033	30	10-115	10-115
8081A TCL	ENDRIN KETONE	WATER	0.10		UG/L	0.0021	30	70-110	70-130
8081A TCL	GAMMA-BHC (LINDANE)	WATER	0.05		UG/L	0.0018	30	44-131	44-131
8081A TCL	GAMMA-CHLORDANE	WATER	0.05		UG/L	0.0039	30	48-122	48-122
8081A TCL	HEPTACHLOR	WATER	0.05		UG/L	0.0037	30	37-123	37-123
8081A TCL	HEPTACHLOR EPOXIDE	WATER	0.05		UG/L	0.0049	30	74-104	70-130
8081A TCL	METHOXYCHLOR	WATER	0.50		UG/L	0.0046	30	62-130	62-130
8081A TCL	TOXAPHENE	WATER	1.00		UG/L	0.20	30	46-84	46-84
8081A TCL	DECACHLOROBIPHENYL (DCB) -SURR	WATER	NA		UG/L	NA	NA	11-131	11-131
8081A TCL	TETRACHLORO-META-XYLENE (TCMX) -SU	WATER	NA		UG/L	NA	NA	13-125	13-125
8081A ADDITIONAL COMPOUNDS BY REQUEST									
8081A	CHLORDANE, TECHNICAL	WATER	0.25		UG/L	0.045	30	50-150	50-150
8081A	FAMPHUR	WATER	1.0		UG/L	0.240	30	50-150	50-150
8081A	HEXACHLOROBENZENE	WATER	0.05		UG/L	0.008	30	50-150	50-150
8081A	KEPONE	WATER	5.0		UG/L	3.5	30	50-150	50-150

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8081A TCL	4,4'-DDD	SOIL	3.3		UG/KG	0.19	30	65-106	65-106
8081A TCL	4,4'-DDE	SOIL	3.3		UG/KG	0.078	30	33-124	33-124
8081A TCL	4,4'-DDT	SOIL	3.3		UG/KG	0.17	30	45-159	45-159
8081A TCL	ALDRIN	SOIL	1.7		UG/KG	0.070	30	53-115	53-115
8081A TCL	ALPHA-BHC	SOIL	1.7		UG/KG	0.31	30	38-108	38-108
8081A TCL	ALPHA-CHLORDANE	SOIL	1.7		UG/KG	0.15	30	27-130	27-130
8081A TCL	ALPHA-ENDOSULFAN	SOIL	1.7		UG/KG	0.10	30	34-127	34-127
8081A TCL	BETA-BHC	SOIL	1.7		UG/KG	0.25	30	61-106	61-106
8081A TCL	BETA-ENDOSULFAN	SOIL	3.3		UG/KG	0.091	30	66-105	66-105
8081A TCL	DELTA-BHC	SOIL	1.7		UG/KG	0.089	30	44-119	44-119
8081A TCL	DIELDRIN	SOIL	3.3		UG/KG	0.26	30	26-174	26-174
8081A TCL	ENDOSULFAN SULFATE	SOIL	3.3		UG/KG	0.09	30	37-122	10-138
8081A TCL	ENDRIN	SOIL	3.3		UG/KG	0.11	30	45-143	45-143
8081A TCL	ENDRIN ALDEHYDE	SOIL	3.3		UG/KG	0.83	30	10-110	10-110
8081A TCL	ENDRIN KETONE	SOIL	3.3		UG/KG	0.12	30	70-130	50-150
8081A TCL	GAMMA-BHC (LINDANE)	SOIL	1.7		UG/KG	0.12	30	47-133	47-133
8081A TCL	GAMMA-CHLORDANE	SOIL	1.7		UG/KG	0.12	30	38-127	38-127
8081A TCL	HEPTACHLOR	SOIL	1.7		UG/KG	0.088	30	50-120	50-120
8081A TCL	HEPTACHLOR EPOXIDE	SOIL	1.7		UG/KG	0.11	30	77-106	77-106
8081A TCL	METHOXYCHLOR	SOIL	17		UG/KG	0.26	30	73-125	73-125
8081A TCL	TOXAPHENE	SOIL	33		UG/KG	9.7	30	46-130	46-130
8081A TCL	DECACHLOROBIPHENYL (DCB) -SURR	SOIL	NA		UG/KG	NA	NA	18-176	18-176
8081A TCL	TETRACHLORO-META-XYLENE (TCMX) -SU	SOIL	NA		UG/KG	NA	NA	24-136	24-136
8081A ADDITIONAL COMPOUNDS BY REQUEST									
8081A	CHLORDANE, TECHNICAL	SOIL	8.3		UG/KG	1.9	30	50-150	50-150
8081A	FAMPHUR	SOIL	33		UG/KG	6.8	30	50-150	50-150
8081A	HEXACHLOROBENZENE	SOIL	1.67		UG/KG	0.48	30	50-150	50-150
8081A	KEPONE	SOIL	167		UG/KG	57	30	50-150	50-150
8081A	MIREX	SOIL	1.67		UG/KG	0.27	30	70-130	31-134

Columbia Analytical Services

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8082	PCB 1016	WATER	1.0	2.0	UG/L	0.39	30	53-118	53-118
8082	PCB 1221	WATER	2.0	3.0	UG/L	0.96	30	70-130	50-150
8082	PCB 1232	WATER	1.0	2.0	UG/L	0.58	30	70-130	50-150
8082	PCB 1242	WATER	1.0	2.0	UG/L	0.59	30	70-130	50-150
8082	PCB 1248	WATER	1.0	2.0	UG/L	0.41	30	56-119	56-119
8082	PCB 1254	WATER	1.0	2.0	UG/L	0.46	30	60-143	60-143
8082	PCB 1260	WATER	1.0	2.0	UG/L	0.44	30	57-129	42-132
8082	PCB 1268	WATER	1.0	2.0	UG/L	0.32	30	70-130	50-150
8082	DECACHLOROBIPHENYL -SURR	WATER	NA		UG/L	NA	NA	10-129	10-129
8082	TETRACHLORO-META-XYLENE -SURR	WATER	NA		UG/L	NA	NA	34-113	34-113
8082	PCB 1016	SOIL	33	67	UG/KG	9.1	30	34-130	33-132
8082	PCB 1221	SOIL	67	133	UG/KG	28	30	70-130	50-150
8082	PCB 1232	SOIL	33	67	UG/KG	11	30	70-130	50-150
8082	PCB 1242	SOIL	33	67	UG/KG	18	30	70-130	50-150
8082	PCB 1248	SOIL	33	67	UG/KG	19	30	49-140	49-140
8082	PCB 1254	SOIL	33	67	UG/KG	9.8	30	32-159	32-159
8082	PCB 1260	SOIL	33	67	UG/KG	8.6	30	57-141	24-178
8082	PCB 1268	SOIL	33	67	UG/KG	14	30	70-130	50-150
8082	DECACHLOROBIPHENYL -SURR	SOIL	NA		UG/KG	NA	NA	29-153	29-153
8082	TETRACHLORO-META-XYLENE -SURR	SOIL	NA		UG/KG	NA	NA	27-134	27-134
8082	PCB 1016	WIPES	33		UG/WIPE	9.1	30	70-130	50-150
8082	PCB 1221	WIPES	67		UG/WIPE	28	30	70-130	50-150
8082	PCB 1232	WIPES	33		UG/WIPE	11	30	70-130	50-150
8082	PCB 1242	WIPES	33		UG/WIPE	18	30	70-130	50-150
8082	PCB 1248	WIPES	33		UG/WIPE	19	30	70-130	50-150
8082	PCB 1254	WIPES	33		UG/WIPE	9.8	30	70-130	50-150
8082	PCB 1260	WIPES	33		UG/WIPE	8.6	30	70-130	50-150
8082	DECACHLOROBIPHENYL -SURR	WIPES	NA		UG/WIPE	NA	30	75-150	75-150
8082	TETRACHLORO-META-XYLENE -SURR	WIPES	NA		UG/WIPE	NA	30	73-139	73-139
8151A	2,4-D	WATER	0.5	1.0	UG/L	0.19	30	23-141	23-141
8151A	DICAMBA	WATER	0.5	1.0	UG/L	0.18	30	11-116	11-116
8151A	DINOSEB	WATER	0.5	1.0	UG/L	0.14	30	17-103	17-103
8151A	2,4,5-T	WATER	0.5	1.0	UG/L	0.24	30	18-140	18-140
8151A	2,4,5-TP (SILVEX)	WATER	0.5	1.0	UG/L	0.15	30	18-127	18-127
8151A	PENTACHLOROPHENOL	WATER	1.0		UG/L	0.14	30	40-115	40-115
8151A	DCAA -SURR	WATER	NA		UG/L	NA	NA	24-127	21-132
8151A	2,4-D	SOIL	100		UG/KG	26	30	45-134	45-134
8151A	DICAMBA	SOIL	100		UG/KG	20	30	50-150	50-150
8151A	2,4,5-T	SOIL	100		UG/KG	22	30	55-119	55-119
8151A	2,4,5-TP (SILVEX)	SOIL	100		UG/KG	22	30	45-112	45-112
8151A	PENTACHLOROPHENOL	SOIL	200		UG/KG	15	30	50-150	50-150
8151A	DCAA -SURR	SOIL	NA		UG/KG	NA	NA	20-150	20-150
METACIDS -HPLC	ACETIC ACID	WATER	1.0		MG/L	0.12	30	50-150	50-150
METACIDS -HPLC	BUTYRIC ACID	WATER	1.0		MG/L	0.25	30	50-150	50-150
METACIDS -HPLC	LACTIC ACID	WATER	1.0		MG/L	0.25	30	50-150	50-150
METACIDS -HPLC	PROPIONIC ACID	WATER	1.0		MG/L	0.23	30	50-150	50-150
METACIDS -HPLC	PYRUVIC ACID	WATER	0.1		MG/L	0.043	30	50-150	50-150

ROCHESTER ORGANIC QC LIMITS

METHOD		ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8260B TCL	*	1,1,1-TRICHLOROETHANE	WATER	5.0		UG/L	0.67	30	70-130	70-130
8260B TCL		1,1,2,2-TETRACHLOROETHANE	WATER	5.0		UG/L	0.76	30	70-130	70-130
8260B TCL		1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	WATER	5.0		UG/L	0.71	30	70-130	70-130
8260B TCL		1,1,2-TRICHLOROETHANE	WATER	5.0		UG/L	0.77	30	70-130	70-130
8260B TCL	*	1,1-DICHLOROETHANE	WATER	5.0		UG/L	0.57	30	70-130	70-130
8260B TCL	*	1,1-DICHLOROETHENE	WATER	5.0		UG/L	0.65	30	70-130	70-130
8260B TCL		1,2,4-TRICHLOROBENZENE	WATER	5.0		UG/L	0.95	30	70-130	70-130
8260B TCL		1,2-DIBROMO-3-CHLOROPROPANE	WATER	5.0		UG/L	1.1	30	50-150	50-150
8260B TCL		1,2-DIBROMOETHANE	WATER	5.0		UG/L	0.77	30	70-130	70-130
8260B TCL	*	1,2-DICHLOROBENZENE	WATER	5.0		UG/L	0.69	30	70-130	70-130
8260B TCL	*	1,2-DICHLOROETHANE	WATER	5.0		UG/L	0.71	30	70-130	70-130
8260B TCL		1,2-DICHLOROPROPANE	WATER	5.0		UG/L	0.82	30	70-130	70-130
8260B TCL		1,3-DICHLOROBENZENE	WATER	5.0		UG/L	0.79	30	70-130	70-130
8260B TCL		1,4-DICHLOROBENZENE	WATER	5.0		UG/L	0.84	30	70-130	70-130
8260B TCL		2-BUTANONE (MEK)	WATER	10		UG/L	1.0	30	50-150	50-150
8260B TCL		2-HEXANONE	WATER	10		UG/L	0.80	30	70-130	70-130
8260B TCL		4-METHYL-2-PENTANONE (MIBK)	WATER	10		UG/L	0.66	30	70-130	70-130
8260B TCL		ACETONE	WATER	20		UG/L	2.0	30	50-150	50-150
8260B TCL	*	BENZENE	WATER	5.0		UG/L	0.69	30	70-130	70-130
8260B TCL		BROMODICHLOROMETHANE	WATER	5.0		UG/L	0.69	30	70-130	70-130
8260B TCL		BROMOFORM	WATER	5.0		UG/L	0.78	30	70-130	70-130
8260B TCL		BROMOMETHANE	WATER	5.0		UG/L	1.0	30	50-150	50-150
8260B TCL		CARBON DISULFIDE	WATER	10		UG/L	1.2	30	70-130	70-130
8260B TCL		CARBON TETRACHLORIDE	WATER	5.0		UG/L	0.66	30	70-130	70-130
8260B TCL	*	CHLOROBENZENE	WATER	5.0		UG/L	0.69	30	70-130	70-130
8260B TCL		CHLOROETHANE	WATER	5.0		UG/L	0.73	30	70-130	70-130
8260B TCL	*	CHLOROFORM	WATER	5.0		UG/L	0.60	30	70-130	70-130
8260B TCL		CHLOROMETHANE	WATER	5.0		UG/L	0.68	30	70-130	70-130
8260B TCL	*	CIS-1,2-DICHLOROETHENE	WATER	5.0		UG/L	0.76	30	70-130	70-130
8260B TCL		CIS-1,3-DICHLOROPROPENE	WATER	5.0		UG/L	0.52	30	70-130	70-130
8260B TCL		CYCLOHEXANE	WATER	10		UG/L	0.60	30	50-150	50-150
8260B TCL		DIBROMOCHLOROMETHANE	WATER	5.0		UG/L	0.67	30	70-130	70-130
8260B TCL		DICHLORODIFLUOROMETHANE (FREON 12)	WATER	5.0		UG/L	0.72	30	70-130	70-130
8260B TCL	*	ETHYLBENZENE	WATER	5.0		UG/L	0.81	30	70-130	70-130
8260B TCL		ISOPROPYLBENZENE	WATER	5.0		UG/L	0.74	30	70-130	70-130
8260B TCL		M+P-XYLENE	WATER	5.0		UG/L	1.4	30	70-130	70-130
8260B TCL		METHYL ACETATE	WATER	10		UG/L	0.79	30	50-150	50-150
8260B TCL		METHYLCYCLOHEXANE	WATER	10		UG/L	0.88	30	50-150	50-150
8260B TCL		METHYLENE CHLORIDE	WATER	5.0		UG/L	0.61	30	70-130	70-130
8260B TCL		METHYL-TERT-BUTYL ETHER (MTBE)	WATER	5.0		UG/L	0.82	30	70-130	70-130
8260B TCL	*	O-XYLENE	WATER	5.0		UG/L	0.75	30	70-130	70-130
8260B TCL		STYRENE	WATER	5.0		UG/L	0.75	30	70-130	70-130
8260B TCL	*	TETRACHLOROETHENE	WATER	5.0		UG/L	0.71	30	70-130	70-130
8260B TCL	*	TOLUENE	WATER	5.0		UG/L	0.72	30	70-130	70-130
8260B TCL	*	TRANS-1,2-DICHLOROETHENE	WATER	5.0		UG/L	0.51	30	70-130	70-130
8260B TCL		TRANS-1,3-DICHLOROPROPENE	WATER	5.0		UG/L	0.74	30	70-130	70-130
8260B TCL	*	TRICHLOROETHENE	WATER	5.0		UG/L	0.74	30	70-130	70-130
8260B TCL		TRICHLOROFLUOROMETHANE (FREON 11)	WATER	5.0		UG/L	0.94	30	70-130	70-130
8260B TCL	*	VINYL CHLORIDE	WATER	5.0		UG/L	0.64	30	70-130	70-130
8260B TCL		4-BROMOFLUOROBENZENE -SURR	WATER	NA		UG/L	NA	NA	80-123	80-123
8260B TCL		DIBROMOFLUOROMETHANE -SURR	WATER	NA		UG/L	NA	NA	89-115	89-115
8260B TCL		DICHLOROETHANE-D4 -SURR	WATER	NA		UG/L	NA	NA	80-120	80-120
8260B TCL		TOLUENE-D8 -SURR	WATER	NA		UG/L	NA	NA	88-124	88-124

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8260B ADDITIONAL COMPOUNDS BY REQUEST									
8260B	1,1,1,2-TETRACHLOROETHANE	WATER	5.0		UG/L	0.59	30	70-130	70-130
8260B	1,1-DICHLOROPROPENE	WATER	5.0		UG/L	0.76	30	70-130	70-130
8260B	1,2,3-TRICHLOROBENZENE	WATER	5.0		UG/L	0.92	30	70-130	70-130
8260B	1,2,3-TRICHLOROPROPANE	WATER	5.0		UG/L	1.70	30	70-130	70-130
8260B	1,2,4-TRIMETHYLBENZENE	WATER	5.0		UG/L	0.80	30	70-130	70-130
8260B	1,2-DICHLORO-1,1,2-TRIFLUOROETHANE (FREON 123A)	WATER	5.0		UG/L	0.77	30	70-130	70-130
8260B	1,3,5-TRIMETHYLBENZENE	WATER	5.0		UG/L	0.76	30	70-130	70-130
8260B	1,3-DICHLOROPROPANE	WATER	5.0		UG/L	0.61	30	70-130	70-130
8260B	1,4-DIOXANE	WATER	100		UG/L	28	30	50-150	50-150
8260B	2,2-DICHLORO-1,1,1-TRIFLUOROETHANE (FREON 123)	WATER	5.0		UG/L	0.45	30	70-130	70-130
8260B	2,2-DICHLOROPROPANE	WATER	5.0		UG/L	0.70	30	70-130	70-130
8260B	2-CHLORO-1,3-BUTADIENE	WATER	5.0		UG/L	0.75	30	70-130	70-130
8260B	2-CHLOROETHYLVINYL ETHER	WATER	5.0		UG/L	0.68	30	50-150	50-150
8260B	2-CHLOROTOLUENE	WATER	5.0		UG/L	0.75	30	70-130	70-130
8260B	2-NITROPROPANE	WATER	5.0		UG/L	1.8	30	50-150	50-150
8260B	2-PROPANOL	WATER	100		UG/L	12	30	70-130	70-130
8260B	3-CHLOROPROPENE (ALLYL CHLORIDE)	WATER	5.0		UG/L	1.1	30	70-130	70-130
8260B	4-CHLOROTOLUENE	WATER	5.0		UG/L	0.72	30	70-130	70-130
8260B	ACETONITRILE	WATER	100		UG/L	5.4	30	50-150	50-150
8260B	ACROLEIN	WATER	100		UG/L	13	30	50-150	50-150
8260B	ACRYLONITRILE	WATER	100		UG/L	8.1	30	50-150	50-150
8260B	ALLYL CHLORIDE	WATER	5.0		UG/L	1.1	30	70-130	70-130
8260B	BROMOBENZENE	WATER	5.0		UG/L	0.63	30	70-130	70-130
8260B	BROMOCHLOROMETHANE	WATER	5.0		UG/L	0.72	30	70-130	70-130
8260B	CYCLOHEXANONE	WATER	100		UG/L	10	30	50-150	50-150
8260B	DIBROMOMETHANE	WATER	5.0		UG/L	0.74	30	70-130	70-130
8260B	DICHLOROFLUOROMETHANE (FREON 21)	WATER	5.0		UG/L	0.74	30	50-150	50-150
8260B	DIETHYL ETHER	WATER	5.0		UG/L	0.74	30	70-130	70-130
8260B	ETHYL METHACRYLATE	WATER	10		UG/L	0.73	30	70-130	70-130
8260B	HEXACHLOROBUTADIENE	WATER	5.0		UG/L	1.5	30	70-130	70-130
8260B	IODOMETHANE	WATER	10		UG/L	0.73	30	50-150	50-150
8260B	ISOBUTYL ALCOHOL	WATER	100		UG/L	13	30	50-150	50-150
8260B	METHACRYLONITRILE	WATER	20		UG/L	0.52	30	50-150	50-150
8260B	METHYL METHACRYLATE	WATER	10		UG/L	0.71	30	70-130	70-130
8260B	NAPTHALENE	WATER	5.0		UG/L	0.66	30	50-150	50-150
8260B	N-BUTYLBENZENE	WATER	5.0		UG/L	0.82	30	70-130	70-130
8260B	N-HEPTANE	WATER	5.0		UG/L	1.4	30	70-130	70-130
8260B	N-PROPYLBENZENE	WATER	5.0		UG/L	0.79	30	70-130	70-130
8260B	P-ISOPROPYLTOLUENE	WATER	5.0		UG/L	0.84	30	70-130	70-130
8260B	PROPIONITRILE	WATER	100		UG/L	3.2	30	50-150	50-150
8260B	SEC-BUTYLBENZENE	WATER	5.0		UG/L	0.80	30	70-130	70-130
8260B	TERT-BUTYL ALCOHOL	WATER	100		UG/L	15	30	50-150	50-150
8260B	TERT-BUTYLBENZENE	WATER	5.0		UG/L	0.80	30	70-130	70-130
8260B	TETRA HYDROFURAN	WATER	5.0		UG/L	0.89	30	50-150	50-150
8260B	TRANS-1,4-DICHLORO-2-BUTENE	WATER	5.0		UG/L	0.54	30	50-150	50-150
8260B	VINYL ACETATE	WATER	10		UG/L	1.9	30	50-150	50-150

ROCHESTER ORGANIC QC LIMITS

METHOD		ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8260B TCL	*	1,1,1-TRICHLOROETHANE	SOIL	5.0		UG/KG	0.60	30	70-130	70-130
8260B TCL		1,1,2,2-TETRACHLOROETHANE	SOIL	5.0		UG/KG	0.51	30	70-130	70-130
8260B TCL		1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	SOIL	5.0		UG/KG	0.39	30	70-130	70-130
8260B TCL		1,1,2-TRICHLOROETHANE	SOIL	5.0		UG/KG	0.22	30	70-130	70-130
8260B TCL	*	1,1-DICHLOROETHANE	SOIL	5.0		UG/KG	0.24	30	70-130	70-130
8260B TCL	*	1,1-DICHLOROETHENE	SOIL	5.0		UG/KG	0.48	30	70-130	70-130
8260B TCL		1,2,4-TRICHLOROBENZENE	SOIL	5.0		UG/KG	0.94	30	70-130	70-130
8260B TCL		1,2-DIBROMO-3-CHLOROPROPANE	SOIL	5.0		UG/KG	0.70	30	50-150	50-150
8260B TCL		1,2-DIBROMOETHANE	SOIL	5.0		UG/KG	0.40	30	70-130	70-130
8260B TCL	*	1,2-DICHLOROBENZENE	SOIL	5.0		UG/KG	0.23	30	70-130	70-130
8260B TCL	*	1,2-DICHLOROETHANE	SOIL	5.0		UG/KG	0.30	30	70-130	70-130
8260B TCL		1,2-DICHLOROPROPANE	SOIL	5.0		UG/KG	0.47	30	70-130	70-130
8260B TCL		1,3-DICHLOROBENZENE	SOIL	5.0		UG/KG	0.53	30	70-130	70-130
8260B TCL		1,4-DICHLOROBENZENE	SOIL	5.0		UG/KG	0.57	30	70-130	70-130
8260B TCL		2-BUTANONE (MEK)	SOIL	10		UG/KG	1.0	30	50-150	50-150
8260B TCL		2-HEXANONE	SOIL	10		UG/KG	0.72	30	70-130	70-130
8260B TCL		4-METHYL-2-PENTANONE (MIBK)	SOIL	10		UG/KG	0.95	30	70-130	70-130
8260B TCL		ACETONE	SOIL	20		UG/KG	1.5	30	50-150	50-150
8260B TCL	*	BENZENE	SOIL	5.0		UG/KG	0.19	30	70-130	70-130
8260B TCL		BROMODICHLOROMETHANE	SOIL	5.0		UG/KG	0.39	30	70-130	70-130
8260B TCL		BROMOFORM	SOIL	5.0		UG/KG	0.46	30	70-130	70-130
8260B TCL		BROMOMETHANE	SOIL	5.0		UG/KG	0.50	30	50-150	50-150
8260B TCL		CARBON DISULFIDE	SOIL	10		UG/KG	0.19	30	70-130	70-130
8260B TCL		CARBON TETRACHLORIDE	SOIL	5.0		UG/KG	0.35	30	70-130	70-130
8260B TCL	*	CHLOROBENZENE	SOIL	5.0		UG/KG	0.24	30	70-130	70-130
8260B TCL		CHLOROETHANE	SOIL	5.0		UG/KG	0.21	30	70-130	70-130
8260B TCL	*	CHLOROFORM	SOIL	5.0		UG/KG	0.15	30	70-130	70-130
8260B TCL		CHLOROMETHANE	SOIL	5.0		UG/KG	0.44	30	70-130	70-130
8260B TCL	*	CIS-1,2-DICHLOROETHENE	SOIL	5.0		UG/KG	0.55	30	70-130	70-130
8260B TCL		CIS-1,3-DICHLOROPROPENE	SOIL	5.0		UG/KG	0.20	30	70-130	70-130
8260B TCL		CYCLOHEXANE	SOIL	10		UG/KG	0.36	30	70-130	70-130
8260B TCL		DIBROMOCHLOROMETHANE	SOIL	5.0		UG/KG	0.32	30	70-130	70-130
8260B TCL		DICHLORODIFLUOROMETHANE (FREON 12)	SOIL	5.0		UG/KG	0.35	30	70-130	70-130
8260B TCL	*	ETHYLBENZENE	SOIL	5.0		UG/KG	0.37	30	70-130	70-130
8260B TCL		ISOPROPYLBENZENE	SOIL	5.0		UG/KG	0.40	30	70-130	70-130
8260B TCL		M+P-XYLENE	SOIL	5.0		UG/KG	0.78	30	70-130	70-130
8260B TCL		METHYLCYCLOHEXANE	SOIL	10		UG/KG	0.34	30	50-150	50-150
8260B TCL		METHYLENE CHLORIDE	SOIL	5.0		UG/KG	0.32	30	70-130	70-130
8260B TCL		METHYL-TERT-BUTYL ETHER (MTBE)	SOIL	5.0		UG/KG	0.19	30	70-130	70-130
8260B TCL	*	O-XYLENE	SOIL	5.0		UG/KG	0.31	30	70-130	70-130
8260B TCL		STYRENE	SOIL	5.0		UG/KG	0.16	30	70-130	70-130
8260B TCL	*	TETRACHLOROETHENE	SOIL	5.0		UG/KG	0.24	30	70-130	70-130
8260B TCL	*	TOLUENE	SOIL	5.0		UG/KG	0.30	30	70-130	70-130
8260B TCL	*	TRANS-1,2-DICHLOROETHENE	SOIL	5.0		UG/KG	0.30	30	70-130	70-130
8260B TCL		TRANS-1,3-DICHLOROPROPENE	SOIL	5.0		UG/KG	0.33	30	70-130	70-130
8260B TCL	*	TRICHLOROETHENE	SOIL	5.0		UG/KG	0.28	30	70-130	70-130
8260B TCL		TRICHLOROFLUOROMETHANE (FREON 11)	SOIL	5.0		UG/KG	0.32	30	70-130	70-130
8260B TCL	*	VINYL CHLORIDE	SOIL	5.0		UG/KG	0.68	30	70-130	70-130
8260B TCL		4-BROMOFLUOROBENZENE -SURR	SOIL	NA		UG/KG	NA	NA	50-135	50-135
8260B TCL		DIBROMOFLUOROMETHANE -SURR	SOIL	NA		UG/KG	NA	NA	58-133	58-133
8260B TCL		DICHLOROETHANE-D4	SOIL	NA		UG/KG	NA	NA	80-120	80-120
8260B TCL		TOLUENE-D8 -SURR	SOIL	NA		UG/KG	NA	NA	75-128	75-128

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8260B ADDITIONAL COMPOUNDS BY REQUEST									
8260B	1,1,1,2-TETRACHLOROETHANE	SOIL	5.0		UG/KG	0.44	30	70-130	70-130
8260B	1,1-DICHLOROPROPENE	SOIL	5.0		UG/KG	0.43	30	70-130	70-130
8260B	1,2,3-TRICHLOROBENZENE	SOIL	5.0		UG/KG	1.1	30	70-130	70-130
8260B	1,2,3-TRICHLOROPROPANE	SOIL	5.0		UG/KG	0.95	30	70-130	70-130
8260B	1,2,4-TRIMETHYLBENZENE	SOIL	5.0		UG/KG	0.42	30	70-130	70-130
8260B	1,3,5-TRIMETHYLBENZENE	SOIL	5.0		UG/KG	0.51	30	70-130	70-130
8260B	1,3-DICHLOROPROPANE	SOIL	5.0		UG/KG	0.38	30	70-130	70-130
8260B	1,4-DIOXANE	SOIL	100		UG/KG	21	30	50-150	50-150
8260B	2,2-DICHLOROPROPANE	SOIL	5.0		UG/KG	0.21	30	70-130	70-130
8260B	2-CHLORO-1,3-BUTADIENE	SOIL	5.0		UG/KG	0.53	30	70-130	70-130
8260B	2-CHLOROETHYLVINYL ETHER	SOIL	5.0		UG/KG	2.7	30	50-150	50-150
8260B	2-CHLOROTOLUENE	SOIL	5.0		UG/KG	0.28	30	70-130	70-130
8260B	2-NITROPROPANE	SOIL	5.0		UG/KG	1.5	30	50-150	50-150
8260B	2-PROPANOL	SOIL	100		UG/KG	39	30	70-130	70-130
8260B	3-CHLOROPROPENE (ALLYL CHLORIDE)	SOIL	5.0		UG/KG	1.0	30	70-130	70-130
8260B	4-CHLOROTOLUENE	SOIL	5.0		UG/KG	0.37	30	70-130	70-130
8260B	ACETONITRILE	SOIL	100		UG/KG	13	30	50-150	50-150
8260B	ACROLEIN	SOIL	100		UG/KG	5.4	30	50-150	50-150
8260B	ACRYLONITRILE	SOIL	100		UG/KG	3.6	30	50-150	50-150
8260B	ALLYL CHLORIDE	SOIL	5.0		UG/KG	1.0	30	70-130	70-130
8260B	BROMOBENZENE	SOIL	5.0		UG/KG	0.42	30	70-130	70-130
8260B	BROMOCHLOROMETHANE	SOIL	5.0		UG/KG	0.34	30	70-130	70-130
8260B	DIBROMOMETHANE	SOIL	5.0		UG/KG	0.35	30	70-130	70-130
8260B	DIETHYL ETHER	SOIL	5.0		UG/KG	0.49	30	70-130	70-130
8260B	ETHYL METHACRYLATE	SOIL	10.0		UG/KG	0.26	30	70-130	70-130
8260B	HEXACHLOROBUTADIENE	SOIL	5.0		UG/KG	0.60	30	70-130	70-130
8260B	IODOMETHANE	SOIL	10		UG/KG	0.35	30	50-150	50-150
8260B	ISOBUTYL ALCOHOL	SOIL	100		UG/KG	14	30	50-150	50-150
8260B	METHACRYLONITRILE	SOIL	20		UG/KG	1.7	30	50-150	50-150
8260B	METHYL METHACRYLATE	SOIL	10		UG/KG	1.2	30	70-130	70-130
8260B	NAPTHALENE	SOIL	5.0		UG/KG	1.1	30	50-150	50-150
8260B	N-BUTYLBENZENE	SOIL	5.0		UG/KG	0.61	30	70-130	70-130
8260B	N-HEPTANE	SOIL	5.0		UG/KG	0.36	30	70-130	70-130
8260B	N-PROPYLBENZENE	SOIL	5.0		UG/KG	0.36	30	70-130	70-130
8260B	P-ISOPROPYLTOLUENE	SOIL	5.0		UG/KG	0.41	30	70-130	70-130
8260B	PROPIONITRILE	SOIL	100		UG/KG	8.9	30	50-150	50-150
8260B	SEC-BUTYLBENZENE	SOIL	5.0		UG/KG	0.32	30	70-130	70-130
8260B	TERT-BUTYL ALCOHOL	SOIL	100		UG/KG	10	30	50-150	50-150
8260B	TERT-BUTYLBENZENE	SOIL	5.0		UG/KG	0.29	30	70-130	70-130
8260B	TETRA HYDROFURAN	SOIL	5.0		UG/KG	1.1	30	50-150	50-150
8260B	TRANS-1,4-DICHLORO-2-BUTENE	SOIL	5.0		UG/KG	0.98	30	50-150	50-150
8260B	VINYL ACETATE	SOIL	10		UG/KG	1.2	30	50-150	50-150

ROCHESTER ORGANIC QC LIMITS

METHOD		ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8270C TCL		1,1'-BIPHENYL	WATER	10		UG/L	0.55	30	40-150	40-150
8270C TCL		2,2'-OXYBIS(1-CHLOROPROPANE)	WATER	10		UG/L	0.78	30	10-140	10-140
8270C TCL	*	2,4,5-TRICHLOROPHENOL	WATER	10		UG/L	0.84	30	40-110	40-110
8270C TCL	*	2,4,6-TRICHLOROPHENOL	WATER	10		UG/L	0.59	30	40-110	40-110
8270C TCL		2,4-DICHLOROPHENOL	WATER	10		UG/L	0.37	30	66-104	66-104
8270C TCL		2,4-DIMETHYLPHENOL	WATER	10		UG/L	1.8	30	31-92	31-92
8270C TCL	*	2,4-DINITROPHENOL	WATER	50		UG/L	14	30	21-123	21-123
8270C TCL		2,4-DINITROTOLUENE	WATER	10		UG/L	0.53	30	68-113	58-114
8270C TCL		2,6-DINITROTOLUENE	WATER	10		UG/L	0.55	30	70-130	70-130
8270C TCL	*	2-CHLORONAPHTHALENE	WATER	10		UG/L	0.55	30	52-111	52-111
8270C TCL		2-CHLOROPHENOL	WATER	10		UG/L	0.69	30	16-116	37-105
8270C TCL	*	2-METHYLNAPHTHALENE	WATER	10		UG/L	0.45	30	42-107	42-107
8270C TCL		2-METHYLPHENOL	WATER	10		UG/L	0.79	30	16-102	16-102
8270C TCL		2-NITROANILINE	WATER	50		UG/L	0.59	30	63-130	63-130
8270C TCL		2-NITROPHENOL	WATER	10		UG/L	0.61	30	63-130	63-130
8270C TCL		3,3'-DICHLOROBENZIDINE	WATER	10		UG/L	0.73	30	48-119	48-119
8270C TCL		3-NITROANILINE	WATER	50		UG/L	0.43	30	56-111	56-111
8270C TCL	*	4,6-DINITRO-2-METHYLPHENOL	WATER	50		UG/L	0.51	30	47-130	47-130
8270C TCL	*	4-BROMOPHENYL-PHENYLETHER	WATER	10		UG/L	0.67	30	64-130	64-130
8270C TCL		4-CHLORO-3-METHYLPHENOL	WATER	10		UG/L	0.50	30	21-131	21-131
8270C TCL		4-CHLOROANILINE	WATER	10		UG/L	0.70	30	39-107	39-107
8270C TCL		4-CHLOROPHENYL-PHENYLETHER	WATER	10		UG/L	0.49	30	55-106	55-106
8270C TCL		4-METHYLPHENOL	WATER	10		UG/L	1.5	30	26-99	26-99
8270C TCL	*	4-NITROANILINE	WATER	50		UG/L	0.59	30	70-130	70-130
8270C TCL	*	4-NITROPHENOL	WATER	50		UG/L	6.7	30	11-130	10-130
8270C TCL	*	ACENAPHTHENE	WATER	10		UG/L	0.48	30	41-121	41-121
8270C TCL		ACENAPHTHYLENE	WATER	10		UG/L	0.33	30	36-125	36-125
8270C TCL		ACETOPHENONE	WATER	10		UG/L	1.4	30	40-150	40-150
8270C TCL		ANTHRACENE	WATER	10		UG/L	0.60	30	73-130	73-130
8270C TCL		ATRAZINE	WATER	10		UG/L	1.3	30	40-150	40-150
8270C TCL		BENZALDEHYDE	WATER	10		UG/L	1.3	30	40-150	40-150
8270C TCL		BENZO(A)ANTHRACENE	WATER	10		UG/L	0.54	30	71-130	40-130
8270C TCL		BENZO(A)PYRENE	WATER	10		UG/L	0.42	30	61-119	38-118
8270C TCL		BENZO(B)FLUORANTHENE	WATER	10		UG/L	0.54	30	68-130	39-130
8270C TCL		BENZO(G,H,I)PERYLENE	WATER	10		UG/L	0.62	30	50-125	50-125
8270C TCL		BENZO(K)FLUORANTHENE	WATER	10		UG/L	0.53	30	68-113	41-112
8270C TCL		BIS(-2-CHLOROETHOXY)METHANE	WATER	10		UG/L	0.86	30	61-130	61-130
8270C TCL		BIS(2-CHLOROETHYL)ETHER	WATER	10		UG/L	0.74	30	55-130	55-130
8270C TCL		BIS(2-ETHYLHEXYL)PHTHALATE	WATER	10		UG/L	0.48	30	70-130	70-130
8270C TCL		BUTYL BENZYL PHTHALATE	WATER	10		UG/L	0.59	30	22-141	22-141
8270C TCL		CAPROLACTAM	WATER	10		UG/L	1.0	30	8-100	8-100
8270C TCL		CARBAZOLE	WATER	10		UG/L	0.47	30	70-130	70-130
8270C TCL		CHRYSENE	WATER	10		UG/L	0.53	30	61-119	61-119
8270C TCL		DIBENZO(A,H)ANTHRACENE	WATER	10		UG/L	0.63	30	70-130	70-130
8270C TCL		DIBENZOFURAN	WATER	10		UG/L	0.41	30	70-130	70-130
8270C TCL		DIETHYLPHTHALATE	WATER	10		UG/L	0.31	30	31-124	31-124
8270C TCL		DIMETHYL PHTHALATE	WATER	10		UG/L	0.53	30	10-121	10-121
8270C TCL		DI-N-BUTYLPHTHALATE	WATER	10		UG/L	0.39	30	46-130	46-130
8270C TCL		DI-N-OCTYL PHTHALATE	WATER	10		UG/L	0.45	30	65-130	65-130
8270C TCL		FLUORANTHENE	WATER	10		UG/L	0.32	30	75-130	62-130
8270C TCL		FLUORENE	WATER	10		UG/L	0.47	30	60-111	27-113
8270C TCL	*	HEXACHLOROBENZENE	WATER	10		UG/L	0.43	30	58-130	58-130
8270C TCL		HEXACHLOROBUTADIENE	WATER	10		UG/L	0.69	30	13-130	13-130
8270C TCL		HEXACHLOROCYCLOPENTADIENE	WATER	10		UG/L	1.1	30	10-130	10-130
8270C TCL		HEXACHLOROETHANE	WATER	10		UG/L	0.48	30	11-130	11-130
8270C TCL		INDENO(1,2,3-CD)PYRENE	WATER	10		UG/L	0.49	30	70-130	70-130
8270C TCL		ISOPHORONE	WATER	10		UG/L	0.61	30	58-130	58-130
8270C TCL	*	NAPHTHALENE	WATER	10		UG/L	0.62	30	26-109	26-109
8270C TCL	*	NITROBENZENE	WATER	10		UG/L	0.78	30	49-130	49-130
8270C TCL	*	N-NITROSO-DI-N-PROPYLAMINE	WATER	10		UG/L	1.2	30	25-120	25-120
8270C TCL		N-NITROSODIPHENYLAMINE	WATER	10		UG/L	0.75	30	70-130	70-130
8270C TCL	*	PENTACHLOROPHENOL	WATER	50		UG/L	0.60	30	16-131	16-131
8270C TCL	*	PHENANTHRENE	WATER	10		UG/L	0.45	30	68-130	38-130
8270C TCL	*	PHENOL	WATER	10		UG/L	0.54	30	10-65	10-71
8270C TCL	*	PYRENE	WATER	10		UG/L	0.65	30	60-130	52-130

ROCHESTER ORGANIC QC LIMITS

METHOD		ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8270C TCL		2,4,6-TRIBROMOPHENOL -SURR	WATER	NA		UG/L	NA	NA	41-135	41-135
8270C TCL		2-FLUOROBIPHENYL -SURR	WATER	NA		UG/L	NA	NA	38-100	38-100
8270C TCL		2-FLUOROPHENOL -SURR	WATER	NA		UG/L	NA	NA	17-74	17-74
8270C TCL		NITROBENZENE-d5 -SURR	WATER	NA		UG/L	NA	NA	38-105	38-105
8270C TCL		PHENOL-d6 -SURR	WATER	NA		UG/L	NA	NA	10-69	10-69
8270C TCL		TERPHENYL-d14 -SURR	WATER	NA		UG/L	NA	NA	40-137	40-137
8270C ADDITIONAL COMPOUNDS BY REQUEST										
8270C		1,2,4,5-TETRACHLOROBENZENE	WATER	10		UG/L	0.74	30	40-150	40-150
8270C	*	1,2,4-TRICHLOROBENZENE	WATER	10		UG/L	0.65	30	17-99	27-104
8270C		1,2-DICHLOROBENZENE	WATER	10		UG/L	0.67	30	23-130	23-130
8270C		1,2-DIPHENYLHYDRAZINE	WATER	10		UG/L	0.48	30	10-142	10-142
8270C		1,3,5-TRINITROBENZENE	WATER	10		UG/L	1.1	30	40-150	40-150
8270C		1,3-DICHLOROBENZENE	WATER	10		UG/L	0.50	30	17-130	17-130
8270C	*	1,4-DICHLOROBENZENE	WATER	10		UG/L	0.58	30	16-83	23-85
8270C		1,4-NAPHTHOQUINONE	WATER	50		UG/L	12	30	40-150	40-150
8270C		1-METHYLNAPHTHALENE	WATER	10		UG/L	0.62	30	40-150	40-150
8270C		1-NAPHTHYLAMINE	WATER	50		UG/L	4.5	30	40-150	40-150
8270C		2,3,4,6-TETRACHLOROPHENOL	WATER	10		UG/L	0.60	30	40-150	40-150
8270C		2,6-DICHLOROPHENOL	WATER	10		UG/L	0.82	30	40-150	40-150
8270C		2-ACETYLAMINOFLUORENE	WATER	10		UG/L	0.59	30	40-150	40-150
8270C		2-NAPHTHYLAMINE	WATER	50		UG/L	3.6	30	40-150	40-150
8270C		2-PICOLINE	WATER	10		UG/L	2.5	30	40-150	40-150
8270C		3,3'-DIMETHYLBENZIDINE	WATER	50		UG/L	24	30	40-150	40-150
8270C		3-METHYLCHOLANTHRENE	WATER	10		UG/L	2.2	30	40-150	40-150
8270C		4-AMINOBIPHENYL	WATER	50		UG/L	3.1	30	40-150	40-150
8270C		4-NITROQUINOLINE-1-OXIDE	WATER	50		UG/L	24	30	40-150	40-150
8270C		5-NITRO-O-TOLUIDINE	WATER	10		UG/L	1.4	30	40-150	40-150
8270C		7,12-DIMETHYLBENZ(a)ANTHRACENE	WATER	10		UG/L	2.4	30	40-150	40-150
8270C		aa-DIMETHYLPHENETHYLAMINE	WATER	50		UG/L	46	30	40-150	40-150
8270C		ANILINE	WATER	10		UG/L	0.78	30	13-123	13-123
8270C		ARAMITE	WATER	50		UG/L	6.3	30	40-150	40-150
8270C		BENZIDINE	WATER	100	200	UG/L	43	30	10-130	10-130
8270C		BENZOIC ACID	WATER	50	100	UG/L	15	30	30-130	30-130
8270C		BENZYL ALCOHOL	WATER	10		UG/L	1.1	30	31-109	31-109
8270C		CHLOROBENZILATE	WATER	10		UG/L	0.78	30	40-150	40-150
8270C		DIALLATE	WATER	10		UG/L	1.4	30	40-150	40-150
8270C		DIMETHOATE	WATER	50		UG/L	1.1	30	40-150	40-150
8270C		DINOSEB	WATER	50		UG/L	1.0	30	40-150	40-150
8270C		DIPHENYLAMINE	WATER	10		UG/L	0.64	30	40-150	40-150
8270C		DISULFOTON	WATER	10		UG/L	2.7	30	40-150	40-150
8270C		ETHYL METHANESULFONATE	WATER	10		UG/L	1.0	30	40-150	40-150
8270C		ETHYL PARATHION	WATER	10		UG/L	1.1	30	40-150	40-150
8270C		HEXACHLOROPHENE	WATER	500		UG/L	310	30	40-150	40-150
8270C		HEXACHLOROPROPENE	WATER	10		UG/L	1.4	30	40-150	40-150
8270C		ISODRIN	WATER	10		UG/L	1.1	30	40-150	40-150
8270C		ISOSAFROLE	WATER	10		UG/L	1.8	30	40-150	40-150
8270C		m-DINITROBENZENE	WATER	10		UG/L	0.69	30	40-150	40-150
8270C		METHAPYRILENE	WATER	50		UG/L	36	30	40-150	40-150
8270C		METHYL METHANESULFONATE	WATER	10		UG/L	1.1	30	40-150	40-150
8270C		METHYL PARATHION	WATER	10		UG/L	0.90	30	40-150	40-150
8270C		N-NITROSODIETHYLAMINE	WATER	10		UG/L	2.0	30	40-150	40-150
8270C		N-NITROSODIMETHYLAMINE	WATER	10		UG/L	0.79	30	27-130	27-130
8270C		N-NITROSODI-N-BUTYLAMINE	WATER	10		UG/L	2.7	30	40-150	40-150
8270C		N-NITROSOMETHYLETHYLAMINE	WATER	10		UG/L	1.8	30	40-150	40-150
8270C		N-NITROSOMORPHOLINE	WATER	10		UG/L	2.2	30	40-150	40-150
8270C		N-NITROSOPIPERIDINE	WATER	10		UG/L	2.6	30	40-150	40-150
8270C		N-NITROSOPYRROLIDINE	WATER	10		UG/L	2.2	30	40-150	40-150
8270C		ooo-TRIETHYL PHOSPHOROTHIOATE	WATER	10		UG/L	0.99	30	40-150	40-150
8270C		o-TOLUIDINE	WATER	10		UG/L	1.5	30	40-150	40-150
8270C		p-DIMETHYLAMINOAZOBENZENE	WATER	10		UG/L	1.0	30	40-150	40-150
8270C		PENTACHLOROBENZENE	WATER	10		UG/L	0.88	30	40-150	40-150
8270C		PENTACHLOROETHANE	WATER	10		UG/L	1.5	30	40-150	40-150
8270C		PENTACHLORONITROBENZENE	WATER	10		UG/L	0.89	30	40-150	40-150
8270C		PHENACETIN	WATER	10		UG/L	0.73	30	40-150	40-150
8270C		PHORATE	WATER	10		UG/L	1.2	30	40-150	40-150

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8270C	p-PHENYLENEDIAMINE	WATER	50		UG/L		30	40-150	40-150
8270C	PRONAMIDE	WATER	10		UG/L	1.0	30	40-150	40-150
8270C	PYRIDINE	WATER	50		UG/L	0.020	30	10-130	10-130
8270C	SAFROLE	WATER	10		UG/L	1.5	30	40-150	40-150
8270C	SULFOTEPP	WATER	10		UG/L	1.1	30	40-150	40-150
8270C	THIONAZIN	WATER	10		UG/L	0.98	30	40-150	40-150

ROCHESTER ORGANIC QC LIMITS

METHOD		ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8270C TCL		1'1-BIPHENYL	SOIL	330		UG/KG	23	30	40-150	40-150
8270C TCL		2,2'-OXYBIS(1-CHLOROPROPANE)	SOIL	330		UG/KG	25	30	10-126	10-126
8270C TCL		2,4,5-TRICHLOROPHENOL	SOIL	330		UG/KG	24	30	34-121	34-121
8270C TCL	*	2,4,6-TRICHLOROPHENOL	SOIL	330		UG/KG	24	30	33-120	33-120
8270C TCL	*	2,4-DICHLOROPHENOL	SOIL	330		UG/KG	24	30	57-130	57-130
8270C TCL		2,4-DIMETHYLPHENOL	SOIL	330		UG/KG	19	30	45-130	45-130
8270C TCL		2,4-DINITROPHENOL	SOIL	1700		UG/KG	420	30	23-130	23-130
8270C TCL	*	2,4-DINITROTOLUENE	SOIL	330		UG/KG	32	30	46-124	46-124
8270C TCL		2,6-DINITROTOLUENE	SOIL	330		UG/KG	33	30	62-130	62-130
8270C TCL		2-CHLORONAPHTHALENE	SOIL	330		UG/KG	21	30	55-130	55-130
8270C TCL	*	2-CHLOROPHENOL	SOIL	330		UG/KG	18	30	36-116	18-126
8270C TCL		2-METHYLNAPHTHALENE	SOIL	330		UG/KG	22	30	52-130	13-130
8270C TCL	*	2-METHYLPHENOL	SOIL	330		UG/KG	27	30	26-105	26-105
8270C TCL		2-NITROANILINE	SOIL	1700		UG/KG	32	30	51-111	51-111
8270C TCL		2-NITROPHENOL	SOIL	330		UG/KG	26	30	55-130	55-130
8270C TCL		3,3'-DICHLOROBENZIDINE	SOIL	330		UG/KG	46	30	10-121	10-121
8270C TCL		3-NITROANILINE	SOIL	1700		UG/KG	25	30	10-130	10-130
8270C TCL		4,6-DINITRO-2-METHYLPHENOL	SOIL	1700		UG/KG	22	30	38-119	38-119
8270C TCL	*	4-BROMOPHENYL-PHENYLETHER	SOIL	330		UG/KG	36	30	61-113	61-113
8270C TCL	*	4-CHLORO-3-METHYLPHENOL	SOIL	330		UG/KG	26	30	40-125	28-130
8270C TCL		4-CHLOROANILINE	SOIL	330		UG/KG	33	30	10-130	10-130
8270C TCL		4-CHLOROPHENYL-PHENYLETHER	SOIL	330		UG/KG	27	30	60-130	60-130
8270C TCL		4-METHYLPHENOL	SOIL	330		UG/KG	52	30	22-108	22-108
8270C TCL		4-NITROANILINE	SOIL	1700		UG/KG	24	30	31-105	31-105
8270C TCL	*	4-NITROPHENOL	SOIL	1700	3300	UG/KG	710	30	25-132	12-128
8270C TCL	*	ACENAPHTHENE	SOIL	330		UG/KG	28	30	47-123	39-124
8270C TCL	*	ACENAPHTHYLENE	SOIL	330		UG/KG	22	30	44-124	31-124
8270C TCL		ACETOPHENONE	SOIL	330		UG/KG	60	30	40-150	40-150
8270C TCL		ANTHRACENE	SOIL	330		UG/KG	29	30	44-125	39-122
8270C TCL		ATRAZINE	SOIL	330		UG/KG	74	30	40-150	40-150
8270C TCL		BENZALDEHYDE	SOIL	330	670	UG/KG	130	30	40-150	40-150
8270C TCL		BENZO(A)ANTHRACENE	SOIL	330		UG/KG	28	30	48-122	35-129
8270C TCL		BENZO(A)PYRENE	SOIL	330		UG/KG	68	30	49-126	36-130
8270C TCL		BENZO(B)FLUORANTHENE	SOIL	330		UG/KG	32	30	42-128	37-124
8270C TCL		BENZO(G,H,I)PERYLENE	SOIL	330		UG/KG	35	30	42-126	34-129
8270C TCL		BENZO(K)FLUORANTHENE	SOIL	330		UG/KG	27	30	48-124	36-124
8270C TCL		BIS(-2-CHLOROETHOXY)METHANE	SOIL	330		UG/KG	43	30	48-130	48-130
8270C TCL		BIS(2-CHLOROETHYL)ETHER	SOIL	330		UG/KG	27	30	43-130	43-130
8270C TCL		BIS(2-ETHYLHEXYL)PHTHALATE	SOIL	330		UG/KG	38	30	60-130	60-130
8270C TCL		BUTYL BENZYL PHTHALATE	SOIL	330		UG/KG	30	30	56-130	56-130
8270C TCL		CAPROLACTAM	SOIL	330		UG/KG	26	30	40-150	40-150
8270C TCL		CARBAZOLE	SOIL	330		UG/KG	25	30	51-130	51-130
8270C TCL		CHRYSENE	SOIL	330		UG/KG	28	30	49-122	32-131
8270C TCL		DIBENZO(A,H)ANTHRACENE	SOIL	330		UG/KG	29	30	23-140	23-140
8270C TCL		DIBENZOFURAN	SOIL	330		UG/KG	27	30	42-130	42-130
8270C TCL		DIETHYLPHTHALATE	SOIL	330		UG/KG	29	30	62-130	62-130
8270C TCL		DIMETHYL PHTHALATE	SOIL	330		UG/KG	32	30	61-130	61-130
8270C TCL		DI-N-BUTYLPHTHALATE	SOIL	330		UG/KG	33	30	62-130	62-130
8270C TCL		DI-N-OCTYL PHTHALATE	SOIL	330		UG/KG	40	30	59-130	59-130
8270C TCL		FLUORANTHENE	SOIL	330		UG/KG	36	30	42-124	33-125
8270C TCL		FLUORENE	SOIL	330		UG/KG	34	30	36-128	33-121
8270C TCL	*	HEXACHLOROBENZENE	SOIL	330		UG/KG	21	30	56-116	56-116
8270C TCL		HEXACHLOROBUTADIENE	SOIL	330		UG/KG	23	30	10-104	10-104
8270C TCL		HEXACHLOROCYCLOPENTADIENE	SOIL	330		UG/KG	18	30	9-102	9-102
8270C TCL		HEXACHLOROETHANE	SOIL	330		UG/KG	28	30	10-107	10-107
8270C TCL		INDENO(1,2,3-CD)PYRENE	SOIL	330		UG/KG	28	30	41-127	35-129
8270C TCL		ISOPHORONE	SOIL	330		UG/KG	27	30	50-130	50-130
8270C TCL	*	NAPHTHALENE	SOIL	330		UG/KG	20	30	38-116	25-120
8270C TCL	*	NITROBENZENE	SOIL	330		UG/KG	21	30	32-130	32-130
8270C TCL	*	N-NITROSO-DI-N-PROPYLAMINE	SOIL	330		UG/KG	26	30	45-117	34-122
8270C TCL		N-NITROSODIPHENYLAMINE	SOIL	330		UG/KG	24	30	54-116	54-116
8270C TCL	*	PENTACHLOROPHENOL	SOIL	1700		UG/KG	340	30	21-131	13-128
8270C TCL	*	PHENANTHRENE	SOIL	330		UG/KG	43	30	48-130	28-130
8270C TCL	*	PHENOL	SOIL	330	670	UG/KG	160	30	34-118	26-122
8270C TCL	*	PYRENE	SOIL	330		UG/KG	41	30	53-130	34-130

ROCHESTER ORGANIC QC LIMITS

METHOD		ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8270C TCL		2,4,6-TRIBROMOPHENOL -SURR	SOIL	NA		UG/KG	NA	NA	33-139	33-139
8270C TCL		2-FLUOROBIPHENYL -SURR	SOIL	NA		UG/KG	NA	NA	32-130	32-130
8270C TCL		2-FLUOROPHENOL -SURR	SOIL	NA		UG/KG	NA	NA	10-130	10-130
8270C TCL		NITROBENZENE-d5 -SURR	SOIL	NA		UG/KG	NA	NA	27-130	27-130
8270C TCL		PHENOL-d6 -SURR	SOIL	NA		UG/KG	NA	NA	10-133	10-133
8270C TCL		TERPHENYL-d14 -SURR	SOIL	NA		UG/KG	NA	NA	48-131	48-131
8270C ADDITIONAL COMPOUNDS BY REQUEST										
8270C		1,2,4,5-TETRACHLOROBENZENE	SOIL	330		UG/KG	35	30	40-150	40-150
8270C	*	1,2,4-TRICHLOROBENZENE	SOIL	330		UG/KG	22	30	42-130	34-130
8270C		1,2-DICHLOROBENZENE	SOIL	330		UG/KG	19	30	45-130	45-130
8270C		1,2-DIPHENYLHYDRAZINE	SOIL	330		UG/KG	34	30	10-136	10-136
8270C		1,3,5-TRINITROBENZENE	SOIL	330		UG/KG	62	30	40-150	40-150
8270C		1,3-DICHLOROBENZENE	SOIL	330		UG/KG	18	30	43-130	43-130
8270C	*	1,4-DICHLOROBENZENE	SOIL	330		UG/KG	16	30	20-112	18-107
8270C		1,4-NAPHTHOQUINONE	SOIL	1700		UG/KG	160	30	40-150	40-150
8270C		1-METHYLNAPHTHALENE	SOIL	330		UG/KG	26	30	40-150	40-150
8270C		1-NAPHTHYLAMINE	SOIL	1700		UG/KG	110	30	40-150	40-150
8270C		2,3,4,6-TETRACHLOROPHENOL	SOIL	330		UG/KG	38	30	40-150	40-150
8270C		2,6-DICHLOROPHENOL	SOIL	330		UG/KG	40	30	40-150	40-150
8270C		2-ACETYLAMINOFLUORENE	SOIL	330		UG/KG	60	30	40-150	40-150
8270C		2-NAPHTHYLAMINE	SOIL	1700		UG/KG	110	30	40-150	40-150
8270C		2-PICOLINE	SOIL	330		UG/KG	140	30	40-150	40-150
8270C		3,3'-DIMETHYLBENZINE	SOIL	1700		UG/KG	400	30	40-150	40-150
8270C		3-METHYLCHOLANTHRENE	SOIL	330		UG/KG	64	30	40-150	40-150
8270C		4-AMINOBIPHENYL	SOIL	1700		UG/KG	71	30	40-150	40-150
8270C		4-NITROQUINOLINE-1-OXIDE	SOIL	1700		UG/KG	590	30	40-150	40-150
8270C		5-NITRO-O-TOLUIDINE	SOIL	330		UG/KG	62	30	40-150	40-150
8270C		7,12-DIMETHYLBENZ(a)ANTHRACENE	SOIL	330		UG/KG	51	30	40-150	40-150
8270C		aa-DIMETHYLPHENETHYLAMINE	SOIL	1700		UG/KG	850	30	40-150	40-150
8270C		ANILINE	SOIL	330		UG/KG	42	30	10-130	10-130
8270C		ARAMITE	SOIL	1700		UG/KG	85	30	40-150	40-150
8270C		BENZIDINE	SOIL	3300	6700	UG/KG	1,200	30	30-130	30-130
8270C		BENZOIC ACID	SOIL	1700	3300	UG/KG	880	30	30-130	30-130
8270C		BENZYL ALCOHOL	SOIL	330		UG/KG	31	30	38-106	38-106
8270C		CHLOROBENZILATE	SOIL	330		UG/KG	52	30	40-150	40-150
8270C		DIALLATE	SOIL	330		UG/KG	55	30	40-150	40-150
8270C		DIMETHOATE	SOIL	1700		UG/KG	49	30	40-150	40-150
8270C		DINOSEB	SOIL	1700		UG/KG	44	30	40-150	40-150
8270C		DIPHENYLAMINE	SOIL	330		UG/KG	24	30	40-150	40-150
8270C		DISULFOTON	SOIL	330		UG/KG	190	30	40-150	40-150
8270C		ETHYL METHANESULFONATE	SOIL	330		UG/KG	46	30	40-150	40-150
8270C		ETHYL PARATHION	SOIL	330		UG/KG	49	30	40-150	40-150
8270C		HEXACHLOROPHENE	SOIL	17000		UG/KG	6,800	30	40-150	40-150
8270C		HEXACHLOROPROPENE	SOIL	330		UG/KG	36	30	40-150	40-150
8270C		ISODRIN	SOIL	330		UG/KG	50	30	40-150	40-150
8270C		ISOSAFROLE	SOIL	330		UG/KG	42	30	40-150	40-150
8270C		m-DINITROBENZINE	SOIL	330		UG/KG	37	30	40-150	40-150
8270C		METHAPYRILENE	SOIL	1700		UG/KG	680	30	40-150	40-150
8270C		METHYL METHANESULFONATE	SOIL	330		UG/KG	44	30	40-150	40-150
8270C		METHYL PARATHION	SOIL	330		UG/KG	47	30	40-150	40-150
8270C		N-NITROSODIETHYLAMINE	SOIL	330		UG/KG	37	30	40-150	40-150
8270C		N-NITROSODIMETHYLAMINE	SOIL	330		UG/KG	29	30	38-130	38-130
8270C		N-NITROSODI-N-BUTYLAMINE	SOIL	330		UG/KG	72	30	40-150	40-150
8270C		N-NITROSOMETHYLETHYLAMINE	SOIL	330		UG/KG	89	30	40-150	40-150
8270C		N-NITROSOMORPHOLINE	SOIL	330		UG/KG	56	30	40-150	40-150
8270C		N-NITROSOPIPERIDINE	SOIL	330		UG/KG	53	30	40-150	40-150
8270C		N-NITROSOPYRROLIDINE	SOIL	330		UG/KG	70	30	40-150	40-150
8270C		ooo-TRIETHYL PHOSPHOROTHIOATE	SOIL	330		UG/KG	57	30	40-150	40-150
8270C		o-TOLUIDINE	SOIL	330		UG/KG	76	30	40-150	40-150
8270C		p-DIMETHYLAMINOAZOBENZENE	SOIL	330		UG/KG	55	30	40-150	40-150
8270C		PENTACHLOROBENZENE	SOIL	330		UG/KG	48	30	40-150	40-150
8270C		PENTACHLOROETHANE	SOIL	330		UG/KG	26	30	40-150	40-150
8270C		PENTACHLORONITROBENZENE	SOIL	330		UG/KG	59	30	40-150	40-150
8270C		PHENACETIN	SOIL	330		UG/KG	45	30	40-150	40-150
8270C		PHORATE	SOIL	330		UG/KG	120	30	40-150	40-150

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8270C	p-PHENYLENEDIAMINE	SOIL	1700		UG/KG	590	30	40-150	40-150
8270C	PRONAMIDE	SOIL	330		UG/KG	51	30	40-150	40-150
8270C	PYRIDINE	SOIL	1700		UG/KG	50	30	28-130	28-130
8270C	SAFROLE	SOIL	330		UG/KG	40	30	40-150	40-150
8270C	SULFOTEPP	SOIL	330		UG/KG	73	30	40-150	40-150
8270C	THIONAZIN	SOIL	330		UG/KG	50	30	40-150	40-150

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8270C LVI	ACENAPHTHENE	WATER	0.20		UG/L	0.022	30	44-112	44-112
8270C LVI	ACENAPHTHYLENE	WATER	0.20		UG/L	0.025	30	51-115	51-115
8270C LVI	ANTHRACENE	WATER	0.20		UG/L	0.019	30	51-119	51-119
8270C LVI	BENZO(A)ANTHRACENE	WATER	0.10		UG/L	0.028	30	58-115	58-115
8270C LVI	BENZO(A)PYRENE	WATER	0.20		UG/L	0.016	30	36-119	36-119
8270C LVI	BENZO(B)FLUORANTHENE	WATER	0.20		UG/L	0.027	30	45-121	45-121
8270C LVI	BENZO(G,H,I)PERYLENE	WATER	0.20		UG/L	0.023	30	39-122	39-122
8270C LVI	BENZO(K)FLUORANTHENE	WATER	0.20		UG/L	0.019	30	47-119	47-119
8270C LVI	CHRYSENE	WATER	0.20		UG/L	0.022	30	55-113	55-113
8270C LVI	DIBENZO(A,H)ANTHRACENE	WATER	0.20		UG/L	0.025	30	47-116	47-116
8270C LVI	FLUORANTHENE	WATER	0.20		UG/L	0.035	30	59-117	59-117
8270C LVI	FLUORENE	WATER	0.20		UG/L	0.021	30	38-121	38-121
8270C LVI	INDENO(1,2,3-CD)PYRENE	WATER	0.20		UG/L	0.016	30	47-119	47-119
8270C LVI	NAPHTHALENE	WATER	0.20		UG/L	0.042	30	33-121	33-121
8270C LVI	PHENANTHRENE	WATER	0.20		UG/L	0.025	30	54-114	54-114
8270C LVI	PYRENE	WATER	0.20		UG/L	0.011	30	55-115	55-115
8270C LVI	2-FLUOROBIPHENYL -SURR	WATER	NA		UG/L	NA	NA	27-114	27-114
8270C LVI	NITROBENZENE-d5 -SURR	WATER	NA		UG/L	NA	NA	22-124	22-124
8270C LVI	TERPHENYL-d14 -SURR	WATER	NA		UG/L	NA	NA	23-139	23-139
8270C LVI ADDITIONAL COMPOUNDS BY REQUEST									
8270C LVI	1,4-DIOXANE	WATER	0.20		UG/L	0.075	30	31-80	31-80
8270C LVI	1-METHYLNAPHTHALENE	WATER	0.20		UG/L	0.031	30	62-102	50-150
8270C LVI	2-METHYLNAPHTHALENE	WATER	0.10		UG/L	0.023	30	42-130	42-130
8270C LVI	BIS(2-ETHYLHEXYL)PHTHALATE	WATER	2.0		UG/L	0.19	30	55-130	55-130
8270C LVI	CARBAZOLE	WATER	1.0		UG/L	0.032	30	40-150	40-150
8270C LVI	DIBENZOFURAN	WATER	0.20		UG/L	0.027	30	50-150	50-150
8270C LVI	HEXACHLOROBENZENE	WATER	0.20		UG/L	0.027	30	47-108	47-108
8270C LVI	NITROBENZENE	WATER	0.20		UG/L	0.032	30	50-150	50-150

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8270C LVI	2,6-DIMETHYLNAPHTHALENE	SOIL	6.6		UG/KG	0.78	30	50-150	50-150
8270C LVI	ACENAPHTHENE	SOIL	6.6		UG/KG	1.8	30	39-130	39-130
8270C LVI	ACENAPHTHYLENE	SOIL	6.6		UG/KG	2.0	30	44-130	44-130
8270C LVI	ANTHRACENE	SOIL	6.6		UG/KG	2.5	30	49-130	49-130
8270C LVI	BENZO(A)ANTHRACENE	SOIL	3.3		UG/KG	2.7	30	47-116	47-116
8270C LVI	BENZO(A)PYRENE	SOIL	6.6		UG/KG	2.5	30	27-124	27-124
8270C LVI	BENZO(B)FLUORANTHENE	SOIL	6.6		UG/KG	2.5	30	19-132	19-132
8270C LVI	BENZO(G,H,I)PERYLENE	SOIL	6.6		UG/KG	2.4	30	24-128	24-128
8270C LVI	BENZO(K)FLUORANTHENE	SOIL	6.6		UG/KG	2.9	30	41-123	41-123
8270C LVI	CHRYSENE	SOIL	6.6		UG/KG	2.1	30	45-117	45-117
8270C LVI	DIBENZO(A,H)ANTHRACENE	SOIL	6.6		UG/KG	1.9	30	29-129	29-129
8270C LVI	FLUORANTHENE	SOIL	6.6		UG/KG	4.0	30	51-124	51-124
8270C LVI	FLUORENE	SOIL	6.6		UG/KG	1.8	30	40-130	40-130
8270C LVI	INDENO(1,2,3-CD)PYRENE	SOIL	6.6		UG/KG	2.3	30	40-122	40-122
8270C LVI	NAPHTHALENE	SOIL	6.6		UG/KG	2.7	30	44-130	44-130
8270C LVI	PHENANTHRENE	SOIL	6.6		UG/KG	5.0	30	51-130	51-130
8270C LVI	PYRENE	SOIL	6.6		UG/KG	3.5	30	33-123	33-123
8270C LVI	2-FLUOROBIPHENYL -SURR	SOIL	NA		UG/KG	NA	NA	23-120	23-120
8270C LVI	NITROBENZENE-d5 -SURR	SOIL	NA		UG/KG	NA	NA	18-125	18-125
8270C LVI	TERPHENYL-d14 -SURR	SOIL	NA		UG/KG	NA	NA	19-145	19-145
8270C LVI ADDITIONAL COMPOUNDS BY REQUEST									
8270C LVI	1,4-DIOXANE	SOIL	67		UG/KG	1.4	30	31-80	31-80
8270C LVI	1-METHYLNAPHTHALENE	SOIL	6.6		UG/KG	2.0	30	50-150	50-150
8270C LVI	2-METHYLNAPHTHALENE	SOIL	3.3		UG/KG	2.8	30	42-130	50-150
8270C LVI	BIS(2-ETHYLHEXYL)PHTHALATE	SOIL	67		UG/KG	7.8	30	50-150	50-150
8270C LVI	CARBAZOLE	SOIL	33		UG/KG	1.8	30	40-150	40-150
8270C LVI	DIBENZOFURAN	SOIL	6.6		UG/KG	1.9	30	50-150	50-150
8270C LVI	HEXACHLOROBENZENE	SOIL	6.6		UG/KG	2.6	30	50-150	50-150
8270C LVI	NITROBENZENE	SOIL	6.6		UG/KG	1.8	30	50-150	50-150
8310	NAPHTHALENE	WATER	0.080		UG/L	0.020	30	50-150	50-150
8310	ACENAPHTHYLENE	WATER	0.080		UG/L	0.048	30	50-150	50-150
8310	FLUORENE	WATER	0.080		UG/L	0.013	30	50-150	50-150
8310	ACENAPHTHENE	WATER	0.080		UG/L	0.029	30	50-150	50-150
8310	PHENANTHRENE	WATER	0.080		UG/L	0.017	30	50-150	50-150
8310	ANTHRACENE	WATER	0.080		UG/L	0.016	30	50-150	50-150
8310	FLUORANTHENE	WATER	0.080		UG/L	0.015	30	50-150	50-150
8310	PYRENE	WATER	0.080		UG/L	0.016	30	50-150	50-150
8310	BENZO(A)ANTRACENE	WATER	0.080		UG/L	0.013	30	50-150	50-150
8310	CHRYSENE	WATER	0.080		UG/L	0.015	30	50-150	50-150
8310	BENZO(B)FLUORANTHENE	WATER	0.080		UG/L	0.016	30	50-150	50-150
8310	BENZO(K)FLUORANTHENE	WATER	0.080		UG/L	0.017	30	50-150	50-150
8310	BENZO(A)PYRENE	WATER	0.080		UG/L	0.024	30	50-150	50-150
8310	DIBENZO(A,H)ANTHRACENE	WATER	0.080		UG/L	0.019	30	50-150	50-150
8310	INDENO(1,2,3-CD)PYRENE	WATER	0.080		UG/L	0.011	30	50-150	50-150
8310	BENZO(G,H,I)PERYLENE	WATER	0.080		UG/L	0.022	30	50-150	50-150
8310	O-TERPHENYL -SURR	WATER	NA		UG/L	NA	NA	50-150	50-150

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
8315A	FORMALDEHYDE	WATER	8.0		UG/L	1.1	30	59-136	59-153
8315A	FORMALDEHYDE	SOIL	1600		UG/KG	230	30	70-130	50-150
8330	1,3,5-TRINITROBENZENE	SOIL	2000		UG/KG	160	30	70-130	70-130
8330	1,3-DINITROBENZENE	SOIL	2000		UG/KG	150	30	70-130	70-130
8330	2,4,6-TRINITROTOLUENE (TNT)	SOIL	2000		UG/KG	170	30	70-130	70-130
8330	2,4-DINITROTOLUENE	SOIL	2000		UG/KG	150	30	70-130	70-130
8330	2,6-DINITROTOLUENE	SOIL	2000		UG/KG	160	30	70-130	70-130
8330	2-AMINO-4,6-DINITROTOLUENE	SOIL	2000		UG/KG	180	30	70-130	70-130
8330	2-NITROTOLUENE	SOIL	2000		UG/KG	150	30	70-130	70-130
8330	3-NITROTOLUENE	SOIL	2000		UG/KG	150	30	70-130	70-130
8330	4-AMINO-2,6-DINITROTOLUENE	SOIL	2000		UG/KG	190	30	70-130	70-130
8330	4-NITROTOLUENE	SOIL	2000		UG/KG	160	30	70-130	70-130
8330	HMX (OCTAHYDRO-1,3,5,7-TETRANITRO-	SOIL	2000		UG/KG	180	30	70-130	70-130
8330	NITROBENZENE	SOIL	2000		UG/KG	150	30	70-130	70-130
8330	NITROGLYCERIN	SOIL	2000		UG/KG	860	30	70-130	70-130
8330	PETN	SOIL	2000		UG/KG	420	30	70-130	70-130
8330	RDX (HEXAHYDRO-1,3,5-TRINITRO-1,3,	SOIL	2000		UG/KG	170	30	70-130	70-130
8330	TETRYL (METHYL-2,4,6-TRINITROPHENY	SOIL	2000		UG/KG	530	30	70-130	70-130
8330	1,2-DINITROBENZENE - SURR	SOIL	NA		UG/KG	NA	NA	50-150	50-150
6850	PERCHLORATE	WATER	0.2		UG/L	0.051	15	80-120	80-120
6850	PERCHLORATE	SOIL	2.0		UG/KG	0.031	15	85-115	75-125

ROCHESTER ORGANIC QC LIMITS

METHOD		ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
VOA OLM4.2/4.3		1,1,1-TRICHLOROETHANE	WATER	10		UG/L	0.35			
VOA OLM4.2/4.3		1,1,2,2-TETRACHLOROETHANE	WATER	10		UG/L	0.56			
VOA OLM4.2/4.3		1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	WATER	10		UG/L	0.79			
VOA OLM4.2/4.3		1,1,2-TRICHLOROETHANE	WATER	10		UG/L	0.31			
VOA OLM4.2/4.3		1,1-DICHLOROETHANE	WATER	10		UG/L	0.49			
VOA OLM4.2/4.3	*	1,1-DICHLOROETHENE	WATER	10		UG/L	0.80	14	61-145	61-145
VOA OLM4.2/4.3		1,2,4-TRICHLOROBENZENE	WATER	10		UG/L	0.41			
VOA OLM4.2/4.3		1,2-DIBROMO-3-CHLOROPROPANE	WATER	10		UG/L	0.40			
VOA OLM4.2/4.3		1,2-DIBROMOETHANE	WATER	10		UG/L	0.57			
VOA OLM4.2/4.3		1,2-DICHLOROBENZENE	WATER	10		UG/L	0.39			
VOA OLM4.2/4.3		1,2-DICHLOROETHANE	WATER	10		UG/L	0.32			
VOA OLM4.2/4.3		1,2-DICHLOROPROPANE	WATER	10		UG/L	0.58			
VOA OLM4.2/4.3		1,3-DICHLOROBENZENE	WATER	10		UG/L	0.35			
VOA OLM4.2/4.3		1,4-DICHLOROBENZENE	WATER	10		UG/L	0.41			
VOA OLM4.2/4.3		2-BUTANONE	WATER	10		UG/L	0.72			
VOA OLM4.2/4.3		2-HEXANONE	WATER	10		UG/L	1.4			
VOA OLM4.2/4.3		4-METHYL-2-PENTANONE	WATER	10		UG/L	1.2			
VOA OLM4.2/4.3		ACETONE	WATER	10		UG/L	2.3			
VOA OLM4.2/4.3	*	BENZENE	WATER	10		UG/L	0.45	11	76-127	76-127
VOA OLM4.2/4.3		BROMODICHLOROMETHANE	WATER	10		UG/L	0.36			
VOA OLM4.2/4.3		BROMOFORM	WATER	10		UG/L	0.44			
VOA OLM4.2/4.3		BROMOMETHANE	WATER	10		UG/L	0.53			
VOA OLM4.2/4.3		CARBON DISULFIDE	WATER	10		UG/L	0.34			
VOA OLM4.2/4.3		CARBON TETRACHLORIDE	WATER	10		UG/L	0.42			
VOA OLM4.2/4.3	*	CHLOROBENZENE	WATER	10		UG/L	0.36	13	75-130	75-130
VOA OLM4.2/4.3		CHLOROETHANE	WATER	10		UG/L	0.41			
VOA OLM4.2/4.3		CHLOROFORM	WATER	10		UG/L	0.37			
VOA OLM4.2/4.3		CHLOROMETHANE	WATER	10		UG/L	0.72			
VOA OLM4.2/4.3		CIS-1,2-DICHLOROETHENE	WATER	10		UG/L	0.59			
VOA OLM4.2/4.3		CIS-1,3-DICHLOROPROPENE	WATER	10		UG/L	0.50			
VOA OLM4.2/4.3		CYCLOHEXANE	WATER	10		UG/L	0.46			
VOA OLM4.2/4.3		DIBROMOCHLOROMETHANE	WATER	10		UG/L	0.56			
VOA OLM4.2/4.3		DICHLORODIFLUOROMETHANE	WATER	10		UG/L	0.43			
VOA OLM4.2/4.3		ETHYLBENZENE	WATER	10		UG/L	0.46			
VOA OLM4.2/4.3		ISOPROPYLBENZENE	WATER	10		UG/L	0.44			
VOA OLM4.2/4.3		M+P-XYLENE	WATER	10		UG/L	0.60			
VOA OLM4.2/4.3		METHYL ACETATE	WATER	10		UG/L	0.49			
VOA OLM4.2/4.3		METHYL TERT-BUTYL ETHER	WATER	10		UG/L	0.31			
VOA OLM4.2/4.3		METHYLCYCLOHEXANE	WATER	10		UG/L	0.71			
VOA OLM4.2/4.3		METHYLENE CHLORIDE	WATER	10		UG/L	0.48			
VOA OLM4.2/4.3		O-XYLENE	WATER	10		UG/L	0.37			
VOA OLM4.2/4.3		STYRENE	WATER	10		UG/L	0.27			
VOA OLM4.2/4.3		TETRACHLOROETHENE	WATER	10		UG/L	0.60			
VOA OLM4.2/4.3	*	TOLUENE	WATER	10		UG/L	0.54	13	76-125	76-125
VOA OLM4.2/4.3		TRANS-1,2-DICHLOROETHENE	WATER	10		UG/L	0.41			
VOA OLM4.2/4.3		TRANS-1,3-DICHLOROPROPENE	WATER	10		UG/L	0.26			
VOA OLM4.2/4.3	*	TRICHLOROETHENE	WATER	10		UG/L	0.57	14	71-120	71-120
VOA OLM4.2/4.3		TRICHLOROFLUOROMETHANE	WATER	10		UG/L	0.44			
VOA OLM4.2/4.3		VINYL CHLORIDE	WATER	10		UG/L	0.42			
VOA OLM4.2/4.3		BROMOFLUOROBENZENE -SURR	WATER	NA		UG/L	NA	NA	86-115	86-115
VOA OLM4.2/4.3		1,2-DICHLOROETHANE-D4 -SURR	WATER	NA		UG/L	NA	NA	76-114	76-114
VOA OLM4.2/4.3		TOLUENE-D8 -SURR	WATER	NA		UG/L	NA	NA	88-110	88-110

ROCHESTER ORGANIC QC LIMITS

METHOD		ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
VOA OLM4.2/4.3		1,1,1-TRICHLOROETHANE	SOIL	10		UG/KG	0.53			
VOA OLM4.2/4.3		1,1,2,2-TETRACHLOROETHANE	SOIL	10		UG/KG	0.27			
VOA OLM4.2/4.3		1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (	SOIL	10		UG/KG	0.62			
VOA OLM4.2/4.3		1,1,2-TRICHLOROETHANE	SOIL	10		UG/KG	0.45			
VOA OLM4.2/4.3		1,1-DICHLOROETHANE	SOIL	10		UG/KG	0.41			
VOA OLM4.2/4.3	*	1,1-DICHLOROETHENE	SOIL	10		UG/KG	0.72	22	59-172	59-172
VOA OLM4.2/4.3		1,2,4-TRICHLOROBENZENE	SOIL	10		UG/KG	0.94			
VOA OLM4.2/4.3		1,2-DIBROMO-3-CHLOROPROPANE	SOIL	10		UG/KG	0.85			
VOA OLM4.2/4.3		1,2-DIBROMOETHANE	SOIL	10		UG/KG	0.45			
VOA OLM4.2/4.3		1,2-DICHLOROBENZENE	SOIL	10		UG/KG	0.52			
VOA OLM4.2/4.3		1,2-DICHLOROETHANE	SOIL	10		UG/KG	0.66			
VOA OLM4.2/4.3		1,2-DICHLOROPROPANE	SOIL	10		UG/KG	0.46			
VOA OLM4.2/4.3		1,3-DICHLOROBENZENE	SOIL	10		UG/KG	0.50			
VOA OLM4.2/4.3		1,4-DICHLOROBENZENE	SOIL	10		UG/KG	0.73			
VOA OLM4.2/4.3		2-BUTANONE	SOIL	10		UG/KG	2.2			
VOA OLM4.2/4.3		2-HEXANONE	SOIL	10		UG/KG	1.3			
VOA OLM4.2/4.3		4-METHYL-2-PENTANONE	SOIL	10		UG/KG	1.4			
VOA OLM4.2/4.3		ACETONE	SOIL	10		UG/KG	3.1			
VOA OLM4.2/4.3	*	BENZENE	SOIL	10		UG/KG	0.38	21	66-142	66-142
VOA OLM4.2/4.3		BROMODICHLOROMETHANE	SOIL	10		UG/KG	0.37			
VOA OLM4.2/4.3		BROMOFORM	SOIL	10		UG/KG	0.37			
VOA OLM4.2/4.3		BROMOMETHANE	SOIL	10		UG/KG	0.59			
VOA OLM4.2/4.3		CARBON DISULFIDE	SOIL	10		UG/KG	0.51			
VOA OLM4.2/4.3		CARBON TETRACHLORIDE	SOIL	10		UG/KG	0.33			
VOA OLM4.2/4.3	*	CHLOROBENZENE	SOIL	10		UG/KG	0.33	21	60-133	60-133
VOA OLM4.2/4.3		CHLOROETHANE	SOIL	10		UG/KG	0.23			
VOA OLM4.2/4.3		CHLOROFORM	SOIL	10		UG/KG	0.50			
VOA OLM4.2/4.3		CHLOROMETHANE	SOIL	10		UG/KG	0.55			
VOA OLM4.2/4.3		CIS-1,2-DICHLOROETHENE	SOIL	10		UG/KG	0.69			
VOA OLM4.2/4.3		CIS-1,3-DICHLOROPROPENE	SOIL	10		UG/KG	0.35			
VOA OLM4.2/4.3		CYCLOHEXANE	SOIL	10		UG/KG	0.91			
VOA OLM4.2/4.3		DIBROMOCHLOROMETHANE	SOIL	10		UG/KG	0.20			
VOA OLM4.2/4.3		DICHLORODIFLUOROMETHANE	SOIL	10		UG/KG	0.83			
VOA OLM4.2/4.3		ETHYLBENZENE	SOIL	10		UG/KG	1.7			
VOA OLM4.2/4.3		ISOPROPYLBENZENE	SOIL	10		UG/KG	0.77			
VOA OLM4.2/4.3		M+P-XYLENE	SOIL	10		UG/KG	1.6			
VOA OLM4.2/4.3		METHYL ACETATE	SOIL	10		UG/KG	0.81			
VOA OLM4.2/4.3		METHYL TERT-BUTYL ETHER	SOIL	10		UG/KG	0.44			
VOA OLM4.2/4.3		METHYLCYCLOHEXANE	SOIL	10		UG/KG	0.80			
VOA OLM4.2/4.3		METHYLENE CHLORIDE	SOIL	10		UG/KG	1.0			
VOA OLM4.2/4.3		O-XYLENE	SOIL	10		UG/KG	0.53			
VOA OLM4.2/4.3		STYRENE	SOIL	10		UG/KG	0.36			
VOA OLM4.2/4.3		TETRACHLOROETHENE	SOIL	10		UG/KG	0.62			
VOA OLM4.2/4.3	*	TOLUENE	SOIL	10		UG/KG	0.40	21	59-139	59-139
VOA OLM4.2/4.3		TRANS-1,2-DICHLOROETHENE	SOIL	10		UG/KG	0.42			
VOA OLM4.2/4.3		TRANS-1,3-DICHLOROPROPENE	SOIL	10		UG/KG	0.41			
VOA OLM4.2/4.3	*	TRICHLOROETHENE	SOIL	10		UG/KG	0.68	24	62-137	62-137
VOA OLM4.2/4.3		TRICHLOROFLUOROMETHANE	SOIL	10		UG/KG	0.53			
VOA OLM4.2/4.3		VINYL CHLORIDE	SOIL	10		UG/KG	0.65			
VOA OLM4.2/4.3		BROMOFLUOROBENZENE -SURR	SOIL	NA		UG/KG	NA	NA	59-113	59-113
VOA OLM4.2/4.3		1,2-DICHLOROETHANE-D4 -SURR	SOIL	NA		UG/KG	NA	NA	70-121	70-121
VOA OLM4.2/4.3		TOLUENE-D8 -SURR	SOIL	NA		UG/KG	NA	NA	84-138	84-138

ROCHESTER ORGANIC QC LIMITS

METHOD		ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
BNA OLM4.2/4.3		1,1'-BIPHENYL	WATER	10		UG/L	0.28			
BNA OLM4.2/4.3		2,2'-OXYBIS(1-CHLOROPROPANE)	WATER	10		UG/L	1.2			
BNA OLM4.2/4.3		2,4,5-TRICHLOROPHENOL	WATER	25		UG/L	1.8			
BNA OLM4.2/4.3		2,4,6-TRICHLOROPHENOL	WATER	10		UG/L	1.2			
BNA OLM4.2/4.3		2,4-DICHLOROPHENOL	WATER	10		UG/L	0.73			
BNA OLM4.2/4.3		2,4-DIMETHYLPHENOL	WATER	10		UG/L	0.36			
BNA OLM4.2/4.3		2,4-DINITROPHENOL	WATER	25		UG/L	2.0			
BNA OLM4.2/4.3	*	2,4-DINITROTOLUENE	WATER	10		UG/L	1.8	38	24-96	24-96
BNA OLM4.2/4.3		2,6-DINITROTOLUENE	WATER	10		UG/L	1.3			
BNA OLM4.2/4.3		2-CHLORONAPHTHALENE	WATER	10		UG/L	0.18			
BNA OLM4.2/4.3	*	2-CHLOROPHENOL	WATER	10		UG/L	0.53	40	27-123	27-123
BNA OLM4.2/4.3		2-METHYLNAPHTHALENE	WATER	10		UG/L	0.33			
BNA OLM4.2/4.3		2-METHYLPHENOL	WATER	10		UG/L	2.2			
BNA OLM4.2/4.3		2-NITROANILINE	WATER	25		UG/L	1.5			
BNA OLM4.2/4.3		2-NITROPHENOL	WATER	10		UG/L	1.3			
BNA OLM4.2/4.3		3,3'-DICHLOROBENZIDINE	WATER	10		UG/L	0.86			
BNA OLM4.2/4.3		3-NITROANILINE	WATER	25		UG/L	0.78			
BNA OLM4.2/4.3		4,6-DINITRO-2-METHYLPHENOL	WATER	25		UG/L	1.4			
BNA OLM4.2/4.3		4-BROMOPHENYL-PHENYLETHER	WATER	10		UG/L	0.11			
BNA OLM4.2/4.3	*	4-CHLORO-3-METHYLPHENOL	WATER	10		UG/L	0.36	42	23-97	23-97
BNA OLM4.2/4.3		4-CHLOROANILINE	WATER	10		UG/L	0.46			
BNA OLM4.2/4.3		4-CHLOROPHENYL-PHENYLETHER	WATER	10		UG/L	0.75			
BNA OLM4.2/4.3		4-METHYLPHENOL	WATER	10		UG/L	0.85			
BNA OLM4.2/4.3		4-NITROANILINE	WATER	25		UG/L	0.94			
BNA OLM4.2/4.3	*	4-NITROPHENOL	WATER	25		UG/L	1.6	50	10-80	10-80
BNA OLM4.2/4.3	*	ACENAPHTHENE	WATER	10		UG/L	0.53	31	46-118	46-118
BNA OLM4.2/4.3		ACENAPHTHYLENE	WATER	10		UG/L	0.74			
BNA OLM4.2/4.3		ACETOPHENONE	WATER	10		UG/L	0.96			
BNA OLM4.2/4.3		ANTHRACENE	WATER	10		UG/L	0.46			
BNA OLM4.2/4.3		ATRAZINE	WATER	10		UG/L	1.3			
BNA OLM4.2/4.3		BENZALDEHYDE	WATER	10		UG/L	0.86			
BNA OLM4.2/4.3		BENZO(A)ANTHRACENE	WATER	10		UG/L	0.16			
BNA OLM4.2/4.3		BENZO(A)PYRENE	WATER	10		UG/L	0.53			
BNA OLM4.2/4.3		BENZO(B)FLUORANTHENE	WATER	10		UG/L	2.7			
BNA OLM4.2/4.3		BENZO(G,H,I)PERYLENE	WATER	10		UG/L	2.5			
BNA OLM4.2/4.3		BENZO(K)FLUORANTHENE	WATER	10		UG/L	0.66			
BNA OLM4.2/4.3		BIS(-2-CHLOROETHOXY)METHANE	WATER	10		UG/L	0.69			
BNA OLM4.2/4.3		BIS(-2-CHLOROETHYL)ETHER	WATER	10		UG/L	1.1			
BNA OLM4.2/4.3		BIS(2-ETHYLHEXYL)PHTHALATE	WATER	10		UG/L	0.40			
BNA OLM4.2/4.3		BUTYL BENZYL PHTHALATE	WATER	10		UG/L	1.4			
BNA OLM4.2/4.3		CAPROLACTAM	WATER	10		UG/L	0.91			
BNA OLM4.2/4.3		CARBAZOLE	WATER	10		UG/L	0.56			
BNA OLM4.2/4.3		CHRYSENE	WATER	10		UG/L	0.07			
BNA OLM4.2/4.3		DIBENZ(A,H)ANTHRACENE	WATER	10		UG/L	2.09			
BNA OLM4.2/4.3		DIBENZOFURAN	WATER	10		UG/L	0.21			
BNA OLM4.2/4.3		DIETHYLPHTHALATE	WATER	10		UG/L	0.38			
BNA OLM4.2/4.3		DIMETHYL PHTHALATE	WATER	10		UG/L	0.54			
BNA OLM4.2/4.3		DI-N-BUTYLPHTHALATE	WATER	10		UG/L	0.35			
BNA OLM4.2/4.3		DI-N-OCTYL PHTHALATE	WATER	10		UG/L	2.5			
BNA OLM4.2/4.3		FLUORANTHENE	WATER	10		UG/L	0.76			
BNA OLM4.2/4.3		FLUORENE	WATER	10		UG/L	0.63			
BNA OLM4.2/4.3		HEXACHLOROBENZENE	WATER	10		UG/L	1.4			
BNA OLM4.2/4.3		HEXACHLOROBUTADIENE	WATER	10		UG/L	0.48			
BNA OLM4.2/4.3		HEXACHLOROCYCLOPENTADIENE	WATER	10		UG/L	1.6			
BNA OLM4.2/4.3		HEXACHLOROETHANE	WATER	10		UG/L	0.74			
BNA OLM4.2/4.3		INDENO(1,2,3-CD)PYRENE	WATER	10		UG/L	2.5			
BNA OLM4.2/4.3		ISOPHORONE	WATER	10		UG/L	0.45			
BNA OLM4.2/4.3		NAPHTHALENE	WATER	10		UG/L	0.14			
BNA OLM4.2/4.3		NITROBENZENE	WATER	10		UG/L	0.90			
BNA OLM4.2/4.3	*	N-NITROSO-DI-N-PROPYLAMINE	WATER	10		UG/L	0.64	38	41-116	41-116
BNA OLM4.2/4.3		N-NITROSODIPHENYLAMINE	WATER	10		UG/L	1.1			
BNA OLM4.2/4.3	*	PENTACHLOROPHENOL	WATER	25		UG/L	3.0	50	9-103	9-103
BNA OLM4.2/4.3		PHENANTHRENE	WATER	10		UG/L	0.56			
BNA OLM4.2/4.3	*	PHENOL	WATER	10		UG/L	0.37	42	12-110	12-110
BNA OLM4.2/4.3	*	PYRENE	WATER	10		UG/L	1.6	31	26-127	26-127

ROCHESTER ORGANIC QC LIMITS

METHOD		ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
BNA OLM4.2/4.3		TERPHENYL-D14 -SURR	WATER	NA		UG/L	NA	NA	33-141	33-141
BNA OLM4.2/4.3		2-CHLOROPHENOL-D4 -SURR (adviso	WATER	NA		UG/L	NA	NA	33-110	33-110
BNA OLM4.2/4.3		1,2-DICHLOROBENZENE-D4 -SURR (ad	WATER	NA		UG/L	NA	NA	16-110	16-110
BNA OLM4.2/4.3		NITROBENZENE-D5 -SURR	WATER	NA		UG/L	NA	NA	35-114	35-114
BNA OLM4.2/4.3		PHENOL-D6 -SURR	WATER	NA		UG/L	NA	NA	10-110	10-110
BNA OLM4.2/4.3		2-FLUOROBIPHENYL -SURR	WATER	NA		UG/L	NA	NA	43-116	43-116
BNA OLM4.2/4.3		2-FLUOROPHENOL -SURR	WATER	NA		UG/L	NA	NA	21-110	21-110
BNA OLM4.2/4.3		2,4,6-TRIBROMOPHENOL -SURR	WATER	NA		UG/L	NA	NA	10-123	10-123
BNA OLM4.2/4.3 additional compounds upon request										
BNA OLM4.2/4.3		1,3-DICHLOROBENZENE	WATER	10		UG/L	0.51			
BNA OLM4.2/4.3		1,2-DICHLOROBENZENE	WATER	10		UG/L	0.86			
BNA OLM4.2/4.3		1,4-DICHLOROBENZENE	WATER	10		UG/L	0.53			
BNA OLM4.2/4.3		1,1'-BIPHENYL	SOIL	330		UG/KG	9.3			
BNA OLM4.2/4.3		2,2'-OXYBIS(1-CHLOROPROPANE)	SOIL	330		UG/KG	41			
BNA OLM4.2/4.3		2,4,5-TRICHLOROPHENOL	SOIL	800		UG/KG	61			
BNA OLM4.2/4.3		2,4,6-TRICHLOROPHENOL	SOIL	330		UG/KG	41			
BNA OLM4.2/4.3		2,4-DICHLOROPHENOL	SOIL	330		UG/KG	24			
BNA OLM4.2/4.3		2,4-DIMETHYLPHENOL	SOIL	330		UG/KG	12			
BNA OLM4.2/4.3		2,4-DINITROPHENOL	SOIL	800		UG/KG	66			
BNA OLM4.2/4.3	*	2,4-DINITROTOLUENE	SOIL	330		UG/KG	59	47	28-89	28-89
BNA OLM4.2/4.3		2,6-DINITROTOLUENE	SOIL	330		UG/KG	44			
BNA OLM4.2/4.3		2-CHLORONAPHTHALENE	SOIL	330		UG/KG	6.0			
BNA OLM4.2/4.3	*	2-CHLOROPHENOL	SOIL	330		UG/KG	18	50	25-102	25-102
BNA OLM4.2/4.3		2-METHYLNAPHTHALENE	SOIL	330		UG/KG	11			
BNA OLM4.2/4.3		2-METHYLPHENOL	SOIL	330		UG/KG	73			
BNA OLM4.2/4.3		2-NITROANILINE	SOIL	800		UG/KG	50			
BNA OLM4.2/4.3		2-NITROPHENOL	SOIL	330		UG/KG	42			
BNA OLM4.2/4.3		3,3'-DICHLOROBENZIDINE	SOIL	330		UG/KG	29			
BNA OLM4.2/4.3		3-NITROANILINE	SOIL	800		UG/KG	26			
BNA OLM4.2/4.3		4,6-DINITRO-2-METHYLPHENOL	SOIL	800		UG/KG	47			
BNA OLM4.2/4.3		4-BROMOPHENYL-PHENYLETHER	SOIL	330		UG/KG	3.7			
BNA OLM4.2/4.3	*	4-CHLORO-3-METHYLPHENOL	SOIL	330		UG/KG	12	33	26-103	26-103
BNA OLM4.2/4.3		4-CHLOROANILINE	SOIL	330		UG/KG	15			
BNA OLM4.2/4.3		4-CHLOROPHENYL-PHENYLETHER	SOIL	330		UG/KG	25			
BNA OLM4.2/4.3		4-METHYLPHENOL	SOIL	330		UG/KG	28			
BNA OLM4.2/4.3		4-NITROANILINE	SOIL	800		UG/KG	31			
BNA OLM4.2/4.3	*	4-NITROPHENOL	SOIL	800		UG/KG	54	50	11-114	11-114
BNA OLM4.2/4.3	*	ACENAPHTHENE	SOIL	330		UG/KG	18	19	31-137	31-137
BNA OLM4.2/4.3		ACENAPHTHYLENE	SOIL	330		UG/KG	25			
BNA OLM4.2/4.3		ACETOPHENONE	SOIL	330		UG/KG	32			
BNA OLM4.2/4.3		ANTHRACENE	SOIL	330		UG/KG	15			
BNA OLM4.2/4.3		ATRAZINE	SOIL	330		UG/KG	42			
BNA OLM4.2/4.3		BENZALDEHYDE	SOIL	330		UG/KG	29			
BNA OLM4.2/4.3		BENZO(A)ANTHRACENE	SOIL	330		UG/KG	5.3			
BNA OLM4.2/4.3		BENZO(A)PYRENE	SOIL	330		UG/KG	18			
BNA OLM4.2/4.3		BENZO(B)FLUORANTHENE	SOIL	330		UG/KG	88			
BNA OLM4.2/4.3		BENZO(G,H,I)PERYLENE	SOIL	330		UG/KG	82			
BNA OLM4.2/4.3		BENZO(K)FLUORANTHENE	SOIL	330		UG/KG	22			
BNA OLM4.2/4.3		BIS(-2-CHLOROETHOXY)METHANE	SOIL	330		UG/KG	23			
BNA OLM4.2/4.3		BIS(-2-CHLOROETHYL)ETHER	SOIL	330		UG/KG	37			
BNA OLM4.2/4.3		BIS(2-ETHYLHEXYL)PHTHALATE	SOIL	330		UG/KG	13			
BNA OLM4.2/4.3		BUTYL BENZYL PHTHALATE	SOIL	330		UG/KG	46			
BNA OLM4.2/4.3		CAPROLACTAM	SOIL	330		UG/KG	30			
BNA OLM4.2/4.3		CARBAZOLE	SOIL	330		UG/KG	19			
BNA OLM4.2/4.3		CHRYSENE	SOIL	330		UG/KG	2.3			
BNA OLM4.2/4.3		DIBENZ(A,H)ANTHRACENE	SOIL	330		UG/KG	70			
BNA OLM4.2/4.3		DIBENZOFURAN	SOIL	330		UG/KG	7.0			
BNA OLM4.2/4.3		DIETHYLPHTHALATE	SOIL	330		UG/KG	13			
BNA OLM4.2/4.3		DIMETHYL PHTHALATE	SOIL	330		UG/KG	18			
BNA OLM4.2/4.3		DI-N-BUTYLPHTHALATE	SOIL	330		UG/KG	12			
BNA OLM4.2/4.3		DI-N-OCTYL PHTHALATE	SOIL	330		UG/KG	82			
BNA OLM4.2/4.3		FLUORANTHENE	SOIL	330		UG/KG	25			
BNA OLM4.2/4.3		FLUORENE	SOIL	330		UG/KG	21			
BNA OLM4.2/4.3		HEXACHLOROBENZENE	SOIL	330		UG/KG	45			
BNA OLM4.2/4.3		HEXACHLOROBUTADIENE	SOIL	330		UG/KG	16			

ROCHESTER ORGANIC QC LIMITS

METHOD		ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
BNA OLM4.2/4.3		HEXACHLOROCYCLOPENTADIENE	SOIL	330		UG/KG	53			
BNA OLM4.2/4.3		HEXACHLOROETHANE	SOIL	330		UG/KG	25			
BNA OLM4.2/4.3		INDENO(1,2,3-CD)PYRENE	SOIL	330		UG/KG	82			
BNA OLM4.2/4.3		ISOPHORONE	SOIL	330		UG/KG	15			
BNA OLM4.2/4.3		NAPHTHALENE	SOIL	330		UG/KG	4.7			
BNA OLM4.2/4.3		NITROBENZENE	SOIL	330		UG/KG	30			
BNA OLM4.2/4.3	*	N-NITROSO-DI-N-PROPYLAMINE	SOIL	330		UG/KG	21	38	41-126	41-126
BNA OLM4.2/4.3		N-NITROSODIPHENYLAMINE	SOIL	330		UG/KG	35			
BNA OLM4.2/4.3	*	PENTACHLOROPHENOL	SOIL	800		UG/KG	99	47	17-109	17-109
BNA OLM4.2/4.3		PHENANTHRENE	SOIL	330		UG/KG	19			
BNA OLM4.2/4.3	*	PHENOL	SOIL	330		UG/KG	12	35	26-90	26-90
BNA OLM4.2/4.3	*	PYRENE	SOIL	330		UG/KG	53	36	35-142	35-142
BNA OLM4.2/4.3		TERPHENYL-D14 -SURR	SOIL	NA		UG/KG	NA	NA	18-137	18-137
BNA OLM4.2/4.3		2-CHLOROPHENOL-D4 -SURR (advisor	SOIL	NA		UG/KG	NA	NA	20-130	20-130
BNA OLM4.2/4.3		1,2-DICHLOROBENZENE-D4 -SURR (a	SOIL	NA		UG/KG	NA	NA	20-130	20-130
BNA OLM4.2/4.3		NITROBENZENE-D5 -SURR	SOIL	NA		UG/KG	NA	NA	23-120	23-120
BNA OLM4.2/4.3		PHENOL-D6 -SURR	SOIL	NA		UG/KG	NA	NA	24-113	24-113
BNA OLM4.2/4.3		2-FLUOROBIPHENYL -SURR	SOIL	NA		UG/KG	NA	NA	30-115	30-115
BNA OLM4.2/4.3		2-FLUOROPHENOL -SURR	SOIL	NA		UG/KG	NA	NA	25-121	25-121
BNA OLM4.2/4.3		2,4,6-TRIBROMOPHENOL -SURR	SOIL	NA		UG/KG	NA	NA	19-122	19-122
BNA OLM4.2/4.3 additional compounds by request										
BNA OLM4.2/4.3		1,3-DICHLOROBENZENE	SOIL	330		UG/KG	17			
BNA OLM4.2/4.3		1,2-DICHLOROBENZENE	SOIL	330		UG/KG	29			
BNA OLM4.2/4.3		1,4-DICHLOROBENZENE	SOIL	330		UG/KG	18			

ROCHESTER ORGANIC QC LIMITS

METHOD		ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
P/PCB OLM4.2/4.3		AROCLOR-1016	WATER	1.0		UG/L	0.48			
P/PCB OLM4.2/4.3		AROCLOR-1221	WATER	2.0		UG/L	0.68			
P/PCB OLM4.2/4.3		AROCLOR-1232	WATER	1.0		UG/L	0.79			
P/PCB OLM4.2/4.3		AROCLOR-1242	WATER	1.0		UG/L	0.36			
P/PCB OLM4.2/4.3		AROCLOR-1248	WATER	1.0		UG/L	0.27			
P/PCB OLM4.2/4.3		AROCLOR-1254	WATER	1.0		UG/L	0.073			
P/PCB OLM4.2/4.3		AROCLOR-1260	WATER	1.0		UG/L	0.19			
P/PCB OLM4.2/4.3	*	ALDRIN	WATER	0.050		UG/L	0.0026	22	40-120	40-120
P/PCB OLM4.2/4.3		ALPHA-BHC	WATER	0.050		UG/L	0.0084			
P/PCB OLM4.2/4.3		BETA-BHC	WATER	0.050		UG/L	0.0041			
P/PCB OLM4.2/4.3		DELTA-BHC	WATER	0.050		UG/L	0.0035			
P/PCB OLM4.2/4.3	*	GAMMA-BHC (LINDANE)	WATER	0.050		UG/L	0.0076	15	56-123	56-123
P/PCB OLM4.2/4.3		ALPHA-CHLORDANE	WATER	0.050		UG/L	0.0057			
P/PCB OLM4.2/4.3		GAMMA-CHLORDANE	WATER	0.050		UG/L	0.0025			
P/PCB OLM4.2/4.3		4,4'-DDD	WATER	0.10		UG/L	0.0091			
P/PCB OLM4.2/4.3		4,4'-DDE	WATER	0.10		UG/L	0.0049			
P/PCB OLM4.2/4.3	*	4,4'-DDT	WATER	0.10		UG/L	0.0034	27	38-127	38-127
P/PCB OLM4.2/4.3	*	DIELDRIN	WATER	0.10		UG/L	0.014	18	52-126	52-126
P/PCB OLM4.2/4.3		ENDOSULFAN I	WATER	0.050		UG/L	0.0056			
P/PCB OLM4.2/4.3		ENDOSULFAN II	WATER	0.10		UG/L	0.011			
P/PCB OLM4.2/4.3		ENDOSULFAN SULFATE	WATER	0.10		UG/L	0.0074			
P/PCB OLM4.2/4.3	*	ENDRIN	WATER	0.10		UG/L	0.014	21	56-121	56-121
P/PCB OLM4.2/4.3		ENDRIN ALDEHYDE	WATER	0.10		UG/L	0.006			
P/PCB OLM4.2/4.3		ENDRIN KETONE	WATER	0.10		UG/L	0.009			
P/PCB OLM4.2/4.3	*	HEPTACHLOR	WATER	0.050		UG/L	0.0081	20	40-131	40-131
P/PCB OLM4.2/4.3		HEPTACHLOR EPOXIDE	WATER	0.050		UG/L	0.0024			
P/PCB OLM4.2/4.3		METHOXYCHLOR	WATER	0.50		UG/L	0.031			
P/PCB OLM4.2/4.3		TOXAPHENE	WATER	5.0		UG/L	1.0			
P/PCB OLM4.2/4.3		DECACHLOROBIPHENYL (DCB) -SURR	WATER	NA		UG/L	NA	NA	30-150	30-150
P/PCB OLM4.2/4.3		TETRACHLORO-META-XYLENE (TCMX) -SU	WATER	NA		UG/L	NA	NA	30-150	30-150
P/PCB OLM4.2/4.3		AROCLOR-1016	SOIL	33		UG/KG	16			
P/PCB OLM4.2/4.3		AROCLOR-1221	SOIL	67		UG/KG	23			
P/PCB OLM4.2/4.3		AROCLOR-1232	SOIL	33		UG/KG	26			
P/PCB OLM4.2/4.3		AROCLOR-1242	SOIL	33		UG/KG	12			
P/PCB OLM4.2/4.3		AROCLOR-1248	SOIL	33		UG/KG	9.2			
P/PCB OLM4.2/4.3		AROCLOR-1254	SOIL	33		UG/KG	2.4			
P/PCB OLM4.2/4.3		AROCLOR-1260	SOIL	33		UG/KG	6.3			
P/PCB OLM4.2/4.3	*	ALDRIN	SOIL	1.7		UG/KG	0.10	43	40-120	34-132
P/PCB OLM4.2/4.3		ALPHA-BHC	SOIL	1.7		UG/KG	0.27			
P/PCB OLM4.2/4.3		BETA-BHC	SOIL	1.7		UG/KG	0.13			
P/PCB OLM4.2/4.3		DELTA-BHC	SOIL	1.7		UG/KG	0.13			
P/PCB OLM4.2/4.3	*	GAMMA-BHC (LINDANE)	SOIL	1.7		UG/KG	0.27	50	56-123	46-127
P/PCB OLM4.2/4.3		ALPHA-CHLORDANE	SOIL	1.7		UG/KG	0.20			
P/PCB OLM4.2/4.3		GAMMA-CHLORDANE	SOIL	1.7		UG/KG	0.10			
P/PCB OLM4.2/4.3		4,4'-DDD	SOIL	3.3		UG/KG	0.30			
P/PCB OLM4.2/4.3		4,4'-DDE	SOIL	3.3		UG/KG	0.17			
P/PCB OLM4.2/4.3	*	4,4'-DDT	SOIL	3.3		UG/KG	0.10	50	38-127	23-134
P/PCB OLM4.2/4.3	*	DIELDRIN	SOIL	3.3		UG/KG	0.47	38	52-126	31-134
P/PCB OLM4.2/4.3		ENDOSULFAN I	SOIL	1.7		UG/KG	0.20			
P/PCB OLM4.2/4.3		ENDOSULFAN II	SOIL	3.3		UG/KG	0.37			
P/PCB OLM4.2/4.3		ENDOSULFAN SULFATE	SOIL	3.3		UG/KG	0.23			
P/PCB OLM4.2/4.3	*	ENDRIN	SOIL	3.3		UG/KG	0.47	45	56-121	42-139
P/PCB OLM4.2/4.3		ENDRIN ALDEHYDE	SOIL	3.3		UG/KG	0.20			
P/PCB OLM4.2/4.3		ENDRIN KETONE	SOIL	3.3		UG/KG	0.30			
P/PCB OLM4.2/4.3	*	HEPTACHLOR	SOIL	1.7		UG/KG	0.27	31	40-131	35-130
P/PCB OLM4.2/4.3		HEPTACHLOR EPOXIDE	SOIL	1.7		UG/KG	0.070			
P/PCB OLM4.2/4.3		METHOXYCHLOR	SOIL	17		UG/KG	1.0			
P/PCB OLM4.2/4.3		TOXAPHENE	SOIL	170		UG/KG	34			
P/PCB OLM4.2/4.3		DECACHLOROBIPHENYL (DCB) -SURR	SOIL	NA		UG/KG	NA	NA	30-150	30-150
P/PCB OLM4.2/4.3		TETRACHLORO-META-XYLENE (TCMX) -SU	SOIL	NA		UG/KG	NA	NA	30-150	30-150

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
MAVPH	BENZENE	WATER	0.5		UG/L	0.17	50	70-130	70-130
MAVPH	METHYL-TERT-BUTYL ETHER	WATER	5.0		UG/L	0.64	50	70-130	70-130
MAVPH	C9-C10 AROMATICS	WATER	10		UG/L	1.7	50	70-130	70-130
MAVPH	C9-C12 ALIPHATICS	WATER	20		UG/L	4.8	50	70-130	70-130
MAVPH	C5-C8 ALIPHATICS	WATER	15		UG/L	8.8	50	70-130	70-130
MAVPH	ETHYLBENZENE	WATER	1.0		UG/L	0.19	50	70-130	70-130
MAVPH	NAPHTHALENE	WATER	5.0		UG/L	0.51	50	70-130	70-130
MAVPH	TOLUENE	WATER	1.0		UG/L	0.46	50	70-130	70-130
MAVPH	M+P-XYLENE	WATER	1.0		UG/L	0.70	50	70-130	70-130
MAVPH	O-XYLENE	WATER	1.0		UG/L	0.50	50	70-130	70-130
MAVPH	1,4-DIFLUOROBENZENE (FID) -SURR	WATER	NA		UG/L	NA	NA	70-130	70-130
MAVPH	1,4-DIFLUOROBENZENE (PID) -SURR	WATER	NA		UG/L	NA	NA	70-130	70-130
MAVPH	BENZENE	SOIL	25		UG/KG	8.6	50	70-130	70-130
MAVPH	METHYL-TERT-BUTYL ETHER	SOIL	250		UG/KG	32	50	70-130	70-130
MAVPH	C9-C10 AROMATICS	SOIL	500		UG/KG	85	50	70-130	70-130
MAVPH	C9-C12 ALIPHATICS	SOIL	1000		UG/KG	240	50	70-130	70-130
MAVPH	C5-C8 ALIPHATICS	SOIL	750		UG/KG	440	50	70-130	70-130
MAVPH	ETHYLBENZENE	SOIL	50		UG/KG	9.7	50	70-130	70-130
MAVPH	NAPHTHALENE	SOIL	250		UG/KG	26	50	70-130	70-130
MAVPH	TOLUENE	SOIL	50		UG/KG	23	50	70-130	70-130
MAVPH	M+P-XYLENE	SOIL	50		UG/KG	35	50	70-130	70-130
MAVPH	O-XYLENE	SOIL	50		UG/KG	25	50	70-130	70-130
MAVPH	1,4-DIFLUOROBENZENE (FID) -SURR	SOIL	NA		UG/KG	NA	NA	70-130	70-130
MAVPH	1,4-DIFLUOROBENZENE (PID) -SURR	SOIL	NA		UG/KG	NA	NA	70-130	70-130
MAEPH	ACENAPHTHENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	ACENAPHTHYLENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	ANTHRACENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	BENZO(A)ANTHRACENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	BENZO(A)PYRENE	WATER	0.20		UG/L		50	40-140	40-140
MAEPH	BENZO(B)FLUORANTHENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	BENZO(G,H,I)PERYLENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	BENZO(K)FLUORANTHENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	C9-C18 ALIPHATIC HYDROCARBONS	WATER	100		UG/L	NA	50	40-140	40-140
MAEPH	UNADJUSTED C11-C22 AROMATIC HYDROC	WATER	100		UG/L	NA	50	40-140	40-140
MAEPH	C11-C22 AROMATICS	WATER	100		UG/L	NA	50	40-140	40-140
MAEPH	C19-C36 ALIPHATIC HYDROCARBONS	WATER	100		UG/L	NA	50	40-140	40-140
MAEPH	INDENO(1,2,3-CD)PYRENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	CHRYSENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	DIBENZ(A,H)ANTHRACENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	FLUORANTHENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	FLUORENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	2-METHYLNAPHTHALENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	NAPHTHALENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	PHENANTHRENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	PYRENE	WATER	0.50		UG/L		50	40-140	40-140
MAEPH	2-BROMONAPHTHALENE -SURR	WATER	NA		UG/L	NA	NA	40-140	40-140
MAEPH	2-FLUOROBIPHENYL -SURR	WATER	NA		UG/L	NA	NA	40-140	40-140
MAEPH	1-CHLORO-OCTADECANE -SURR	WATER	NA		UG/L	NA	NA	40-140	40-140
MAEPH	O-TERPHENYL -SURR	WATER	NA		UG/L	NA	NA	40-140	40-140

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
MAEPH	ACENAPHTHENE	SOIL	330		UG/KG	29	50	40-140	40-140
MAEPH	ACENAPHTHYLENE	SOIL	330		UG/KG	28	50	40-140	40-140
MAEPH	ANTHRACENE	SOIL	330		UG/KG	195	50	40-140	40-140
MAEPH	BENZO(A)ANTHRACENE	SOIL	330		UG/KG	43	50	40-140	40-140
MAEPH	BENZO(A)PYRENE	SOIL	330		UG/KG	79	50	40-140	40-140
MAEPH	BENZO(B)FLUORANTHENE	SOIL	330		UG/KG	44	50	40-140	40-140
MAEPH	BENZO(G,H,I)PERYLENE	SOIL	330		UG/KG	39	50	40-140	40-140
MAEPH	BENZO(K)FLUORANTHENE	SOIL	330		UG/KG	67	50	40-140	40-140
MAEPH	C9-C18 ALIPHATIC HYDROCARBONS	SOIL	660		UG/KG	NA	50	40-140	40-140
MAEPH	UNADJUSTED C11-C22 AROMATIC HYDROC	SOIL	660		UG/KG	NA	50	40-140	40-140
MAEPH	C11-C22 AROMATICS	SOIL	660		UG/KG	NA	50	40-140	40-140
MAEPH	C19-C36 ALIPHATIC HYDROCARBONS	SOIL	660		UG/KG	NA	50	40-140	40-140
MAEPH	INDENO(1,2,3-CD)PYRENE	SOIL	330		UG/KG	54	50	40-140	40-140
MAEPH	CHRYSENE	SOIL	330		UG/KG	93	50	40-140	40-140
MAEPH	DIBENZ(A,H)ANTHRACENE	SOIL	330		UG/KG	81	50	40-140	40-140
MAEPH	FLUORANTHENE	SOIL	330		UG/KG	83	50	40-140	40-140
MAEPH	FLUORENE	SOIL	330		UG/KG	28	50	40-140	40-140
MAEPH	2-METHYLNAPHTHALENE	SOIL	660		UG/KG	33	50	40-140	40-140
MAEPH	NAPHTHALENE	SOIL	330		UG/KG	41	50	40-140	40-140
MAEPH	PHENANTHRENE	SOIL	330		UG/KG	162	50	40-140	40-140
MAEPH	PYRENE	SOIL	330		UG/KG	50	50	40-140	40-140
MAEPH	2-BROMONAPHTHALENE -SURR	SOIL	NA		UG/KG	NA	NA	40-140	40-140
MAEPH	2-FLUOROBIPHENYL -SURR	SOIL	NA		UG/KG	NA	NA	40-140	40-140
MAEPH	1-CHLORO-OCTADECANE -SURR	SOIL	NA		UG/KG	NA	NA	40-140	40-140
MAEPH	O-TERPHENYL -SURR	SOIL	NA		UG/KG	NA	NA	40-140	40-140
TO-15	1,1,1-TRICHLOROETHANE	AIR	0.50		ppbv	0.013	25	70-130	NA
TO-15	1,1,2,2-TETRACHLOROETHANE	AIR	0.50		ppbv	0.023	25	70-130	NA
TO-15	FREON-113	AIR	0.50		ppbv	0.015	25	70-130	NA
TO-15	1,1,2-TRICHLOROETHANE	AIR	0.50		ppbv	0.017	25	70-130	NA
TO-15	1,1-DICHLOROETHANE	AIR	0.50		ppbv	0.026	25	70-130	NA
TO-15	1,1-DICHLOROETHENE	AIR	0.50		ppbv	0.028	25	70-130	NA
TO-15	1,2,4-TRICHLOROBENZENE	AIR	0.50		ppbv	0.046	25	70-130	NA
TO-15	1,2,4-TRIMETHYLBENZENE	AIR	0.50		ppbv	0.013	25	70-130	NA
TO-15	1,2-DIBROMOETHANE	AIR	0.50		ppbv	0.024	25	70-130	NA
TO-15	1,2-DICHLOROBENZENE	AIR	0.50		ppbv	0.025	25	70-130	NA
TO-15	DICHLORODIFLUOROMETHANE	AIR	0.50		ppbv	0.015	25	70-130	NA
TO-15	1,2-DICHLOROETHANE	AIR	0.50		ppbv	0.021	25	70-130	NA
TO-15	1,2-DICHLOROPROPANE	AIR	0.50		ppbv	0.019	25	70-130	NA
TO-15	1,3,5-TRIMETHYLBENZENE	AIR	0.50		ppbv	0.015	25	70-130	NA
TO-15	1,3-BUTADIENE	AIR	0.50		ppbv	0.029	25	70-130	NA
TO-15	1,3-DICHLOROBENZENE	AIR	0.50		ppbv	0.026	25	70-130	NA
TO-15	1,4-DICHLOROBENZENE	AIR	0.50		ppbv	0.024	25	70-130	NA
TO-15	4-ETHYLTOLUENE	AIR	0.50		ppbv	0.021	25	70-130	NA
TO-15	ACETONE	AIR	1.00		ppbv	0.45	25	70-130	NA
TO-15	BENZENE	AIR	0.50		ppbv	0.013	25	70-130	NA
TO-15	BENZYL CHLORIDE	AIR	0.50		ppbv	0.031	25	70-130	NA
TO-15	BROMODICHLOROMETHANE	AIR	0.50		ppbv	0.015	25	70-130	NA
TO-15	BROMOFORM	AIR	0.50		ppbv	0.021	25	70-130	NA
TO-15	BROMOMETHANE	AIR	0.50		ppbv	0.025	25	70-130	NA
TO-15	CARBON DISULFIDE	AIR	0.50		ppbv	0.010	25	70-130	NA
TO-15	CARBON TETRACHLORIDE	AIR	0.50		ppbv	0.017	25	70-130	NA
TO-15	CHLOROBENZENE	AIR	0.50		ppbv	0.013	25	70-130	NA
TO-15	CHLOROETHANE	AIR	0.50		ppbv	0.032	25	70-130	NA
TO-15	CHLOROFORM	AIR	0.50		ppbv	0.025	25	70-130	NA
TO-15	CHLOROMETHANE	AIR	0.50		ppbv	0.015	25	70-130	NA
TO-15	CIS-1,2-DICHLOROETHENE	AIR	0.50		ppbv	0.015	25	70-130	NA
TO-15	CIS-1,3-DICHLOROPROPENE	AIR	0.50		ppbv	0.015	25	70-130	NA
TO-15	CYCLOHEXANE	AIR	0.50		ppbv	0.028	25	70-130	NA
TO-15	DIBROMOCHLOROMETHANE	AIR	0.50		ppbv	0.015	25	70-130	NA
TO-15	FREON-114	AIR	0.50		ppbv	0.013	25	70-130	NA
TO-15	ETHYL ACETATE	AIR	0.50		ppbv	0.057	25	70-130	NA
TO-15	ETHYLBENZENE	AIR	0.50		ppbv	0.017	25	70-130	NA
TO-15	HEPTANE	AIR	0.50		ppbv	0.015	25	70-130	NA
TO-15	HEXACHLOROBUTADIENE	AIR	0.50		ppbv	0.029	25	70-130	NA
TO-15	HEXANE	AIR	0.50		ppbv	0.021	25	70-130	NA

ROCHESTER ORGANIC QC LIMITS

METHOD	ANALYTE	MATRIX	MRL	DOD LOQ**	UNITS	MDL/ LOD	DUP (RPD)	LCS (% REC)	MS (% REC)
TO-15	M+P-XYLENE	AIR	1.0		ppbv	0.010	25	70-130	NA
TO-15	2-HEXANONE	AIR	0.50		ppbv	0.061	25	70-130	NA
TO-15	2-BUTANONE	AIR	0.50		ppbv	0.060	25	70-130	NA
TO-15	4-METHYL-2-PENTANONE	AIR	0.50		ppbv	0.056	25	70-130	NA
TO-15	METHYL TERT-BUTYL ETHER	AIR	0.50		ppbv	0.015	25	70-130	NA
TO-15	METHYLENE CHLORIDE	AIR	0.50		ppbv	0.024	25	70-130	NA
TO-15	O-XYLENE	AIR	0.50		ppbv	0.010	25	70-130	NA
TO-15	PROPYLENE	AIR	0.50		ppbv	0.027	25	70-130	NA
TO-15	STYRENE	AIR	0.50		ppbv	0.017	25	70-130	NA
TO-15	TETRACHLOROETHENE	AIR	0.50		ppbv	0.019	25	70-130	NA
TO-15	TETRAHYDROFURAN	AIR	0.50		ppbv	0.033	25	70-130	NA
TO-15	TOLUENE	AIR	0.50		ppbv	0.010	25	70-130	NA
TO-15	TRANS-1,2-DICHLOROETHENE	AIR	0.50		ppbv	0.010	25	70-130	NA
TO-15	TRANS-1,3-DICHLOROPROPENE	AIR	0.50		ppbv	0.015	25	70-130	NA
TO-15	TRICHLOROETHENE	AIR	0.50		ppbv	0.028	25	70-130	NA
TO-15	TRICHLOROFLUOROMETHANE	AIR	0.50		ppbv	0.010	25	70-130	NA
TO-15	VINYL ACETATE	AIR	0.50		ppbv	0.15	25	70-130	NA
TO-15	VINYL CHLORIDE	AIR	0.50		ppbv	0.030	25	70-130	NA
TO-15	BROMOFLUOROBENZENE-SURR	AIR	NA		ppbv	NA	NA	70-140	NA

Method Reporting Limits for isomers reported as "total,"
are a summation of each isomer's MRL.

* Subset of compounds used to control the acceptablitily of the QC sample for the batch.
All targets are monitored against the limits provided, however outlying compounds
outside of this subset may not stop analysis based upon the judgement of the analyst.

** The DOD LoQ is the same as the MRL unless there is a value in the DoD LoQ column.
DoD LoQ is required to be at least 3 times the MDL. Only populated for DoD Scope of
Work. DoD requires use of DoD LCS and MS limits where available. See SOPs or DoD QSM.

EPA SOW OLM 04.3 does not require LCS analysis, limits are guidance for EPA
and required for NYS ASP .

Limits for TCLP extracts are the same as the determinative method for the water matrix.

MDL = Method Detection Limit.
LOD = Limit of Detection
TCL = Target Compound List
LVI = Large Volume Injector
-SURR = Surrogate Compound

WETCHEM QC LIMITS

Columbia Analytical Services Rochester, NY

METHOD			ANALYTE	MATRIX	UNITS	MRL	MDL	DUP		MS		LCS		ICV/CCV
EPA	SM	Other						(RPD)	Freq	(% REC)	Freq	(% Rec)	Frequency	
305.1	2310B		Acidity	Water	mg/L	10.0	2.86	20	1/10	61-136	1/10	61-136	1/10	90-110
310.1	2320B		Alkalinity, Total, Carbonate, Bicarb	Water	mg/L	2.00	0.689	20	1/10	80-121	0.1	93-111	1/20	90-110
350.1			Ammonia	Water	mg/L	0.050	0.00955	20	1/10	59-129	0.1	90-110	1/20	90-110
350.1			Ammonia - Low Level	Water	mg/L	0.010	0.00955	20	1/10	59-129	0.1	90-110	1/20	90-110
350.1 M			Ammonia	Soil	mg/Kg	5.00	0.339	30	1/10	48-149	0.1	90-110	1/20	90-110
		D482	Ash, Percent	Non-Aq	%	0.10	NA	10	1/10	NA	NA	61-134	1/20	NA
405.1	5210B		BOD/CBOD	Water	mg/L	2.00	NA	20	1/20	47-141	1/20	85-115	1/20	NA
300.0/9056			Bromide by IC	Water	mg/L	0.10	0.0020	20	1/10	71-122	0.1	90-110	1/20	90-110
300.0M/9056			Bromide by IC	Soil	mg/Kg	10.0	0.385	30	1/10	71-127	0.1	90-110	1/20	90-110
5050/9056			Bromide for total halogens	NonAq/Soil	mg/kg	30.0		20	1/20	NA	NA	50-150	1/20	90-110
		D4809	BTU	Non-Aq	BTU	500	NA	20	1/20	NA	1/20	90-110	1/20	NA
9081			Cation Exchange Capacity	Soil	meqNa/100g	1.0	NA	30	1/20	NA	NA	NA	NA	NA
410.4			Chemical Oxygen Demand - LL	Water	mg/L	5.00	3.31	20	1/10	41-142	1/10	75-116	1/20	85-115
410.4 M			Chemical Oxygen Demand	Soil	mg/Kg	100	49.9	30	1/10	10-170	1/10	10-170	1/20	85-115
325.2	4500-Cl⁻ E		Chloride - Colorimetric	Water	mg/L	1.00	0.567	20	1/10	65-125	1/10	90-112	1/20	90-110
300.0/9056			Chloride by IC	Water	mg/L	0.200	0.029	20	1/10	72-118	1/10	90-110	1/20	90-110
300.0M/9056			Chloride by IC	Soil	mg/Kg	30.0	4.69	30	1/10	72-119	1/10	90-110	1/20	90-110
5050/9056			Chlorine, Percent	Non-Aq	%	0.01	NA	20	1/10	33-141	NA	33-141	1/20	NA
5050/9056			Chloride - for total halogens	NonAq/Soil	mg/kg	60.0		20	1/20	NA	NA	50-150	1/20	90-110
	409A		Chlorine Demand	Water	mg/L	5.00	NA	20	1/20	NA	NA	NA	NA	NA
330.4	4500-Cl F		Chlorine Residual (Free)	Water	mg/L	0.100	NA	20	1/10	50-150	1/20	50-150	1/20	NA
330.4	4500-Cl F		Chlorine Residual (Total)	Water	mg/L	0.100	0.0446	20	1/10	66-129	1/20	87-113	1/20	NA
110.2	2120B		Color (True)	Water	CU	5.0	NA	+/-5units	1/10	NA	NA	NA	NA	NA
120.1			Conductivity	Water	umhos/cm	NA	NA	20	1/20	NA	NA	90-110	1/10	NA
7196A	3500-Cr B		CR+6 Hexavalent Chromium	Water	mg/L	0.010	0.0011	20	1/10	85-115	1/10	90-109	1/20	90-110
218.6			CR+6 Hexavalent Chromium	Water	mg/L	0.010	0.0031	20	1/20	90-110	1/10	90-110	1/20	95-105
7199			CR+6 Hexavalent Chromium	Water	mg/L	0.010	0.0031	20	1/20	70-130	1/20	80-120	1/20	90-110
3060/7196A			CR+6 Hexavalent Chromium	Soil	mg/Kg	4.00	2.00	20	1/20	75-125	1/10	80-120	1/20	90-110
3060/7199			CR+6 Hexavalent Chromium	Soil	mg/Kg	0.40	0.101	20	1/20	75-125	1/20	80-120	1/20	90-110
		ILM05.3	Cyanide, Total	Water	mg/L	0.010		20	1/20	75-125	1/20	85-115	1/20	85-115
		ILM05.3	Cyanide, Total	Soil	mg/Kg	1.00		20	1/20	30-162	1/20	85-115	1/20	85-115
335.2/335.4			Cyanide, Total	Water	mg/L	0.010	0.0031	20	1/10	10-171	1/10	90-110	HL & LL 1/2	90-110
9012A			Cyanide, Total	Water	mg/L	0.010	0.0031	20	1/10	27-153	1/10	85-115	HL & LL 1/2	85-115
9012A			Cyanide, Total	Soil	mg/Kg	1.00	0.218	30	1/10	30-162	1/10	85-115	HL & LL 1/2	85-115
S. 7.3 SW846			Cyanide, Reactivity	Water	mg/Kg	20.0	0.082	20	1/20	1-100	1/20	1-100	1/20	85-115
S. 7.3 SW846			Cyanide, Reactivity	Soil	mg/Kg	20.0	0.082	30	1/20	1-100	1/20	1-100	1/20	85-115
D1298			Density / Specific Gravity	non-aq	kg/m3	NA	NA	10	1/10	NA	NA	0.002units	20/hydromet	NA
NYSDEC 89-9			Ethylene Glycol	Water	mg/L	1.0	0.0526	20	1/20	70-130	1/20	80-120	1/20	90-110
3500-FE D			Ferrous Iron	Water	mg/L	0.10	0.0417	20	1/10	82-123	1/10	86-114	1/20	90-110
3500-FE D			Ferrous Iron	Soil	mg/kg	10.0	2.5	30	1/10	30-161	1/10	81-120	1/20	90-110
340.2			Fluoride by ISE	Water	mg/L	0.100	0.0115	20	1/20	82-116	1/20	82-116	1/20	90-110
300.0/9056			Fluoride by IC	Water	mg/L	0.100	0.0060	20	1/10	85-129	1/10	90-110	1/20	90-110

WETCHEM QC LIMITS

Columbia Analytical Services Rochester, NY

METHOD			ANALYTE	MATRIX	UNITS	MRL	MDL	DUP		MS		LCS		ICV/CCV
EPA	SM	Other						(RPD)	Freq	(% REC)	Freq	(% Rec)	Frequency	
300.0M/9056			Fluoride by IC	Soil	mg/Kg	20.0	0.609	30	1/10	70-130	1/10	90-110	1/20	90-110
5050/9056			Fluoride for total halogens	NonAq/Soil	mg/kg	30.0		20	1/20	NA	NA	50-150	1/20	90-110
130.2	2340C		Hardness, Total	Water	mg/L	2.00	0.311	20	1/10	84-113	1/10	93-107	1/10	NA
1010			IGN- Pensky Martens Closed Cup	Water	degree C	NA	NA	10	1/20	NA	NA	24.3-29.7 C	1/20	NA
D92/ 1010.CC			IGN - Cleveland Open Cup	Soil	degree C	NA	NA	30	1/20	NA	NA	NA	NA	NA
300.0/9056			Iodide	Water	mg/L	0.20	0.041	20	1/10	70-130	1/10	90-110	1/20	90-110
5050/9056			Iodide - for total Halogens	NonAq/Soil	mg/kg	60		20	1/20	NA	NA	30-150	1/20	90-110
300.0/9056			Nitrate as N by IC	Water	mg/L	0.050	0.008	20	1/10	79-111	1/10	90-110	1/20	90-110
300.0M/9056			Nitrate as N by IC	Soil	mg/Kg	5.00	0.359	30	1/10	79-113	1/10	90-110	1/20	90-110
353.2			Nitrate/Nitrite as N	Water	mg/L	0.050	0.00284	20	1/10	69-123	1/10	90-110	1/20	90-110
300.0/9056			Nitrite as N by IC	Water	mg/L	0.050	0.001	20	1/10	70-130	1/10	90-110	1/20	90-110
353.2			Nitrite as N	Water	mg/L	0.010	0.00776	20	1/10	73-126	1/10	90-110	1/20	90-110
351.2			Nitrogen, Total Kjeldahl	Water	mg/L	0.200	0.075	20	1/10	70-117	1/10	72-108	1/20	-110(I)85-115(
351.2-M			Nitrogen, Total Kjeldahl	Soil	mg/Kg	20.0	12.1	30	1/10	13-162	1/10	13-162	1/20	-110(I)85-115(
351.2 LL			Nitrogen, Total Kjeldahl-LL	Water	mg/L	0.080	0.075	20	1/10	70-117	1/10	76-124	1/20	-110(I)85-115(
1664A			Oil and Grease by 1664A	Water	mg/L	5.00	0.84	20	1/20	78-114	1/20	78-114	1/20	NA
365.1			Othophosphate -LL	Water	mg/L	0.0020	0.0018	20	1/10	33-150	1/10	90-110	1/20	90-110
365.1			Orthophosphate	Water	mg/L	0.010	0.0026	20	1/10	33-150	1/10	90-110	1/20	90-110
9095			Paint Filter test	Sludge	mg/Kg	NA	NA	30	1/20	NA	NA	NA	NA	NA
E203			Percent Water	Waste	%	0.1	0.0112	20	1/20	NA	NA	(MeOH)86-132	1/10	NA
150.1	4500-H^+ B		pH	Water	SU	NA	NA	±0.10	1/10	NA	NA	NA	NA	±0.05
9040/9045.			pH / Corrosivity	Water	SU	NA	NA	±0.10	1/20	NA	NA	NA	NA	±0.05
9040/9045.			pH / Corrosivity	Soil	SU	NA	NA	±0.10	1/20	NA	NA	NA	NA	±0.05
420.4			Phenolics, Total LL	Water	mg/L	0.002	0.00044	20	1/10	70-123	1/10	85-113	1/20	85-115
420.4			Phenolics, Total	Water	mg/L	0.005	0.00044	20	1/10	70-123	1/10	85-113	1/20	85-115
420.4			Phenolics, Manual Distillation	Water	mg/L	0.005		20	1/10	68-118	1/10	68-118	1/20	85-115
9066			Phenolics, Total	Water	mg/L	0.005	0.00044	20	1/10	70-123	1/10	85-113	1/20	85-115
9066			Phenolics, Total	Soil	mg/Kg	0.100	0.0177	30	1/10	66-108	1/10	75-112	1/20	85-115

WETCHEM QC LIMITS

Columbia Analytical Services Rochester, NY

METHOD			ANALYTE	MATRIX	UNITS	MRL	MDL	DUP		MS		LCS		ICV/CCV
EPA	SM	Other						(RPD)	Freq	(% REC)	Freq	(% Rec)	Frequency	
365.1 M			Phosphorus, Total - LL	Water	mg/L	0.003	0.0009	20	1/10	51-148	1/10	84-114	1/20	90-110
365.1			Phosphorus, Total	Water	mg/L	0.050	0.0158	20	1/10	51-148	1/10	90-110	1/20	90-110
365.1-M			Phosphorus, Total	Soil	mg/Kg	5.00	1.02	30	1/20	16-184	1/10	16-184	1/20	90-110
GEN-SILICON			Silicon, Percent	Soil/nonAq	%	0.0467		10	1/10	NA	NA	80-120	1/20	NA
370.1		I-2700-85	Silica, Dissolved	Water	mg/L	0.010	0.0031	20	1/10	80-117	1/10	90-117	1/20	90-110
160.3M			Solids, Dry Weight Percent (DWPS)	Soil	mg/Kg	1.0	NA	30	1/10	NA	NA	NA	NA	NA
160.5			Solids, Settleable	Water	mg/L	0.100	NA	20	1/20	NA	NA	NA	NA	NA
160.3	2540B		Solids, Total (TS)	Water	mg/L	10.0	NA	20	1/10	NA	NA	80-120	1/20	NA
160.1	2540C		Solids, Total Dissolved (TDS)	Water	mg/L	10.0	3.6	20	1/10	NA	NA	80-120	1/20	NA
160.2	2540D		Solids, Total Suspended (TSS)	Water	mg/L	1.00	NA	20	1/10	NA	NA	80-120	1/20	NA
160.4			Solids, Total Volatile (TVS)	Water	mg/L	10.0	NA	20	1/10	NA	NA	80-120	NA	NA
160.4D			Solids, Volatile Dissolved (VDS)	Water	mg/L	10.0	NA	20	1/10	NA	NA	NA	NA	NA
160.4S			Solids, Volatile Suspended (VSS)	Water	mg/L	1.00	NA	20	1/10	NA	NA	NA	NA	NA
	2540G		Solids, Percent Volatile	Soil	%	NA	NA	20	1/10	NA	NA	NA	NA	NA
375.4	426C		Sulfate, Turbidimetric	Water	mg/L	5.00	0.528	20	1/10	72-129	1/10	72-129	1/20	NA
300.0/9056			Sulfate by IC	Water	mg/L	0.200	0.007	20	1/10	61-128	1/10	90-110	1/20	90-110
300.0M/0956			Sulfate by IC	Soil	mg/Kg	30.0	0.518	30	1/10	25-151	1/10	90-110	1/20	90-110
AVS			Sulfide, Acid Volatile (AVS)	Soil	umoles/g	1.00	0.614	30	1/20	56-196	1/20	56-196	1/20	NA
S. 7.3 SW846			Sulfide Reactivity	Water	mg/Kg	100	65.2	20	1/20	0-235	NA	84-224	1/20	NA
S. 7.3 SW846			Sulfide Reactivity	Soil	mg/Kg	100	65.2	30	1/20	14-235	NA	14-235	1/20	NA
9030B			Sulfide, Acid Soluble	Water	mg/L	1.00	0.981	20	1/20	26-122	1/20	61-111	1/20	NA
9030B			Sulfide, Acid Soluble	Soil	mg/Kg	20.0	17.9	30	1/20	10-153	1/20	53-116	1/20	NA
376.1	4500-S F		Sulfide, Total	Water	mg/L	1.00	0.146	20	1/10	61-140	1/20	61-140	1/20	NA
300M			Sulfur- Alkaline Digestion	Soil	mg/kg	6.68	2.75	30	1/20	62-124	1/20	62-124	1/20	NA
425.1	5540C		Surfactants	Water	mg/L	0.02	0.00813	20	1/20	58-139	NA	58-139	1/20 HL	NA
415.1			TIC	Water	mg/L	1.00	0.0573	20	1/10	82-127	1/10	82-127	1/20	85-115
415.1	5310C		TOC - LL	Water	mg/L	0.05	0.0457	20	1/10	56-139	1/10	87-120	1/20	85-115
9060			TOC - LL	Water	mg/L	0.10	0.0457	20	1/10	56-139	1/10	87-120	1/20	85-115
415.1M/9060	5310C		TOC - RL	Water	mg/L	1.00	0.306	20	1/10	56-139	1/10	87-120	1/20	85-115
TOCLK			TOC - Lloyd Kahn	Soil	mg/Kg	300	39.8	30	1/20	29-163	1/20	55-133	1/20	85-115
TOCWB			TOC - Walkley-Black	Soil	mg/Kg	0.10	0.0262	30	1/20	69-105	1/20	83-98	1/10	NA
1664A			TPH by 1664A	Water	mg/L	5.00	1.43	20	1/20	64-132	1/20	64-132	1/20	NA
180.1			Turbidity	Water	NTU	0.10	0.035	10	1/20	NA	NA	90-110	3@run start	90-110

METALS ANALYSES QC LIMITS 2005									
Method	**Analyte**	**Matrix**	**Method Reporting Limit (MRL)**	**Method Detection Limit (MDL)**	**Precision (RPD)**	**Matrix Spike Accuracy (%REC)**	**LCS Accuracy (%REC)**	**ICV (%REC)**	**CCV (%REC)**
200.7 (ICP)	Aluminum	Water	100	20.4	20	70-130	85-115	95-105	90-110
(ug/L)	Antimony		60 (LL 10)	32.6 (3.23)	20	70-130	85-115	95-105	90-110
	Arsenic		10	3.56	20	70-130	85-115	95-105	90-110
	Barium		20	3.41	20	70-130	85-115	95-105	90-110
	Beryllium		5.0	0.238	20	70-130	85-115	95-105	90-110
	Boron		200	19.5	20	70-130	85-115	95-105	90-110
	Cadmium		5.0	3.36	20	70-130	85-115	95-105	90-110
	Calcium		1000	15.4	20	70-130	85-115	95-105	90-110
	Chromium		10	1.87	20	70-130	85-115	95-105	90-110
	Cobalt		50	2.43	20	70-130	85-115	95-105	90-110
	Copper		20	10.0	20	70-130	85-115	95-105	90-110
	Iron		100	10.95	20	70-130	85-115	95-105	90-110
	Lead		100 (LL 5.0)	27.9 (1.39)	20	70-130	85-115	95-105	90-110
	Lithium		100	28.39	20	70-130	85-115	95-105	90-110
	Magnesium		1000	18.13	20	70-130	85-115	95-105	90-110
	Manganese		10	0.382	20	70-130	85-115	95-105	90-110
	Molybdenum		25	7.79	20	70-130	85-115	95-105	90-110
	Nickel		40	4.25	20	70-130	85-115	95-105	90-110
	Potassium		2000	48.8	20	70-130	85-115	95-105	90-110
	Selenium		10	4.23	20	70-130	85-115	95-105	90-110
	Silicon		1000	17.39	20	70-130	85-115	95-105	90-110
	Silver		10	0.915	20	70-130	85-115	95-105	90-110
	Sodium		1000	452	20	70-130	85-115	95-105	90-110
	Strontium		100	1.06	20	70-130	85-115	95-105	90-110
	Thallium		10	4.39	20	70-130	85-115	95-105	90-110
	Tin		500	19.5	20	70-130	85-115	95-105	90-110
	Titanium		50	0.336	20	70-130	85-115	95-105	90-110
	Vanadium		50	6.52	20	70-130	85-115	95-105	90-110
	Zinc		20	5.24	20	70-130	85-115	95-105	90-110
1631 (CVAF) ng/L	Mercury	Water	1.00	0.084	20	70-130	80-120	80-120	80-120
245.1 (CVAA) ug/L	Mercury	Water	0.300	0.008	20	70-130	85-115	95-105	90-110
206.2/SM3113B (GFAA) ug/L	Arsenic	Water	10.0	1.711	20	75-125	85-115	90-110	90-110
239.2/SM3113B (GFAA) ug/L	Lead	Water	5.00	0.814	20	75-125	85-115	90-110	90-110
239.2/SM3113B (GFAA) ug/L	Lead - DW	Water	1.00	0.384	20	75-125	85-115	90-110	90-110
270.2/SM3113B (GFAA) ug/L	Selenium	Water	5.00	1.504	20	75-125	85-115	90-110	90-110
279.2/SM3113B (GFAA) ug/L	Thallium	Water	10.0	2.975	20	75-125	85-115	90-110	90-110
6010B (ICP)	Aluminum	Water	100	20.4	20	75-125	80-120	90-110	90-110
(ug/L)	Antimony		60 (LL 10)	32.6 (3.23)	20	75-125	80-120	90-110	90-110
	Arsenic		10	3.56	20	75-125	80-120	90-110	90-110
	Barium		20	3.41	20	75-125	80-120	90-110	90-110
	Beryllium		5.0	0.238	20	75-125	80-120	90-110	90-110
	Boron		200	19.5	20	75-125	80-120	90-110	90-110
	Cadmium		5.0	3.36	20	75-125	80-120	90-110	90-110
	Calcium		1000	15.4	20	75-125	80-120	90-110	90-110
	Chromium		10	1.87	20	75-125	80-120	90-110	90-110
	Cobalt		50	2.43	20	75-125	80-120	90-110	90-110
	Copper		20	10.0	20	75-125	80-120	90-110	90-110
	Iron		100	10.95	20	75-125	80-120	90-110	90-110
	Lead		50 (LL 5.0)	27.9 (1.39)	20	75-125	80-120	90-110	90-110
	Lithium		100	28.39	20	75-125	80-120	90-110	90-110
	Magnesium		1000	18.13	20	75-125	80-120	90-110	90-110
	Manganese		10	0.382	20	75-125	80-120	90-110	90-110
	Molybdenum		25	7.79	20	75-125	80-120	90-110	90-110

METALS ANALYSES QC LIMITS 2005									
Method	**Analyte**	**Matrix**	**Method Reporting Limit (MRL)**	**Method Detection Limit (MDL)**	**Precision (RPD)**	**Matrix Spike Accuracy (%REC)**	**LCS Accuracy (%REC)**	**ICV (%REC)**	**CCV (%REC)**
	Nickel		40	4.25	20	75-125	80-120	90-110	90-110
	Potassium		2000	48.8	20	75-125	80-120	90-110	90-110
	Selenium		10	4.23	20	75-125	80-120	90-110	90-110
	Silicon		1000	17.39	20	75-125	80-120	90-110	90-110
	Silver		10	0.915	20	75-125	80-120	90-110	90-110
	Sodium		1000	452	20	75-125	80-120	90-110	90-110
	Strontium		100	1.06	20	75-125	80-120	90-110	90-110
	Thallium		10	4.39	20	75-125	80-120	90-110	90-110
	Tin		500	19.5	20	75-125	80-120	90-110	90-110
	Titanium		50	0.336	20	75-125	80-120	90-110	90-110
	Vanadium		50	6.52	20	75-125	80-120	90-110	90-110
	Zinc		20	5.24	20	75-125	80-120	90-110	90-110
7470A (CVAA) ug/L	Mercury	Water	0.300	0.00806	20	75-125	80-120	90-110	80-120
7000A/7060A (GFAA) ug/L	Arsenic	Water	10	1.711	20	75-125	80-120	90-110	80-120
7000A/7421 (GFAA) ug/L	Lead	Water	5.0	0.814	20	75-125	80-120	90-110	80-120
7000A/7740 (GFAA) ug/L	Selenium	Water	5.0	1.504	20	75-125	80-120	90-110	80-120
7000A/7841 (GFAA) ug/L	Thallium	Water	10	2.975	20	75-125	80-120	90-110	80-120
6010B (ICP)	Aluminum	Soil	10	6.72	20	75-125	C of A	90-110	90-110
(mg/Kg)	Antimony		6.0 (1.0 LL)	2.61 (0.28 LL)	20	75-125	C of A	90-110	90-110
	Arsenic		1	0.2	20	75-125	C of A	90-110	90-110
	Barium		2.00	0.262	20	75-125	C of A	90-110	90-110
	Beryllium		0.5	0.0356	20	75-125	C of A	90-110	90-110
	Boron		20	0.988	20	75-125	C of A	90-110	90-110
	Cadmium		0.5	0.303	20	75-125	C of A	90-110	90-110
	Calcium		100	11.1	20	75-125	C of A	90-110	90-110
	Chromium		1.00	0.122	20	75-125	C of A	90-110	90-110
	Cobalt		5.0	0.249	20	75-125	C of A	90-110	90-110
	Copper		2.0	0.568	20	75-125	C of A	90-110	90-110
	Iron		10	2.11	20	75-125	C of A	90-110	90-110
	Lead		5.0 (0.5 LL)	1.66 (0.097 LL)	20	75-125	C of A	90-110	90-110
	Lithium		10	3.22	20	75-125	C of A	90-110	90-110
	Magnesium		100	1.31	20	75-125	C of A	90-110	90-110
	Manganese		1.00	0.0247	20	75-125	C of A	90-110	90-110
	Molybdenum		2.5	0.837	20	75-125	C of A	90-110	90-110
	Nickel		4.00	0.473	20	75-125	C of A	90-110	90-110
	Potassium		200	3.43	20	75-125	C of A	90-110	90-110
	Selenium		1	0.31	20	75-125	C of A	90-110	90-110
	Silicon		100	2.33	20	75-125	C of A	90-110	90-110
	Silver		1.00	0.078	20	75-125	C of A	90-110	90-110
	Sodium		100	34.9	20	75-125	C of A	90-110	90-110
	Strontium		10	1.64	20	75-125	C of A	90-110	90-110
	Thallium		1.00	0.397	20	75-125	C of A	90-110	90-110
	Tin		50	1.93	20	75-125	C of A	90-110	90-110
	Titanium		5.0	0.066	20	75-125	C of A	90-110	90-110
	Vanadium		5.0	0.801	20	75-125	C of A	90-110	90-110
	Zinc		2.0	0.844	20	75-125	C of A	90-110	90-110
7471A (CVAA) mg/Kg	Mercury	Soil	0.05	0.0017	35	75-125	C of A	90-110	80-120
7000A/7060A (GFAA) mg/Kg	Arsenic	Soil	1.0	0.120	35	75-125	C of A	90-110	80-120
7000A/7421 (GFAA) mg/Kg	Lead	Soil	0.5	0.043	35	75-125	C of A	90-110	80-120
7000A/7740 (GFAA) mg/Kg	Selenium	Soil	0.5	0.156	35	75-125	C of A	90-110	80-120
7000A/7841 (GFAA) mg/Kg	Thallium	Soil	1.0	0.192	35	75-125	C of A	90-110	80-120

METALS ANALYSES QC LIMITS 2005									
Method	**Analyte**	**Matrix**	**Method Reporting Limit (MRL)**	**Method Detection Limit (MDL)**	**Precision (RPD)**	**Matrix Spike Accuracy (%REC)**	**LCS Accuracy (%REC)**	**ICV (%REC)**	**CCV (%REC)**
ILM05.3 (ICP-AES) (ug/L)	Aluminum	Water	200	17	20	75-125	85-115	90-110	90-110
	Antimony		60	3.09	20	75-125	85-115	90-110	90-110
	Arsenic		10	6.06	20	75-125	85-115	90-110	90-110
	Barium		200	1.44	20	75-125	85-115	90-110	90-110
	Beryllium		5	0.168	20	75-125	85-115	90-110	90-110
	Cadmium		5	0.168	20	75-125	85-115	90-110	90-110
	Calcium		5000	24.1	20	75-125	85-115	90-110	90-110
	Chromium		10	0.938	20	75-125	85-115	90-110	90-110
	Cobalt		50	0.625	20	75-125	85-115	90-110	90-110
	Copper		25	3.23	20	75-125	85-115	90-110	90-110
	Iron		100	21.4	20	75-125	85-115	90-110	90-110
	Lead		10	1.53	20	75-125	85-115	90-110	90-110
	Magnesium		5000	3.69	20	75-125	85-115	90-110	90-110
	Manganese		15	0.283	20	75-125	85-115	90-110	90-110
	Nickel		40	0.574	20	75-125	85-115	90-110	90-110
	Potassium		5000	13.7	20	75-125	85-115	90-110	90-110
	Selenium		35		20	75-125	85-115	90-110	90-110
	Silver		10	0.536	20	75-125	85-115	90-110	90-110
	Sodium		5000	329	20	75-125	85-115	90-110	90-110
	Thallium		25	2.35	20	75-125	85-115	90-110	90-110
	Vanadium		50	0.119	20	75-125	85-115	90-110	90-110
	Zinc		60	3.81	20	75-125	85-115	90-110	90-110
AES CLP additional analytes upon request									
(ug/L)	Boron	Water	200	15.6	20	75-125	85-115	90-110	90-110
	Molybdenum		25	0.54	20	75-125	85-115	90-110	90-110
	Titanium		50	0.238	20	75-125	85-115	90-110	90-110
	Tin		500	18.8	20	75-125	85-115	90-110	90-110
ILM05.3(CVAA) ug/L	Mercury	Water	0.2	0.0086	20	75-125	80-120	90-110	80-120
ILM05.3 (ICP-AES) (mg/Kg)	Aluminum	Soils	20	7.73	20	75-125	C of A	90-110	90-110
	Antimony		6	0.504	20	75-125	C of A	90-110	90-110
	Arsenic		1.0	0.371	20	75-125	C of A	90-110	90-110
	Barium		20	0.0788	20	75-125	C of A	90-110	90-110
	Beryllium		0.5	0.0307	20	75-125	C of A	90-110	90-110
	Cadmium		0.5	0.0495	20	75-125	C of A	90-110	90-110
	Calcium		500	14.5	20	75-125	C of A	90-110	90-110
	Chromium		1.0	0.147	20	75-125	C of A	90-110	90-110
	Cobalt		5	0.099	20	75-125	C of A	90-110	90-110
	Copper		2.5	0.541	20	75-125	C of A	90-110	90-110
	Iron		10	2.85	20	75-125	C of A	90-110	90-110
	Lead		1	0.261	20	75-125	C of A	90-110	90-110
	Magnesium		500	0.906	20	75-125	C of A	90-110	90-110
	Manganese		1.5	0.057	20	75-125	C of A	90-110	90-110
	Nickel		4.0	0.153	20	75-125	C of A	90-110	90-110
	Potassium		500	3.43	20	75-125	C of A	90-110	90-110
	Selenium		3.5	0.863	20	75-125	C of A	90-110	90-110
	Silver		1.0	0.12	20	75-125	C of A	90-110	90-110
	Sodium		500	52.7	20	75-125	C of A	90-110	90-110
	Thallium		2.5	0.855	20	75-125	C of A	90-110	90-110
	Vanadium		5	0.14	20	75-125	C of A	90-110	90-110
	Zinc		6.0	0.918	20	75-125	C of A	90-110	90-110
AES CLP additional analytes upon request									
(mg/Kg)	Boron	Soil	40	2.17	20	75-125	85-115	90-110	90-110
	Molybdenum		5	0.133	20	75-125	85-115	90-110	90-110
	Titanium		5	0.031	20	75-125	85-115	90-110	90-110
	Tin		100	1.67	20	75-125	85-115	90-110	90-110
ILM05.3 (CVAA) mg/Kg	Mercury	Soil	0.1	0.0017	20	75-125	C of A	80-120	80-120

METALS ANALYSES QC LIMITS 2005									
Method	**Analyte**	**Matrix**	**Method Reporting Limit (MRL)**	**Method Detection Limit (MDL)**	**Precision (RPD)**	**Matrix Spike Accuracy (%REC)**	**LCS Accuracy (%REC)**	**ICV (%REC)**	**CCV (%REC)**
200.8 (ICP-MS) ug/L	Arsenic	Water	1.0	0.19	20	70-130	85-115	90-110	90-110
	Antimony		1.0	0.0757	20	70-130	85-115	90-110	90-110
	Barium		1.0	0.0478	20	70-130	85-115	90-110	90-110
	Beryllium		1.0	0.072	20	70-130	85-115	90-110	90-110
	Cadmium		1.0	0.0368	20	70-130	85-115	90-110	90-110
	Chromium		1.0	0.203	20	70-130	85-115	90-110	90-110
	Cobalt		1.0	0.0857	20	70-130	85-115	90-110	90-110
	Copper		1.0	0.77	20	70-130	85-115	90-110	90-110
	Lead		1.0	0.0521	20	70-130	85-115	90-110	90-110
	Manganese		1.0	0.123	20	70-130	85-115	90-110	90-110
	Molybdenum		1.0	0.067	20	70-130	85-115	90-110	90-110
	Nickel		1.0	0.281	20	70-130	85-115	90-110	90-110
	Selenium		2.0	0.307	20	70-130	85-115	90-110	90-110
	Silver		1.0	0.0452	20	70-130	85-115	90-110	90-110
	Thallium		1.0	0.0424	20	70-130	85-115	90-110	90-110
	Vanadium		1.0	0.0996	20	70-130	85-115	90-110	90-110
	Zinc		5.0	0.63	20	70-130	85-115	90-110	90-110
6020 (ICP-MS) ug/L	Arsenic	Water	1.0	0.19	20	75-125	80-120	90-110	90-110
	Antimony		1.0	0.0757	20	75-125	80-120	90-110	90-110
	Barium		1.0	0.0478	20	75-125	80-120	90-110	90-110
	Beryllium		1.0	0.072	20	75-125	80-120	90-110	90-110
	Cadmium		1.0	0.0368	20	75-125	80-120	90-110	90-110
	Chromium		1.0	0.203	20	75-125	80-120	90-110	90-110
	Cobalt		1.0	0.0857	20	75-125	80-120	90-110	90-110
	Copper		1.0	0.77	20	75-125	80-120	90-110	90-110
	Lead		1.0	0.0521	20	75-125	80-120	90-110	90-110
	Manganese		1.0	0.123	20	75-125	80-120	90-110	90-110
	Molybdenum		1.0	0.067	20	75-125	80-120	90-110	90-110
	Nickel		1.0	0.281	20	75-125	80-120	90-110	90-110
	Selenium		2.0	0.307	20	75-125	80-120	90-110	90-110
	Silver		1.0	0.0452	20	75-125	80-120	90-110	90-110
	Thallium		1.0	0.0424	20	75-125	80-120	90-110	90-110
	Vanadium		1.0	0.0996	20	75-125	80-120	90-110	90-110
	Zinc		5.0	0.63	20	75-125	80-120	90-110	90-110
6020 (ICP-MS) ug/g	Arsenic	Soil	0.1	0.0225	20	75-125	C of A	90-110	90-110
	Antimony		0.1	0.044	20	75-125	C of A	90-110	90-110
	Barium		0.1	0.0855	20	75-125	C of A	90-110	90-110
	Beryllium		0.1	0.0085	20	75-125	C of A	90-110	90-110
	Cadmium		0.1	0.005	20	75-125	C of A	90-110	90-110
	Chromium		0.1	0.0315	20	75-125	C of A	90-110	90-110
	Cobalt		0.1	0.0044	20	75-125	C of A	90-110	90-110
	Copper		0.1	0.062	20	75-125	C of A	90-110	90-110
	Lead		0.1	0.0845	20	75-125	C of A	90-110	90-110
	Manganese		0.1	0.025	20	75-125	C of A	90-110	90-110
	Molybdenum		0.1	0.0145	20	75-125	C of A	90-110	90-110
	Nickel		0.1	0.034	20	75-125	C of A	90-110	90-110
	Selenium		0.2	0.084	20	75-125	C of A	90-110	90-110
	Silver		0.1	0.0114	20	75-125	C of A	90-110	90-110
	Thallium		0.1	0.07	20	75-125	C of A	90-110	90-110
	Vanadium		0.1	0.015	20	75-125	C of A	90-110	90-110
	Zinc		0.1	3.08	20	75-125	C of A	90-110	90-110

METALS ANALYSES QC LIMITS 2005									
Method	**Analyte**	**Matrix**	**Method Reporting Limit (MRL)**	**Method Detection Limit (MDL)**	**Precision (RPD)**	**Matrix Spike Accuracy (%REC)**	**LCS Accuracy (%REC)**	**ICV (%REC)**	**CCV (%REC)**
ILM05.3 (ICP-MS) (ug/L)	Arsenic	Water	1.0	0.19	20	70-130	85-115	90-110	90-110
	Antimony		2.0	0.0757	20	70-130	85-115	90-110	90-110
	Barium		10.0	0.0478	20	70-130	85-115	90-110	90-110
	Beryllium		1.0	0.072	20	70-130	85-115	90-110	90-110
	Cadmium		1.0	0.0368	20	70-130	85-115	90-110	90-110
	Chromium		2.0	0.203	20	70-130	85-115	90-110	90-110
	Cobalt		1.0	0.0857	20	70-130	85-115	90-110	90-110
	Copper		2.0	0.77	20	70-130	85-115	90-110	90-110
	Lead		1.0	0.0521	20	70-130	85-115	90-110	90-110
	Manganese		1.0	0.123	20	70-130	85-115	90-110	90-110
	Molybdenum		--	0.067	20	70-130	85-115	90-110	90-110
	Nickel		1.0	0.281	20	70-130	85-115	90-110	90-110
	Selenium		5.0	0.307	20	70-130	85-115	90-110	90-110
	Silver		1.0	0.0452	20	70-130	85-115	90-110	90-110
	Thallium		1.0	0.0424	20	70-130	85-115	90-110	90-110
	Vanadium		1.0	0.0996	20	70-130	85-115	90-110	90-110
	Zinc		2.0	0.63	20	70-130	85-115	90-110	90-110

LL Low Level Analysis
C of A Certificate of Analysis QC Limits Provided per manufacturer.

APPENDIX D

DATA QUALIFIERS

March 29, 2006

REPORT QUALIFIERS

U - Indicates compound was analyzed for but not detected. The sample quantitation limit must be corrected for dilution and for percent moisture.

J - Indicates an estimated value. The flag is used either when estimating a concentration for tentatively identified compounds, or when the concentration is less than the reporting limit and greater than the MDL (concentrations are not verified within the initial calibration range).

For DoD reports, the J-flag may also be used to indicate that the concentration between two columns for pesticides/Aroclors is greater than 40% difference.

B - Indicates this compound was also detected in the associated method blank at a concentration that may have contributed to the sample result.

E - Indicates that the sample concentration had exceeded the calibration range for that specific analysis.

D - Indicates the sample concentration is a result of a dilution, typically a secondary analysis of the sample due to exceeding the calibration range.

* - Indicates that a quality control parameter has exceeded laboratory limits.

X - See Case Narrative for discussion.

P - This flag is used for a pesticide/Aroclor target concentration when there is a greater than 40% (25% for CLP) difference for detected concentrations between the two GC columns.

For DoD reports, the J-flag is used instead of "P".

N - Indicates presumptive evidence of a compound (reported as a tentatively identified compound) based on the mass spectral library search.

CAS/Rochester Lab ID # for State Certifications[1]

NELAP Accredited
Delaware Accredited
Connecticut ID # PH0556
Florida ID # E87674
Illinois ID #200047
Maine ID #NY0032
Nebraska Accredited
Navy Facilities Engineering Service Center Approved
Nevada ID # NY-00032
New Jersey ID # NY004
New York ID # 10145
New Hampshire ID # 294100 A/B
Pennsylvania ID# 68-786
Rhode Island ID # 158
West Virginia ID # 292

[1] Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable, except as noted in the laboratory case narrative provided. For a specific list of accredited analytes, refer to the certifications section at www.caslab.com.

Columbia Analytical Services INC

ORGANIC QUALIFIERS

U - Indicates compound was analyzed for but not detected. The sample quantitation limit must be corrected for dilution and for percent moisture.

J - Indicates an estimated value. The flag is used either when estimating a concentration for tentatively identified compounds, or when the data indicate the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit and greater than the MDL. This flag is also used for DoD instead of "P" as indicated below.

N - Indicates presumptive evidence of a compound. This flag is only used for tentatively identified compounds, where the identification is based on a mass spectral library search.

P - This flag is used for a pesticide/Aroclor target analyte when there is a greater than 40% (25% for CLP) difference for detected concentrations between the two GC columns. The concentration is reported on the Form I and flagged with a "P" ("J" for DoD).

Q - for DoD only – indicates a pesticide/Aroclor target is not confirmed. This flag is used when there is ≥ 100% difference for the detected concentrations between the two GC columns.

C - This flag applies to pesticide results where the identification has been confirmed by GC/MS.

B - This flag is used when the analyte is found in the associated blank as well as in the sample.

E - This flag identifies compounds whose concentrations exceed the calibration range of the instrument for that specific analysis.

D - This flag identifies all compounds identified in an analysis at a secondary dilution factor. If a sample or extract is re-analyzed at a higher dilution factor, as in the "E" flag above, the "DL" suffix is appended to the sample number on the Form I for the diluted sample, and ALL concentration values reported on that Form I are flagged with the "D" flag.

A - This flag indicates that a TIC is a suspected aldol-condensation product.

X - As specified in Case Narrative.

* - This flag identifies compounds associated with a quality control parameter which exceeds laboratory limits.

ACCREDITED IN ACCORDANCE WITH nelac

CAS/Rochester Lab ID # for Massachusetts Certification

M-NY032

Analyses were conducted in accordance with Massachusetts Department of Environmental Protection certification standards, except as noted in the laboratory case narrative provided. A copy of the current Department issued parameter list is included in this report.

Columbia Analytical Services INC

INORGANIC QUALIFIERS

C (Concentration) qualifier –

- B - if the reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but was greater than or equal to the Instrument Detection Limit (IDL). This qualifier may also be used to indicate that there was contamination above the reporting limit in the associated blank. See Narrative for details.
- U - if the analyte was analyzed for, but not detected

Q qualifier - Specified entries and their meanings are as follows:

- D - Spike was diluted out
- E - The reported value is estimated because the serial dilution did not meet criteria.
- J - Estimated Value
- M - Duplicate injection precision not met.
- N - Spiked sample recovery not within control limits.
- S - The reported value was determined by the Method of Standard Additions (MSA).
- W - Post-digestion spike for Furnace AA Analysis is out of control limits (85-115), while sample absorbance is less than 50% of spike absorbance.
- * - Duplicate analysis not within control limits.
- + - Correlation coefficient for the MSA is less than 0.995.

M (Method) qualifier:

- "P" for ICP
- "A" for Flame AA
- "F" for Furnace AA
- "PM" for ICP when Microwave Digestion is used
- "AM" for Flame AA when Microwave Digestion is used
- "FM" for Furnace M when Microwave Digestion is used
- "CV" for Manual Cold Vapor AA
- "AV" for Automated Cold Vapor AA
- "AF" for Automated Cold Vapor Atomic Fluorescence Spectrometry
- "CA" for Midi-Distillation Spectrophotometric
- "AS" for Semi-Automated Spectrophotometric
- "C" for Manual Spectrophotometric
- "T" for Titrimetric
- " " where no data has been entered
- "NR" if the analyte is not required to be analyzed.

CAS/Rochester Lab ID # for Massachusetts Certification

M-NY032

Analyses were conducted in accordance with Massachusetts Department of Environmental Protection certification standards, except as noted in the laboratory case narrative provided. A copy of the current Department issued parameter list is included in this report.

APPENDIX E

PREVENTIVE MAINTENANCE PROCEDURES

March 29, 2006

Preventive Maintenance Procedures

Instrument	Activity	Frequency
Refrigerators and Coolers	Record temperatures	Daily
	Clean coils	As needed
	Check coolant	As needed or if temperature outside limit
Fume Hoods	Face velocity measured	Quarterly
	Sash operation	As needed
Ovens	Clean	As needed or if temperature outside limit
Incubators	Record temperatures	Daily, morning and evening
Water Baths	Wash with disinfectant solution	When water is murky, dirty, or growth appears
Autoclave	Check temperature	Every month
	Clean	When mold or growth appears
Top Loading Balances	Check calibration	Before every use
Analytical Balances	Check alignment	Before every use
	Check calibration	Before every use
	Clean pans and compartment	After every use
Dissolved Oxygen Meter	Change membrane	When fluctuations occur
pH probes	Condition probe	When fluctuations occur
UV-visible Spectrophotometer	Wavelength check	Annually
Total Organic Carbon Analyzers	Check IR zero	Weekly
	Check digestion/condensation vessels	Each use
	Clean digestion chamber	Every 2000 hours, or as needed
	Clean permeation tube	Every 2000 hours, or as needed
	Clean six-port valves	Every 200 - 2000 hours, or as needed
	Clean sample pump	Every 200 - 2000 hours, or as needed
	Clean carbon scrubber	Every 200 - 2000 hours, or as needed
	Clean IR cell	Every 2000 - 4000 hours, or as needed
Total Organic Halogen Analyzers	Change cell electrolyte	Daily, or as needed
	Change electrode fluids	Daily, or as needed
	Change pyrolysis tube	As needed
	Change inlet and outlet tubes	As needed
	Change electrodes	As needed
Flow Injection Analyzer	Check valve flares	Monthly
	Check valve ports	Monthly
	Check pump tubing	Daily
	Check flow cell flares	Quarterly
	Change bulb	Every six months
	Check manifold tubing	Every six months
	Check T's and connectors	Every six months

Preventive Maintenance Procedures

Instrument	Activity	Frequency
Ion Chromatograph	Change column bed supports	Monthly or as needed
	Clean column	Monthly or as needed
	Change column	Every six months or as needed
	Change valve port face & hex nut	Every six months or as needed
	Clean valve slider	Every six months or as needed
	Change tubing	Annually or as needed
	Eluent pump	Annually
Atomic Absorption Spectro-photometers - FAA and CVAA	Check gases	Daily
	Clean burner head	Daily
	Check aspiration tubing	Daily
	Clean optics	Every three months
	Empty waste container	Weekly
Atomic Absorption Spectro-photometers - GFAA	Check gases	Daily
	Check argon dewar	Daily, or as needed
	Change graphite tube	Daily, or as needed
	Clean furnace windows	Monthly
ICP-AES	Check argon dewar	Daily
	Replace peristaltic pump tubing	Daily, or as needed
	Empty waste container	Daily, or as needed
	Clean nebulizer, spray chamber, and torch	Every two weeks, or as needed
	Replace water filter	Quarterly
	Replace vacuum air filters	Monthly
ICP-MS	Check argon dewar	Daily
	Replace peristaltic pump tubing	Daily, or as needed
	Empty waste container	Daily, or as needed
	Clean nebulizer, spray chamber, and torch	Every two weeks, or as needed
	Clean Cone	As needed
	Check air filters	Annually or as needed
	Check rotary pump oil	Quarterly
	Clean extraction lens	Annually or as needed
	Clean ion lens stack	Annually or as needed
Infrared Spectrophotometer, Fourier Transform	Clean sample cells	Daily, or as needed
Gel-Permeation Chromatographs	Clean and repack column	As needed
	Backflush valves	As needed

Preventive Maintenance Procedures

Instrument	Activity	Frequency
Gas Chromatographs, Semivolatiles	Check gas supplies	Daily, replace when pressure reaches 250 psi
	Change in-line filters	Quarterly or after 30 tanks of gas
	Change injection port liner	Daily or as needed
	Clip first foot of capillary column	As needed
	Change guard column	As needed
	Replace analytical column	As needed when peak resolution fails
	Check system for gas leaks	After changing columns
	Clean FID	As needed
	Leak test ECD	Annually
Gas Chromatograph/Mass Spectrometers, Semivolatiles	Check gas supplies	Daily, replace when pressure reaches 50 psi
	Change in-line filters	Quarterly or after 30 tanks of gas
	Change septum	Daily
	Change injection port liner	Weekly or as needed
	Clip first foot of capillary column	As needed
	Change guard column	As needed
	Replace analytical column	As needed when peak resolution fails
	Clean jet separator	As needed
	Clean source	As needed when tuning problems
	Change pump oil	Every six months
	Oil wick	Every six months
Purge and Trap Concentrators	Change trap	As needed
	Change transfer lines	As needed
	Clean purge vessel	Daily
Gas Chromatographs, Volatiles	Check gas supplies	Daily, replace when pressure reaches 200 psi
	Change in-line filters	Quarterly or after 30 tanks of gas
	Change septum	As needed
	Clip first foot of capillary column	As needed
	Change guard column	As needed
	Replace analytical column	As needed when peak resolution fails
	Check system for gas leaks	After changing columns or as needed
	Replenish ELCD solvents	Weekly
	Clean PID lamp	As needed
	Clean FID	As needed
	Change ion exchange resin	Quarterly
	Replace nickel tubing	Quarterly or as needed

Preventive Maintenance Procedures

Instrument	Activity	Frequency
Gas Chromatograph/Mass Spectrometers, Volatiles	Check gas supplies	Weekly, replace when pressure reaches 200 psi
	Change in-line filters	Quarterly or after 30 tanks of gas
	Change septum	Daily
	Clip first foot of capillary column	As needed
	Change guard column	As needed
	Replace analytical column	As needed when peak resolution fails
	Clean jet separator	As needed
	Clean source	As needed when tuning problems
	Change pump oil	Every six months per HP
	Oil wick	Every six months per HP
HPLC	Check gas supplies	Daily, replace when pressure reaches 200 psi
	Change guard column	As needed
	Change analytical column	As needed
	Change inlet filters	As needed
TCLP/SPLP Extractors	Monitor Room Temperature	Daily
	Monitor RPM of Rotators	Bi-weekly
	Grease fittings	As needed
	O-ring replacement	As needed

APPENDIX F

CERTIFICATIONS/ACCREDITATIONS/CONTRACTS

March 29, 2006

CAS/Rochester Certifications/Accreditations/Contracts

Federal and National Programs

- NELAP Accreditation, since January 2001.
  Primary Accreditation with New York and Florida (see below).
  Secondary Accreditation with Florida, New Jersey, New Hampshire, Pennsylvania and Illinois (see below).

- Naval Facilities Engineering Service Center (NFESC), Approved. Expires 11/27/2009.

State and Local Programs

- State of Connecticut, Department of Health Services, Approved Public Health Laboratory.
  Certified Laboratory for Potable Water, Waste Water, Solid Waste and Soil.
  Examination for Inorganic Chemicals and Organic Chemicals. Registration No. PH-0556.
  Exp. 06/30/2010.

- State of Delaware, Department of Natural Resources and Environmental Control. Approved for Delaware Hazardous Substance Cleanup Act.

- State of Florida, Department of Health.
  Drinking water, Wastewater, Solid Hazardous Waste, CLP. Certification No. E87674. Expires 06/30/2009.

- State of Illinois, Environmental Protection Agency.
  Inorganic and Organic Hazardous and Solid Waste. Certification No. 200047. Expires 11/17/2009.

- State of Maine, Department of Health and Human Services.
  Drinking Water and Wastewater. Certification No.NY0032. Expires 11/12/2010.

- The Commonwealth of Massachusetts, Department of Environmental Protection.
  Non-Potable Water. Certification No. M-NY032. Exp. 06/30/2009.

- State of Nevada, Department of Conservation and Natural Resources, Division of Environmental Protection.
  Non-Potable Water, Soil. Lab ID number NY-00032. Expires 7/31/09.

- State of New Jersey, Department of Environmental Protection
  State Certified Environmental Laboratory for Drinking Water and Water Pollution.
  Certification No. NY004. Exp. 06/30/2009.

- State of New York, Department of Health, Environmental Laboratory Approval Program.
  Potable Water, Non-Potable Water, Solid and Hazardous Waste, and NYSDEC ASP Certification.
  Certification No. 10145. Exp. 04/01/2009.

- State of New Hampshire, Department of Environmental Services
  Full Certification for Non-Potable Water. Certification No. 294102. Exp. 10/14/2009.

- Pennsylvania Department of Environmental Protection.
  Non-Potable Water. Lab ID No. 68-00786. Expires 6/30/2009.

- State of Rhode Island, Department of Health
  Approved for Surface Water, WasteWater, and Sewage. License No. 158. Exp. 12/30/2008.

- West Virginia Division of Environmental Protection
  Certification for TCL/TAL, GRO, DRO, and TPH parameters in WasteWater and Solid Hazardous Waste.
  Certification No.292 Exp. 04/30/2009.

CAS/Rochester Certifications/Accreditations/Contracts

Unregulated State Programs

- State of Minnesota
  Reciprocal Certification for all parameters certified under New York State.

- State of Georgia Environmental Protection Division
  Reciprocal Approval for Non-Potable/Environmental Waters and Wastes.

- State of Indiana Hazardous Waste Division
  Reciprocal Approval for Non-Potable/Environmental Waters and Wastes.

- State of Michigan - Reciprocal Approval for Non-Potable/Environmental Waters and Wastes.

- Commonwealth of Virginia, Department of General Services
  Reciprocal Approval for Non-Potable/Environmental Waters and Wastes.

- State of Mississippi - Reciprocal Approval for Non-Potable/Environmental Waters and Wastes.

- State of Maryland - Reciprocal Approval for Non-Potable/Environmental Waters and Wastes.

APPENDIX G

LIST OF STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME	REV	DATE OF SOP	DATE OF LAST REVIEW
QUALITY ASSURANCE MANUAL	QAM	16	1/24/2008	1/24/2008
ANALYTICAL BATCHES AND SEQUENCES	ADM-BATCH	7	11/2/2005	6/23/2008
CHECKING NEW LOTS OF CHEM. FOR CONTAMINATION	ADM-CTMN	3	11/7/2007	11/7/2007
CONFIRMATION OF ORGANIC ANALYTE IDENTIFICATION AND QUANTITATION	ADM-CONFIRM	2	3/23/2004	6/23/2008
DETM. OF STATISICAL CONTROL LIMITS	ADM-CTRL_LIM	6	9/28/2007	9/28/2007
DOC. OF TECHNICAL PERSONNEL TRAINING	ADM-TRANDOC	10	12/6/2007	12/6/2007
DOCUMENT CONTROL	ADM-DOCCTRL	6	11/7/2007	11/7/2007
MAKING ENTRIES INTO LOGS AND BENCH SHEETS	ADM-DATANTRY	7	11/7/2007	11/7/2007
HANDLING CUSTOMER FEEDBACK	ADM-FDBK	4	12/10/2007	12/10/2007
NONCONFORMITY AND CORRECTIVE ACTION	ADM-NCAR	4	3/26/2004	6/22/2008
MANUAL INTEGRATION OF CHROMATOGRAPHY PEAKS	ADM-INT	3	8/28/2007	8/28/2007
PREPARATION OF SOPs	ADM-SOP	7	10/19/2007	10/19/2007
PREP OF ELECTRONIC-DATA FOR ORGANIC ANALYSES FOR E-DATA AUDITS	ADM-E_DATA	3	8/29/2007	8/29/2007
QUALIFYING SUBCONTRACT LABS	ADM-SUBLAB	2	1/29/2002	6/22/2008
SIGNIFICANT FIGURES	ADM-SIG.FIG	7	12/7/2007	12/7/2007
DETERMINATION OF METHOD DETECTION LIMIT	ADM-MDL	8	9/28/2007	9/28/2007
MANAGEMENT REVIEW	ADM-MGMTRVW	2	11/7/2007	11/7/2007
PROFICIENCY TESTING SAMPLE ANALYSIS	ADM-PTS	1	9/28/2007	9/28/2007
AUTOPIPET CALIBRATION	ADM-PCAL	4	10/5/2006	10/30/2007
INITIAL CALIBRATION	ADM-ICAL	0	3/15/2006	6/23/2008
PREPARING SAMPLE DILUTIONS	ADM-DIL	0	8/18/2000	6/23/2008
GENERATION OF ELECTRONIC DATA DELIVERABLES USING EDDGE	ADM-EDD	0	1/8/2008	1/8/2008
LABORATORY DATA REVIEW PROCESS	ADM-DREV	3	6/2/2003	4/4/2008
PROJECT CHEMIST DUTIES AND REPORT REVIEW	ADM-PCR	2	12/5/2006	6/24/2008
REPORT GENERATION	ADM-RG	1	3/18/2002	4/1/2008
DATA ARCHIVING	ADM-ARCH	0	3/21/2001	10/30/2007
ELECTRONIC DATA ARCHIVING	ADM-BACKUP	2	12/29/2003	10/30/2007
INTERNAL QUALITY ASSURANCE AUDITS	ADM-IAUD	3	12/4/2006	6/23/2008
DAILY BALANCE CALIB. AND TEMP. CHECKS	ADM-DALYCK	1	1/18/2002	6/23/2008
PH MEASUREMENTS FOR SUPPORT OF OTHER METHODS - CALIBRATION, USE, AND DOCUMENTATION	ADM-PhSUPPORT	0	6/10/2008	6/10/2008
DETERMINATION OF FREE CARBON DIOXIDE USING NOMOGRAPHS	PC-CO2	0	7/12/2000	6/23/2008
TOTAL HARDNESS BY CALCULATION	GEN-2340B	0	1/19/2005	6/22/2008

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME	REV	DATE OF SOP	DATE OF LAST REVIEW
FIELD SAMPLING	FLD-SAMPLE	1	11/2/2006	3/7/2008
TEMPERATURE - FIELD	FLD-170.1	0	11/1/2001	7/14/2008
BOTTLE PREPARATION, PACKING, AND SHIPPING	SMO-BPS	1	12/21/2001	4/1/2007
SAMPLE RECEIVING	SMO-GEN	4	1/22/2008	4/19/2008
SAMPLE PREPARATION, COMPOSITING, AND SUBSAMPLINC	SMO-SPLPREP	0	2/7/2002	4/22/2008
INTERNAL CHAINS OF CUSTODY	SMO-ICOC	1	2/15/2005	4/19/2008
SAMPLE DISPOSAL	SMO-SPLDIS	3	6/30/2005	4/19/2008
pH IN WATER AND AQUEOUS WASTE	GEN-150.1/9040B	3	3/25/2008	3/25/2008
TURBIDITY	SMO-180.1	3	6/12/2008	6/12/2008
SETTEABLE SOLIDS	GEN-160.5	2	6/13/2008	6/13/2008
CONDUCTIVITY IN WATER	GEN-120.1	2	6/13/2008	6/13/2008
CORROSIVITY	GEN-9045C	2	6/11/2008	6/11/2008
COLOR	GEN-110.2	2	6/12/2008	6/12/2008
DENSITY OR SPECIFIC GRAVITY BY WEIGHT PER GALLON	GEN-D1475Cup	2	6/13/2008	6/13/2008
REDOX	GEN-REDOX	3	6/13/2008	6/13/2008
PAINT FILTER TEST	SMO-9095	2	6/13/2008	6/13/2008
PASSIVE DIFFUSION BAGS	SMO-BAG	1	3/14/2006	4/19/2008

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME	REV	DATE OF SOP	DATE OF LAST REVIEW
ALKALINITY, TOTAL	GEN-310.1	4	2/14/2008	2/14/2008
ALKALINITY FOR PHOTOPROCESSING SAMPLES	GEN-ALK-CARE	0	9/3/2008	9/3/2008
AMMONIA	GEN-350.1	4	9/6/2005	11/1/2007
ASH, DETERMINATION OF	GEN-ASH	3	6/10/2008	6/10/2008
BIOCHEMICAL OXYGEN DEMAND	GEN-405.1	6	2/20/2007	2/22/2008
BOMB CALORIMETRY PREP AND HEAT OF COMBUSTION	GEN-BOMB	2	6/10/2008	6/10/2008
BROMIDE BY AUTOMATED TITRATOR	GEN-BROMIDE-CA	0	9/18/2008	9/18/2008
CATION EXCHANGE CAPACITY OF SOILS USING SODIUM ACETATE	GEN-9081	0	11/4/2005	1/28/2008
CHEMICAL OXYGEN DEMAND-Soils	GEN-CODS	1	7/2/2001	11/7/2007
CHEMICAL OXYGEN DEMAND-Waters	GEN-410.4	1	4/30/2001	2/14/2008
CHLORIDE	GEN-325.2	2	8/26/2005	11/1/2007
CHLORINE DEMAND	GEN-409A	0	5/21/2001	2/14/2008
CHLORINE RESIDUAL	GEN-330	2	1/18/2002	2/15/2008
CHLOROPHYLL A	GEN-10200	0	7/16/2001	1/28/2008
COLILERT AND VERIFICATION OF E.COLI IN MUG	GEN-BACTI	1	1/27/2003	4/25/2008
CYANIDE, AMENABLE TO CHLORINE	GEN-335.1	0	7/2/2001	1/25/2008
CYANIDE, WEAK ACID DISSOCIABLE	GEN-4500	0	7/9/2001	2/22/2008
CYANIDE, MIDI DISTILLATION	GEN-9012A	4	2/8/2007	2/22/2008
CYANIDE, ILM05.3	GEN-ILM5.3CN	0	2/8/2007	2/22/2008
DENSITY OR SPECIFIC GRAVITY BY WEIGHT PER GALLON	GEN-D1475Cup	1	6/8/2006	1/29/2008
DENSITY BY OSCILLATING CELL METER	GEN-D4052	0	1/2/2008	1/2/2008
DISSOLVED OXYGEN	GEN-360.1	0	5/14/2001	1/24/2008
FERROUS IRON	GEN-3500Fe	2	11/11/2004	2/19/2008
FIXER TITRATION OF PHOTOPROCESSING SAMPLES FOR HYPO INDEX AND THIOSULFATE	GEN-FIXER-TITR-C	0	9/18/2008	9/18/2008
FLUORIDE ANALYSIS, ISE	GEN-340.2	1	7/2/2001	11/29/2007
HARDNESS, TOTAL	GEN-130.2	1	5/4/2001	11/29/2007
ALKALINE DIGESTION FOR HEXAVALENT CHROMIUM IN SOIL	GEN-3060A	1	9/20/2005	11/1/2007
COLORIMETRIC DETERMINATION OF HEXAVALENT CHROMIUM IN SOIL	GEN-7196A	1	9/20/2005	11/1/2007
HEXAVALENT CHROMIUM BY IC	GEN-7199	2	9/30/2005	1/23/2008
HEXAVALENT CHROMIUM - WATERS	GEN-CR+6	2	3/10/2006	4/24/2008
HYDROGEN PEROXIDE IN WATER BY IODOMETRIC	GEN-Hperoxide	0	9/15/2008	9/15/2008
HYPO (FIXER) CONTAMINATION IN PHOTOPROCESSING SAMPLES	GEN-HYPO-CARE	0	9/5/2008	9/5/2008
IGNITABILITY - CLOSED CUP	GEN-CCIGN	1	3/6/2001	6/25/2008
IGNITABILITY - OPEN CUP	GEN-OCIGN	1	3/6/2001	6/25/2008
IN-LAB FILTRATION	GEN-FILTER	0	7/3/2003	1/23/2008
IODIDE BY ION CHROMATOGRAPHY	GEN-IODIDE	0	9/18/2008	9/18/2008
ION CHROMATOGRAPHY	GEN-300.0	6	8/8/2006	11/1/2007
NITRATE AND NITRITE	GEN-353.2	2	3/17/2006	2/14/2008
NITROGEN, TOTAL KJELDAHL	GEN-351.2	3	2/26/2008	2/26/2008
ODOR	GEN-140.1	1	6/18/2001	1/23/2008
OIL AND GREASE HEXANE EXTRACTION	GEN-1664A	4	8/26/2004	10/24/2007

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME	REV	DATE OF SOP	DATE OF LAST REVIEW
PERCENT WATER BY KARL FISCHER	GEN-%W	2	3/17/2004	2/19/2008
PHENOLICS, TOTAL	GEN-420.2/9066	3	5/5/2008	5/5/2008
PHOSPHORUS, ORTHC	GEN- OPO4	2	3/17/2006	10/24/2007
PHOSPHORUS, TOTAL	GEN-365.1	6	4/20/2007	4/28/2008
REACTIVITY, SULFIDE AND CYANIDE	GEN-RS/RCN	1	7/2/2001	11/1/2007
SILICA	GEN-370.1	1	6/12/2001	11/29/2007
SILICON, GRAVIMETRIC	GEN-SILICON	1	6/5/2008	6/5/2008
SOLIDS, PERCENT	GEN-DWPS	1	4/19/2004	2/15/2008
SOLIDS, TOTAL	GEN-160.3	4	6/4/2008	6/4/2008
SOLIDS, TOTAL DISSOLVED	GEN-160.1	3	6/3/2008	6/3/2008
SOLIDS, TOTAL SUSPENDED	GEN-160.2	4	6/4/2008	6/4/2008
SOLIDS, TOTAL VOLATILE	GEN-160.4	2	11/11/2005	2/15/2008
SOLIDS, PERCENT VOLATILE	GEN-2540G	0	3/6/2001	1/23/2008
SULFATE, TOTAL	GEN-375.4	0	5/21/2001	2/14/2008
SULFIDE, ACID SOLUBLE	GEN-9030B/9034	1	5/21/2001	1/28/2008
SULFIDE, ACID VOLATILE	GEN-AVS/SEM	4	11/13/2008	11/13/2008
SULFIDE, TOTAL AND DISSOLVED IN WATERS	GEN-376.1	1	5/21/2001	1/28/2008
SULFITE	GEN-377.1	0	5/14/2001	2/13/2008
SURFACTANTS (MBAS)	GEN-425.1	3	1/11/2005	2/15/2008
TOTAL ORGANIC CARBON OR TIC B Y LLOYD KAHN/906(	GEN-TOCLK/9060	2	1/17/2005	1/17/2008
TOTAL ORGANIC CARBON-WATERS	GEN-415.1	5	8/16/2004	1/23/2008
TOTAL INORGANIC CARBON - WATERS	GEN-TICW	0	1/17/2005	1/23/2008
WET CHEMISTRY GLASSWARE CLEANING	GEN-GC	0	6/23/2000	10/31/2007

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME	REV	DATE OF SOP	DATE OF LAST REVIEW
DETERMINATION OF METALS AND TRACE ELEMENTS BY	MET-200.7/6010B	10	1/24/2008	1/24/2008
DETERMINATION OF METALS AND TRACE ELEMENTS BY ICP-MS	MET-6020	3	7/24/2006	7/7/2008
DETERMINATION OF METALS AND TRACE ELEMENTS BY ICP-MS	MET-200.8	0	5/8/2003	2/13/2008
DETERMINATION OF METALS ANG TRACE ELEMENTS BY ICP-MS BY ILM05.3	MET-ILM05.3MS	0	1/20/2006	1/22/2008
DETERMINATION OF METALS AND TRACE ELEMENTS BY ICP BY ILM05.3	MET-ILM5.3AES	0	1/20/2006	1/22/2008
DETERMINATION OF TRACE METALS BY GFAA	MET-GFAA	4	3/14/2006	1/25/2008
MERCURY IN WATER BY COLD VAPOR ATOMIC ABSORPTION SPEC.	MET-7470A/245.1	5	12/9/2005	1/25/2008
MERCURY IN SOLID OR SEMISOLID BY COLD VAPOR ATOMIC ABSORPTION SPEC.	MET-7471A/245.5	4	12/9/2005	1/25/2008
MERCURY IN WATER BY OXIDATION, P&T, AND CVAFS	MET-1631	1	1/29/2007	2/14/2008
MERCURY IN WATER BY COLD VAPOR ATOMIC ABSORPTION SPEC.CLP	MET-HgILM-W	1	2/19/2007	1/25/2008
MERCURY IN SOLID OR SEMISOLID BY COLD VAPOR ATOMIC ABSORPTION SPEC.	MET-HgILM-S	1	1/11/2006	1/25/2008
METALS DIGESTION, WATERS, TOTAL RECOVERABLE AND DISSOLVED FOR ICP	MET-3005A	3	4/4/2002	6/4/2008
METALS DIGESTION, WATERS FOR ICP	MET-3010A	4	4/4/2002	6/4/2008
METALS DIGESTION, WATERS FOR GFAA ANALYSIS	MET-3020A	3	4/4/2002	7/8/2008
METALS DIGESTION, SOIL, SEDIMENT, SLUDGE FOR ICP AND GFAA ANALYSIS	MET-3050B	3	1/15/2003	6/4/2008
INDUSTRIAL HYGIENE FILTER DIGESTION	MET-NIOSH	3	5/3/2001	7/20/2007
SPLP EXTRACTION FOR METALS AND SEMIVOLATILES	MET-SPLP	2	3/8/2002	7/19/2007
SPLP ZHE EXTRACTION	MET-SPLPZHE	1	2/14/2001	1/28/2008
SULFUR FOR ION CHROMATOGRAPHY	MET-ICS	0	7/30/2004	7/23/2007
ACID DIGESTION FOR SULFATE	MET-SO4	0	8/2/2005	7/23/2007
METALS AND SEMIVOLATILES TCLP EXTRACTION (METHOD 1311)	MET-TCLP	1	10/4/2000	1/28/2008
ZERO HEADSPACE EXTRACTION (EPA METHOD 1311)	MET-TZHE	2	12/3/2001	1/28/2008
SAMPLE PREPARATION OF BIOLOGICAL TISSUE FOR METALS ANALYSIS	MET-TDIG	0	11/11/2008	11/11/2008
CLP DIGESTION TECHNIQUES FOR WATERS AND SOILS	MET-CLPDIG	1	1/20/2006	1/28/2008
METALS GLASSWARE CLEANING	MET-GC	0	9/22/2000	7/23/2007

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME	REV	DATE OF SOP	DATE OF LAST REVIEW
SAMPLE RECEIPT, HANDLING, STORAGE, AND SCREENING	VOC-SAMPL	1	6/28/2002	10/31/2007
VOA STORAGE BLANKS	VOC-BLAN	1	8/7/2008	8/7/2008
PURGEABLE VOLATILES BY GC	VOC-601/602	3	6/17/2005	1/4/2008
MINERIAL SPIRITS	VOC-8015MS	0	3/29/2002	5/28/2008
ANALYSIS OF WATER, SOLIDS, AND SOLUBLE WASTES FOR TOTAL PETROLEUM HYDROCARBONS AS GASOLINE RANGE ORGANICS	VOC-8015GRO	5	4/23/2002	1/28/2008
AROMATIC AND HALOGENATED VOCS BY GC	VOC-8021B	5	9/30/2002	12/12/2007
MIXED GASES BY RSK-175M	VOC-8015/RSK175	1	12/20/2002	4/25/2008
GC ANALYSIS OF SINGLE RESPONSE ANALYTES BY FID	VOC-8015 GEN	0	11/26/2002	4/28/2008
CLOSED SYSTEM PURGE AND TRAP	VOC-5035	1	5/28/2002	10/31/2007
DRINKING WATER VOLATILES BY GC/MS	VOC-524.2	2	2/7/2008	2/7/2008
PURGEABLE VOLATILES BY GC/MS	VOC-624	2	11/8/2005	3/27/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS	VOC-8260B	8	8/22/2006	12/12/2007
CLP VOLATILE ORGANICS COMPOUNDS BY GC/MS SOW OLM04.2/95.1	VOC-CLP4.2	2	1/22/2002	5/14/2007
CLP VOLATILE ORGANICS COMPOUNDS BY GC/MS SOW OLM04.3/95.1	VOC-CLP4.3	3	6/13/2005	5/14/2007
LOW CONC WATER FOR VOCS BY OLC02.1 AND OLC03.2	VOC-OLC	1	10/29/2008	10/29/2008
VOCs IN AIR COLLECTED IN CANs AND GAS COLLECTION BAGS BY GC/MS	VOC-TO-15	1	2/8/2008	2/8/2008

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME	REV	DATE OF SOP	DATE OF LAST REVIEW
DETERMINATION OF POLYAROMATIC HYDROCARBONS BY HPLC	HPLC-8310	0	12/18/2006	4/15/2008
DETERMINATION OF CARBONYL COMPOUNDS BY HPLC	HPLC-8315A	0	6/14/2004	6/24/2005
ANALYSIS OF WATER SAMPLES FOR METABOLIC ACIDS	HPLC-METACIDS	2	6/25/2008	6/25/2008
PERCHLORATE IN WATER, SOIL, SOLID WASTE USING HPLC/ESI/MS	HPLC-6850	3	6/12/2007	6/12/2007
DETERMINATION OF HYDROQUINONE BY HPLC/ECD FOR "Client"	HPLC-"Client"Hyd	0	4/3/2007	4/3/2007
MISCELLANEOUS ANALYTES BY ULTRAVIOLET DETECTOR	HPLC-UV-MISC	0	8/18/2008	8/18/2008
SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION	EXT-3510C	3	11/9/2005	1/24/2008
CONTINUOUS LIQUID LIQUID EXTRATION	EXT-3520C	1	4/2/2002	1/24/2008
AUTOMATED SOXHLET EXTRACTION	EXT-3541	0	8/11/2008	8/11/2008
ULTRASONIC EXTRACTION	EXT-3550B	2	4/3/2002	7/3/2008
WASTE DILUTION	EXT-3580A	0	10/9/2000	1/22/2008
ADDITION OF SPIKES AND SURROGATES	EXT-SAS	0	8/11/1999	1/24/2008
PREPARATION OF ANHYDROUS SODIUM SULFATE	EXT-SUL	0	8/11/1999	1/22/2008
FLORISIL CLEANUP	EXT-3620B	0	10/9/2000	1/22/2008
GEL PERMEATION CLEANUP	EXT-3640A	0	1/26/2000	1/22/2008
SULFUR CLEANUP	EXT-3660B	1	11/11/2004	1/22/2008
ACID CLEANUP	EXT-3665A	0	1/26/2000	1/22/2008
ORGANIC EXTRACTIONS GLASSWARE CLEANING	EXT-GC	2	2/28/2006	1/22/2008
PETROLEUM PRODUCTS IN WATER (HYDROCARBON SCAN) NYSDOH Mtd	SOC-310-13	1	6/24/2005	1/8/2008
ORGANOCHLORINE PESTICIDES AND PCBs IN WATERS AND SOILS	SOC-608	9	2/7/2008	2/7/2008
BASE NEUTRALS AND ACIDS	SOC-625	3	7/18/2005	7/4/2008
PCBs BY GC/MS	SOC-680	2	4/6/2004	6/27/2007
1,2 DIBROMO-3-CHLOROPROPANE & 1,2-DIBROMOETHANE IN WATER	SOC-504/8011	1	4/8/2004	10/31/2007
NONHALOGENATED ORGANICS BY GC/FID USING EXTERNAL CALIBRATION	SOC-8015B-ExtS	0	2/16/2007	2/16/2008
NONHALOGENATED ORGANICS BY GC/FID USING INTERNAL STANDARD CALIBRATION	SOC-8015B-IS	0	2/14/2008	2/14/2008
ORGANOCHLORINE PESTICIDES AND PCBs IN WATERS AND SOILS	SOC-8081A	6	5/22/2002	6/9/2008
PCBs IN WATERS and SOILS	SOC-8082	4	11/3/2004	6/9/2008
PCBs IN WIPES	SOC-8082WIPES	1	11/4/2004	6/9/2008
PETROLEUM HYDROCARBONS AS DIESEL IN WATERS, SOILS, AND WASTE INCLUDING MODS FOR MAINE AND CONNECTICUT	SOC-8015B DRO	5	4/20/2006	10/31/2007
CHLORINATED HERBICIDES	SOC-8151A	5	1/7/2008	1/7/2008
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS	SOC-8270C	6	3/31/2006	7/4/2008
CLP SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS SOW OLM04.2/4.3/95.2	SOC-CLP	3	5/14/2007	7/7/2008
CLP PESTICIDES AND PCBs IN WATERS AND SOILS SOW OLM04.2/95.3	SOC-CLPPEST	3	5/14/2007	7/8/2008
"Client" COMMON SOLVENTS AND FOOTNOTE LIST BY 8015B SVOA	SOC-8015TKP	0	2/16/2007	2/16/2008

APPENDIX H

CAS QUALITY AND ETHICS POLICY STATEMENT

CAS Quality and Ethics Policy Statement

Columbia Analytical Services (CAS) vision is simple. Let's strive to be the best in everything we do. This includes ethics and business conduct where CAS is committed to the highest standards of ethical behavior.

Unethical behavior carries a heavy price – one that we do not want to bear. This includes loss of reputation, loss of business, civil and criminal penalties, and government and customer sanctions.

CAS is committed to excellence and superior performance in everything we do. We will not sacrifice our ethical principles in order to achieve business success. This means we will always strive to conduct business honestly and with integrity. We will always follow and obey the law of the land in which we are operating our business. We will always follow, to the best of our ability, standard operating procedures, rules and regulations that apply to our industry and specifically to our laboratory operations. Our customers, employees, suppliers and communities that we serve expect and deserve nothing less than the highest standards of conduct and compliance.

The following are the critical elements of the Quality and Ethics program at CAS.

- The Executive Management and Board of Directors of CAS sponsor and support the Quality and Ethics program through their personal commitment and by providing the necessary resources to promote this program throughout the organization.
- Chief Quality and Ethics Officer. The position is responsible for the quality and ethics program, ensures that appropriate resources are provided, reviews and recommends changes in the program, and resolves ethical and quality issues brought to management attention. This Officer reports directly to the Board of Directors Audit Committee on quality and ethics.
- Core Values. The CAS Statement of Core Values was developed internally with input from the entire company. We are committed to ensuring the integrity and quality of data, and meeting the needs of our clients, while conducting business with high ethical standards. We hold strong to the core values of Honor, Truth, and Fairness. We are committed to these values and rely on them when confronted by difficult choices.
- Ethical Code of Conduct. As a member of the American Council of Independent Laboratories (ACIL) and part of the laboratory industry, CAS subscribes to and supports the core values and ethical codes established by this industry organization.
- CAS Code of Conduct. CAS requires its employees to be introduced to and to sign the "CAS Commitment to Excellence in Data Quality" statement and to comply with standards outlined in Section 6, Employee Conduct, of our Employee Handbook. This includes Section 6.2, Business Ethics, and 6.2.2, Data Quality and Ethics.

- ACIL Seal of Excellence Program. CAS participates in the Seal of Excellence program which requires each laboratory to sign and submit the "Data Integrity Statement".
- Open Door Policy. Employees have the right and obligation for open communications to ask questions, seek guidance, and report incorrect practices and wrong doing without fear of retribution. As described in the CAS Open Door Policy, CAS believes in using the chain-of-command channels for this dialogue. However, if there is fear or a concern that using this approach is not appropriate, employees are free to take their concerns to the President, the Director of Human Resources, the Chief Administrative Officer, the Chief Quality Officer, or the company Ombudsman. Employees may do so without fear of retribution.
- Ombudsman Program. CAS has implemented an external ombudsman/hotline program through EthicsPoint, a phone and internet-based reporting system, to enhance communication and empower employees to promote safety, security, and ethical behavior. Employees can file a report anonymously to address issues in the workplace and to cultivate a positive work environment.
- Internal Audits. Internal systems and data audits are conducted periodically in addition to external agency and client audits. The data audits include a detailed in-depth review of hardcopy data and electronic data to ensure compliance with the CAS Quality program.
- NELAP Accreditation. CAS maintains NELAP accreditation and as such includes quality systems documented in QA Manuals, documented procedures in Standard Operating Procedures (SOPs) and policies, and documented training for demonstration of capabilities.
- Ethics Training. CAS has the obligation to provide training to its employees with respect to company policies concerning business conduct. This not only includes introductory training at the time of hire, but also on-going training on a periodic basis.

The CAS Quality and Ethics Program has been in place for several years. However, this is a "living" program that will change and improve as the company grows and changes.

Steve Vincent

Steve Vincent, President/CEO

11/14/05

Date

Gary Ward

Gary Ward, Chief Quality/Ethics Officer

11/11/05

Date

Columbia Analytical Services, Inc.

Simi Valley, CA

QUALITY ASSURANCE MANUAL

for

2655 Park Center Drive, Suite A
Simi Valley, California 93065
(805) 526-7161

Document Date: June 29, 2007
Effective Date: 8/10/07

Approved and Authorized by:

Laboratory Manager:	John Yokoyama	7/30/07
Quality Assurance Program Manager:	Lynne Nelson	7/30/07
Team Leader / Technical Manager (Semi-Volatiles/IH):	Madeleine Dangazyan	7/30/07
Team Leader / Technical Manager (Volatiles GC/MS - Air):	Chris Parnell	7/30/07
Team Leader / Technical Manager (Volatiles GC - Air):	Wade Henton	7/30/07
Team Leader / Technical Manager (General Chemistry):	Sue Anderson	7/30/07
Team Leader / Technical Manager (Volatiles Soil/Water):	Karen Ryan	7/30/07

Annual review of this QAM has been performed and the QAM still reflects current practice.

Initials: ____ Date: _____
Initials: ____ Date: _____
Initials: ____ Date: _____

DOCUMENT CONTROL
Number: _____
Initials: _____ Date: _____
Effective Date: _____

UNCONTROLLED COPY

2.0 TABLE OF CONTENTS

Tables ***Page***

Figures ***Page***

Appendices ***Page***

3.0 INTRODUCTION AND COMPANY QUALITY ASSURANCE POLICY

Columbia Analytical Services, Inc. (CAS/SIMI) in Simi Valley, California is a professional consulting laboratory which performs chemical analyses on a wide variety of sample air matrices, including indoor and outdoor ambient air, stationary source emissions, landfill gas, soil vapor, process gas, industrial hygiene samples, and product emissions. In addition, both chemical and physical analyses are conducted on a number of matrices, including drinking water, groundwater, surface water, wastewater, soil, sediment, sludge, industrial and hazardous waste, and other materials.

The quality policy statement is under the issuance of top management and includes the purpose of the quality system and management's commitment to comply with and to continually improve the effectiveness of the system. To assure the quality of the environmental test results, the laboratory has the responsibility and commitment to carry out its testing in such as way as to meet the requirements of all applicable standards (as specified herein) and to satisfy the needs of the customer, the regulatory authorities or organizations providing recognition and their applicable standards and requirements. The purpose of the CAS/SIMI quality management system and quality policy is that there will be sufficient Quality Assurance (QA) activities conducted in the laboratory to ensure that all analytical data generated and processed will be scientifically sound, legally defensible, of known and documented quality, and will accurately reflect the material being tested. In addition, avoidance of involvement in any activity that would diminish confidence in its competence, impartiality, judgment, operational integrity, or integrity of the data provided and the services rendered is a strict policy. This goal is achieved by ensuring that adequate Quality Control (QC) procedures are used throughout the monitoring process, and by establishing a means to assess performance of Quality Control and other QA activities.

The laboratory continually improves the effectiveness of its management system through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions and management review. The scope of laboratory quality assurance is reflected in our Statement of Core Values as specified in the most recent Columbia Analytical Services Employee Handbook. Top management ensures that the integrity of the management system is maintained when changes to the management system are planned and implemented.

Management has implemented a standard of service which includes, but is not limited to, maintaining good client communication regarding any delays or method deviations, affording clients or the client's representative cooperation to clarify requests and/or the ability to monitor the laboratory's performance associated with any work performed (while maintaining the confidentiality of other clients as stated in this document). The laboratory seeks feedback, both positive and negative, from its customers and the feedback is used and analyzed to improve the management system and testing activities, as well as customer service.

It is recognized by management that quality assurance requires a commitment to quality by everyone in the organization - individually, within each operating unit, and throughout the entire laboratory. Management ensures that there are appropriate communication processes within the laboratory whereby

personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the objectives of the quality system and the effectiveness of the management system. In addition, the importance of meeting customer requirements as well as statutory and regulatory requirements is communicated to personnel through the use of laboratory meetings and training sessions. CAS/SIMI including all management personnel is committed to ensuring that all laboratory personnel have read, understood and agree to implement and uphold accepted laboratory policies, practices and the quality of testing services described in this document.

CAS/SIMI conducts all reportable business in accordance with the appropriate procedures, policies and guidelines in this Quality Assurance Manual and other corresponding documents. The laboratory management including the Quality Assurance Program Manager has established, implemented and maintains a quality system, based on the required elements for NELAC Chapter 5, which is appropriate to the type, range and volume of environmental testing activities it undertakes. The laboratory is committed to complying with and ensuring that all documents and practices comply with the National Environmental Laboratory Accreditation Conference (NELAC) Standards, N.J.A.C. 7:18, American Industrial Hygiene Association (AIHA) LQAP Policy Document (Effective April 1, 2005), ISO/IEC 17025:2005(E), Arizona Department of Health Services (Department) pursuant to A.R.S. § 36-495.01 et. seq. and A.A.C. R9-14-601 et seq., and the Department of Defense Quality Systems Manual for Environmental Laboratories (Final Version 3, January 2006), as well as referenced method requirements in order to maintain and uphold the degree of data quality for which these are intended. The frequency with which the laboratory will perform the procedures listed pursuant to the requirements as listed above is specified in this document and/or associated CAS/SIMI procedures and documents.

The information in this document has been organized according to the format described in National Environmental Laboratory Accreditation Conference (NELAC) Quality Systems Standards, June 5, 2003, ISO/IEC 17025:2005(E), *EPA Requirements for Quality Management Plans*, EPA QA/R-2, EPA/240/B-01/002, March 2001, and *Guidance on Preparation of Laboratory Quality Assurance Plans*, USEPA, Revision, 1 October 9, 1992. This document is controlled under the requirements specified in the *Standard Operating Procedure for Document Control.*

4.0 PROGRAM DESCRIPTION

The concept of Quality Assurance can be extended, and is expressed in the mission statement of CAS/SIMI:

"The mission of Columbia Analytical Services is to provide high quality, cost-effective, and timely professional testing services to our customers. We recognize that our success as a company is based on our ability to maintain customer satisfaction. To do this requires constant attention to customer needs, maintenance of state-of-the-art testing capabilities and successful management of our most important asset - our people - in a way that encourages professional growth, personal development and company commitment."

In support of this mission, our QA program addresses all aspects of laboratory operations, including laboratory organization and personnel, sample management, document storage, archival and disposal, critical documents and records including standard operating procedures, sample and quality control data, calibration data, standards traceability, equipment maintenance records, method proficiency data (such as method detection limit studies and control charts), and laboratory personnel training records as well as client communications such as contracts, complaints and confidentiality.

4.1 Quality System Documentation

The quality system is the organizational structure, the policies, processes and procedures necessary to ensure that the overall intentions and direction of an organization as it regards quality are met and that the quality of the laboratory's services are assured. The quality assurance manual, related quality documentation and all policies and operational procedures described therein were established in order to meet requirements as described in NELAC, state, and other agency standard(s) referenced in Section 3.0 of this document. As part of the document control procedure, all written procedures are reviewed at least annually and, where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

4.1.1 Quality Assurance Manual

The documentation of the quality system begins with this document, which contains, describes or provides reference to all of the policies and requirements needed to comply with applicable State, Federal and other governing body standards, policies and requirements.

The quality assurance (QA) manual is applicable to all activities conducted at both the main laboratory located at 2655 Park Center Drive, Suite A, Simi Valley, California and the off-site extraction facility at 8030 Remmet Avenue in Canoga Park, California. This document provides the main platform for technical and administrative operations, as well as laboratory organization and responsibilities, equipment and facilities, and procedures and policies by which the laboratory operates. The laboratory QA manual is one of many tools, including systems and analytical standard operating procedures, available to assist analytical and administrative staff in the uniform implementation of the quality system. For references to all supporting procedures of the laboratory's quality system and this document refer to Appendix C.

The contents of the manual are reviewed, revised (as needed) and approved annually by the Quality Assurance Program Manager (QAPM), Laboratory Manager and Team Leaders to ensure that it continuously reflects current policies and practices.

4.1.2 Standard Operating Procedures

Standard operating procedures (SOPs) are the tools through which the policies and procedures, as expressed in the QA manual, are implemented. They form the next tier in the documentation of the quality system. CAS/SIMI maintains SOPs for use in both technical and administrative functions, which accurately reflect all phases of laboratory activities such as data integrity, corrective actions, customer complaints, and all test methods. Each SOP generated in the laboratory has been reviewed and approved by at least the Laboratory Manager and the Quality Assurance Program Manager (QAPM). Standard operating procedures may be internally written documents or copies of published methods with any changes or selected options clearly documented. In addition, certain administrative standard operating procedures are distributed by the corporate Chief Quality Officer for local implementation. These SOPs are implemented wherever and whenever necessary based on the requirements. However, any exceptions and/or additions to the requirements of these procedures are clearly detailed in the appropriate SOPs. Refer to Appendix C for a list of the laboratory's standard operating procedures.

4.1.3 Analytical Methods

In addition to SOPs, the laboratory maintains a copy of all referenced promulgated and non-promulgated methodology used at CAS/SIMI to perform analyses as well as those methods and/or procedures referenced in a specific test method. These methods and procedures are accessible to all laboratory staff regardless of discipline in the corresponding method manual. Refer to Section 18.0 for a list of references and Appendix C for methods and standard operating procedures. This list includes both routine and non-routine methods performed at CAS/SIMI.

4.1.4 Laboratory Notebooks and Records

The third tier of the quality system can be considered to be all records generated by the quality system as described in Section 8.0. Laboratory logbook entries have been standardized following the guidelines in the *Standard Operating Procedure for Making Entries into Logbooks and onto Benchsheets*. The logbook entries are reviewed (approximately 10%) quarterly by either the QAPM or Laboratory Manager (however named), or the appropriate supervisor. All logbook review deficiencies shall be discussed and documented. Logbooks are retained on file for a period of five years from the date of the last entry. A master list or log of all logbooks shall be maintained and must include at a minimum the logbook identification, type, start and end dates and archival date.

4.2 Measurement Traceability

Traceability is defined as the property of a measurement result or value of a standard which can be related to stated references through an unbroken chain, each with stated uncertainties and is documented for all material used to perform calibrations. The documentation, a certificate of analysis containing, at a minimum, the manufacturer, address, accreditation number (where applicable), how traceability was achieved, the traceable values, their associated uncertainty, and the unique serial or laboratory identification number of the equipment or standard reference material (SRM) shall serve as initial point in the chain of traceability. The unique serial number or laboratory identification number is used throughout the laboratory to trace equipment and materials back to the original certificate of analysis.

All metrology equipment (with unique serial numbers) including analytical balances and weights, thermometers and digital pressure/vacuum gauges are calibrated annually using SRMs traceable to the National Institute of Standards and Technology (NIST). All calibration information for this equipment is kept on file by the laboratory. Refer to Section 11.1 on the evaluation and approval of suppliers of critical services.

Consumable SRMs routinely purchased by the laboratory (e.g. primary stock standards) are purchased from nationally recognized, reputable vendors. Most vendors have fulfilled the requirements for ISO 9000 series certification and/or are accredited by American Association of Laboratory Accreditation (A_2LA). Certificates of Analysis and Statements of Accuracy provided by the vendors of reference materials are retained. Traceability for consumable SRMs as well as the procedure for approval of vendors of critical consumables and supplies is accomplished by following the requirements set forth in the corresponding *Standard Operating Procedure for Handling Consumable Materials*. Nevertheless, the procedure requires that each standard reference material, upon receipt, is given a unique identification code and this number is utilized throughout the standard preparation, analytical, reporting, and disposal processes. This is performed to ensure that all analytical data is traceable to the standard and/or standards information involved in producing the data including standard preparation, storage, expiration date, and vendor. It may be noted that atmospheric air is a natural standard and is used with the same confidence as traceable standards. If particular traceable standards do not exist, then the laboratory uses certified reference materials provided by a competent supplier otherwise able to provide reliable chemical characterizations of materials.

4.3 Operational Assessments

There are a number of methods used to assess the laboratory and its daily operations. In addition to the routine quality control (QC) measurements used by a laboratory to measure quality, the senior laboratory management staff at CAS/SIMI examines a number of other indicators to more accurately assess the overall ability of the laboratory to successfully perform those analyses

requested by clients. These indicators include the ability of the laboratory to carry out analyses with regards to available equipment and personnel. This assessment is carried out through an annual management review of instrumentation, personnel and sample load. In addition, the management review includes a list of analytes for which the laboratory offers analyses versus those additional analytes requested and analyzed over the previous year. At the discretion of management, analyte or analytes may be added to the routine list(s) offered. This decision is based in part to the number of requests received, the costs of standards and suitability of adding the analyte to the existing standard.

A frequent, routine assessment must also be made of the laboratory's facilities and resources in anticipation of accepting an additional or increased workload. CAS/SIMI utilizes a number of different methods to insure that adequate resources are available in anticipation of the demand for service. Regularly scheduled staff meetings, tracking of outstanding proposals and an accurate, current synopsis of incoming work all assist the senior staff in properly allocating resources to achieve the required results. This process is more extensively detailed in Section 4.8 of this document and in the *Standard Operating Procedure for Project Management and Business Development.*

4.4 Subcontract Laboratories

Analytical services are subcontracted when CAS/SIMI needs to balance workload and/or when the laboratory does not perform the requested analyses. Subcontracting is only done with the knowledge and approval of the client and this is accomplished by following the requirements specified in the *Standard Operating Procedure for Project Management and Business Development*. Refer to Section 9.10 for additional information.

4.5 Communications (Contracts and Complaints)

Laboratory communications entail each the following areas:

4.5.1 Contracts – The policy for reviewing contracts and analysis requests ensures that the requirements, including methods to be used, for testing are adequately defined, documented and understood. In addition, the laboratory shall ensure that it has the capability and resources to meet the client's requirements and that the appropriate test method is selected to meet the clients' requirements. The review shall also cover any work that is subcontracted by the laboratory. The client shall be informed of any deviation from the contract. Records of oral discussions with the client are maintained. All amended contracts and requests are distributed to all affected personnel. The actual procedure for performing this review is detailed in the *Standard Operating Procedure for Project Management and Business Development*. Other procedures for evaluating, performing and reporting results for client requests and jobs are also specified in Sections 4.6, 4.7, 4.8, and 4.9.

4.5.2 Complaints – Where a complaint or inquiry, from a client or some other entity raises any doubt as to the laboratory's compliance with CAS/SIMI policies or procedures, or otherwise

concerning the quality of calibrations or results, the laboratory shall promptly evaluate the affected area(s). Records of the complaint and subsequent evaluation and any corrective actions and/or audits are thoroughly documented and maintained. Complaints are primarily handled by the Project Manager and Quality Assurance Program Manager according to the policy and procedures for the resolution of complaints outlined in the *Standard Operating Procedure for Dealing with Complaints.*

4.5.3 Communication – Communication between the laboratory (more specifically the Project Managers) and the client is maintained throughout the duration of a contract and/or request. In addition, whenever there is a request, clients are allowed to monitor testing activities for verification purposes and these visits are handled in such a manner as to not jeopardize other clients' confidentiality (refer to Section 8.5 for information on preserving confidentiality). Additional and more specific information regarding this matter is included in the *Standard Operating Procedure for Project Management and Business Development*.

4.6 Deviation from Standard Operating Procedures

Deviations from current standard operating procedures are handled in accordance with this document. Generally, when a customer requests a modification to a SOP (such as an addition or deletion of target analyte(s), etc.), the Project Manager (PM) handling that project discusses the proposed deviation with the Laboratory Manager and to obtain approval to accept the project. The PM is responsible for documenting the approved deviation from the standard operating procedure and providing a detailed description of the deviation to the laboratory prior to analysis.

For circumstances when a deviation or departure from company policies or procedures involving any non-technical function is found necessary, approval must be obtained from the Laboratory Manager, or other level of authority. Frequent departure from policy is not encouraged. However, if frequent departure from any policy is noted, the Laboratory Manager will address the possible need for a change in policy. The information provided in Section 4.3 entitled Operational Assessments describes in detail the process of managerial review and the criteria for implementing a change in policy or procedure.

4.7 Method Modifications

CAS/SIMI strives to perform published methods as described in the referenced documents. However, if there is a deviation from the published method, the method is cited as a "Modified" method in the analytical report. If the modification is such that the method becomes "Performance Based," client approval is obtained for the use of the method prior to the performance of the analysis.

4.8 Procedures for Accepting New Work

The specific procedures for accepting new work are dictated in this document as well as in the *Standard Operating Procedure for Project Management and Business Development*. The procedure for accepting new work takes into account the laboratories ability to complete the work in a timely fashion and the ability to actually perform the work. The requests include:

1. Normal and routine analysis utilizing existing laboratory methodologies
2. Non-routine analyte which is specified in a laboratory offered method
3. Analyte for which no method is specified by the client
4. Complete start-up of an established method
5. Analysis requested with no published method

In all cases, the current laboratory analysis backlog (which includes all in-house samples), anticipated samples from accepted jobs, sample holding times, analysts availability, requested turn around time, and number of samples requested are taken into account when making the decision to accept a proposed job. Each scenario is specified and the procedure for determining whether or not to accept the work is described in detail below. In addition, the minimum requirements for performing this work with regards to quality issues such as calibration, training, detection limits, and reporting is included in Section 11.4 of this document.

Normal and Routine Analysis Using Existing Laboratory Methodologies – This includes methods and analytes which are currently offered and routinely analyzed. If it is determined that a proposed job can be completed in a time acceptable to the client without hindering completion of any other job (previously accepted and in-house) then the new work is accepted.

Non-Routine Analyte Which is Specified in a Laboratory-Offered Method – This entails an analyte which is listed in the method but for which we do not currently offer in the analyte list for that method. These types of requests are accepted based on whether or not the proposed job can be completed in a time acceptable to the client without hindering completion of any other job (previously accepted and in-house) and the availability of the standard. In addition, the decision is largely made based on the amount of QC requested, as well as the required confidence level of the data.

New Analyte with No Specific Method Requested – The analyte(s) is researched and reviewed by the appropriate personnel for chemical nature, formula, and other related information. The Merck Index and CRC Handbook are reviewed to determine the type of compound, where necessary. After this has been determined, it is assumed, based on the information provided and the matrix that it can be analyzed by an existing method. If not, perhaps a modification of a method or the creation of a method may be attempted. The efficiency of the various approaches is compared and if no method allows for acceptable precision and accuracy then the job is not accepted.

These types of requests are also accepted based on the availability of a standard, sample backlog of the laboratory, the requested QC, and the required confidence level of the data.

Complete Start-up of an Established Method – The method is obtained and reviewed by the Project Manager and/or other appropriate personnel to determine if the laboratory believes it is worth the time and expense necessary to proceed; and if the instrumentation and reagents required by the method are available.

The issues listed above are in addition to the ones previously stated such as whether or not the job can be completed in a time acceptable to the client without hindering completion of any other job (accepted and in-house), availability of a standard and the current sample backlog of the laboratory.

Analysis Requested with No Published Method – These are usually special requests made by a client and include the analysis of a particular substrate or product. The analyte(s) or analysis is researched and reviewed by the appropriate personnel for chemical nature, formula, and other related information. The Merck Index and CRC Handbook are reviewed if necessary to determine the type of compound, where necessary. After this has been determined, it is assumed that it can be analyzed by an existing method. If not, perhaps a modification of a method or the creation of a method could be attempted, comparing the efficiency of the various approaches. The method, which allows for the best precision and accuracy, shall be used. The analysis is reviewed by the Project Manager and/or other appropriate personnel to determine: If the laboratory believes it is worth the time and expense necessary to proceed; and if the instrumentation and reagents required by the method are available.

Instrument Out of Service - The Project Manager assesses the situation for the estimated maintenance time for the instrument against the client's requirements prior to the acceptance of any job. The effect of the downtime on in-house samples is also taken into account when trying to schedule additional analyses.

4.9 Quality Assurance and Control Guidelines for Performing New Work

The purpose of this section is to describe the minimum quality guidelines for performing work (from Section 12.8) with regards to calibration, training, standard operating procedures, method detection limits, standards, and reporting. The expected confidence level of the data, aside from the precision and bias measurements, is especially vital when a primary or second source standard is not available, no standard operating procedure has been written, or no specific training records are available for review. In each of these cases the report will reflect the amount or level of confidence in an analytical result.

Normal and Routine Analysis Using Existing Laboratory Methodologies

The laboratory retains the following information on file for work of this type being performed.

- Standard operating procedure – The SOP may either be a laboratory generated document or in a few cases be the published method with any additions and/or deletions specified in an attachment.
- Training documentation – Initial or continuing demonstration of proficiency.
- Method detection limit – Statistical determination of the minimum concentration of a substance or analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero.
- Initial calibration – Calibration standards of varying analyte concentrations (with the low standard concentration at or below the method reporting limit) used to calibrate the response of the measurement system with respect to target analyte concentration.
- Second source standard – The method SOPs include the specific criteria for this standard. A second source standard is prepared from material obtained from a source other than the source of the calibration standards and is analyzed after the measurement system is calibrated, but prior to sample analysis in order to verify the calibration of the measurement system.

Any deviation from this list will result in either declining the proposed job or a special notation made on the final report to the client.

Non-Routine Analyte Which is Specified in a Laboratory-Offered Method

The quality assurance and control information outlined above may not be fully employed in non-routine analyses (new analyte). If this is the case, results are qualified in the final report. The laboratory analyzes samples based on quantitative, semi-quantitative, or tentatively identified compound(s) reporting confidence levels. Basically, the level of confidence, aside from the precision and accuracy measurements, is established and depends on the existence of a primary standard and initial calibration curve as well as the reporting requirements of the client.

1. Quantitative result with an initial calibration curve, method detection limit study, and whenever possible a second source standard.
2. Quantitative result with an initial calibration curve, method reporting limit indicated as the low standard on the curve, and whenever possible a second source standard.
3. A semi-quantitative result includes (at a minimum) a one-point calibration with the method reporting limit reported as that concentration.
4. Tentatively identified compound(s) are reported as such when the compound of interest is not included in the standard. It is identified when the GC/MS is operated in SCAN mode and the resulting peak is compared to the mass spectra library. An estimated result is determined by assuming a response factor of one (1) for the compound and comparing the height of that compound (TIC) to the nearest internal standard.

Regardless of the confidence level, a standard operating procedure will be in place for the method being offered. However, the SOP specifies only those analytes routinely analyzed and will not be revised to include non-routine analytes. Nevertheless, based on the described procedure for operational assessments, the target analyte list is reviewed on an annual basis.

New Analyte with No Specific Method Specified

Regardless of the confidence level and in all cases where an existing method may be used to analyze the analyte(s), a standard operating procedure will be in place specifying only those analytes routinely analyzed and will not be revised prior to analysis. The laboratory shall analyze the sample using one of the following reporting confidence levels. The confidence level reported shall depend on both the existence of a standard and the required reporting information of the client.

1. Quantitative result with an initial calibration curve, method detection limit study, and whenever possible a second source standard.
2. Quantitative result with an initial calibration curve, method reporting limit reported as the low standard on the curve, and whenever possible a second source standard.
3. A semi-quantitative result includes at a minimum a one-point calibration with the method reporting limit reported as that concentration.
4. Tentatively identified compound(s) are reported as such when the compound of interest is not included in the standard. It is identified when the GC/MS is operated in SCAN mode and the resulting peak is compared to the mass spectra library. An estimated result is determined by assuming a response factor of one (1) for the compound and comparing the height of that compound (TIC) to the nearest internal standard.

Complete Start-up of an Established Method

CAS/SIMI strives to obtain all of the information listed under established and routine methods. However, depending on the required turn around time, reporting confidence and the end result of the data there may be deviations. Specific deviations with regards to calibration, method reporting limits, as well as training are specified on the final report.

Analysis Requested with No Published Method

The final report includes a summary of the method used to analyze the samples. In addition, the job file will contain sufficient information to reconstruct the analysis if necessary. Also, CAS/SIMI shall strive to obtain all of the information listed under established and routine methods. However, depending on the required turn around time, reporting confidence and the end result of the data there may be deviations. Specific deviations with regards to calibration and method reporting limits are specified on the final report.

5.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

Columbia Analytical Services, Inc. (CAS) is an employee-owned company and CAS/SIMI is one of six network laboratories operated by CAS Holdings, Inc. The resumes of all key laboratory personnel as well as the organizational and management structure (as outlined in the organization charts) are in Appendix A. The organizational arrangements are such that there are no conflicting interests, such as production, commercial marketing or financing and do not adversely influence the laboratory's compliance with the requirements of appropriate quality standards or any policies and/or procedures.

The CAS/SIMI staff consists of approximately 47 employees, including management, chemists, technicians, and support personnel. They represent diverse educational backgrounds and experience, and provide the comprehensive skills that a modern analytical laboratory requires. Minimum qualifications for each position listed below are on file in the laboratory and are available for review.

CAS/SIMI is committed to providing an environment that encourages excellence as everyone within CAS/SIMI shares responsibility for maintaining and improving the quality of our analytical services. The responsibilities of key personnel within the laboratory are described below (other staff member descriptions are on file in the laboratory) and Table 5-1 lists the experience, signatures and initials of CAS/SIMI personnel assigned to these key positions. All managerial and technical staff members who, irrespective of other responsibilities, have the authority and resources needed to perform their duties including the implementation, maintenance and improvement of the system and to identify the occurrence of departures from the quality system or from the procedures for performing environmental tests, and to initiate action to prevent or minimize such departures.

All employees are required to and are responsible for familiarizing themselves with the applicable quality documentation and implementing the policies and procedures in their work.

- The role of the **Laboratory Manager (LM)** is to provide technical, operational, and administrative supervision/leadership through planning, allocation and management of financial, personnel and equipment resources of the laboratory. This person is responsible for providing resources for implementation of the QA program and ensuring quality, overall laboratory efficiency, and financial performance of the CAS/SIMI facility. Additional duties of the Laboratory Manager (LM) include, but are not limited to, monitoring standards of performance in quality control and quality assurance; monitoring the validity of the analyses performed and data generated in the laboratory to assure reliable data. The Technical Director shall be referred to throughout all laboratory documentation, including the remainder of this document as Laboratory Manager. The LM is also required to perform direct report laboratory personnel work reviews and shall certify and document that personnel with appropriate educational and/or technical background perform all tests. The LM has the responsibility of working with the Project Managers on scheduling conflicting client projects and the Quality Assurance Program Manager to ensure compliance with all company procedures and policies as well as all standards for accreditations (i.e. NELAC Chapter 5, AIHA Policies, ISO/IEC 17025:2005(E), and other State and Federal requirements).

- The Quality Assurance (QA) program is completely independent of the laboratory and is managed in such as way as to prevent any conflict of interest. The responsibility of the **Quality Assurance Program Manager (QAPM)** is to provide an independent focus for overall quality assurance activities within the laboratory and is responsible for the oversight and/or review of quality control data and has the responsibility and authority for ensuring that the quality system is implemented and followed at all times and notify laboratory management of deficiencies in the quality system and monitor corrective action. The QAPM has direct access to the highest level of management at which decision are made on laboratory policy and resources. The QAPM is able to evaluate data objectively and perform assessments without outside (i.e., managerial) influence including hardcopy data package, electronic data audits and internal systems and method audits. This person works with individual laboratory production units to establish effective quality control and assessment plans and is also responsible for identifying and responding to QA problems, needs and requests from the technical staff and ensuring compliance with all company procedures and policies and standards for accreditation (i.e. NELAC Chapter 5, AIHA Policies and ISO/IEC 17025:2005(E)). The QAPM is a technical advisor and is responsible for arranging and conducting internal audits (in accordance with Section 14.0 of this document), summarizing and reporting overall unit performance, including round-robin programs, certification and accreditation activities, and blind and reference sample analyses, ethics and data integrity training, administering inter-laboratory QA efforts; e.g., review performance evaluation results, monitors and approves nonconformities, complaints and any corrective actions taken, conducts QA/QC training, prepares QA reports to management, and reviews and updates the QA Manual.

The Analytical Laboratory is divided into operational units or departments, based upon specific disciplines. Each department performing tests including VOA/Gas Chromatography, VOA Gas Chromatography/Mass Spectroscopy (Air), VOA Soil and Water, Semi-Volatile Organics, and General Chemistry is responsible for establishing, maintaining and documenting a quality control program based upon the unique requirements within that department. Each **Chemist/Analyst** and/or **Technician** in the laboratory has the responsibility to carry out preparation and testing according to current prescribed methods, standard operating procedures and quality control guidelines particular to the department in which he/she is working.

- The **Team Leader/Technical Manager** has the responsibility to ensure that quality control functions are carried out as planned, and to guarantee the production of high quality data. Team Leaders/Technical Managers have the responsibility to monitor the day-to-day supervision of laboratory operations for the applicable departments/analyses and reporting of results, as well as to ensure that productivity and data quality objectives are met. The Team Leader/Technical Manager's duties includes monitoring standards of performance in quality control and quality assurance; monitoring the validity of the analyses performed and data generated in the laboratory to assure reliable data. In addition, the Team Leader/Technical Manager is required to perform laboratory personnel work reviews, schedule programs such as method detection limit studies and training, review corrective action reports and implement necessary actions to prevent any reoccurrence, and coordinate sample analysis scheduling with respect to holding times and client requirements. The Team Leader is responsible for evaluating and approving team work shifts and vacation requests, monitoring in-house projects including on-time delivery and data review, ensuring that all annual

and semi-annual quality control and assurance activities are completed and approved. The team leader also has the responsibility of occasionally working with the Project Managers on scheduling conflicting client projects and the Quality Assurance Program Manager and Laboratory Manager on certain quality issues and any implementation as needed, as they directly relate to the laboratory and their department. The Team Leader/Technical Manager also ensures compliance with all company procedures and policies as well as all standards for accreditations (i.e. NELAC Chapter 5, AIHA Policies, ISO/IEC 17025:2005(E), and other State and Federal requirements). The Team Leader/Technical Manager will be referred throughout most documentation as Team Leader, Analyst or Chemist with the same job functions/responsibilities as indicated.

- The **Director of Research and Development** is required to identify and develop new markets and technologies, and manage the implementation of such endeavors through support of the **Director of Technology Development.** It is also the responsibility of the Director of R&D to manage business development and those individuals responsible for this role.
- The **Environmental Health and Safety (EH&S) Coordinator** is responsible for the administration of the laboratory health and safety policies. This includes the formulation and implementation of safety policies, the supervision of new-employee safety training, the review of accidents, incidents and prevention plans, the monitoring of hazardous waste disposal and the conducting of departmental safety inspections.
- **Information Technology (IT)** staff (**Systems Analysts**) is responsible for the administration of the laboratory support services. Other functions of the IT staff include laboratory network maintenance, education of analytical staff in the use of scientific software, custom software development and implementation, data back up, archival and integrity operations. **Data Processors** are responsible for generating and reviewing Electronic Data Deliverables (EDDs).
- The **Sample Management Personnel (Sample Custodian)** and alternates play a key role in the laboratory QA program by performing and/or assisting in the proper preparation and shipment of sampling media. In addition, the custodian or alternates are responsible for the verification of sample receipt information, performing sample acceptance and log-in and distribution of documentation per laboratory defined procedures and the initial storage of samples in the proper environment and location and either assisting or performing proper sample disposal. The custodian also monitors and records all thermal preservation equipment temperatures and calibrates associated thermometers against a NIST traceable thermometer.
- The **Project Manager (PM)** is a assigned to act as a technical liaison between the client and the laboratory. The PM is responsible for ensuring that the analyses performed by the laboratory meet all project, contract, and regulatory-specific requirements. This entails coordinating with the CAS/SIMI laboratory and administrative staff to ensure client-specific needs are understood and that the services CAS/SIMI provides are properly executed and satisfy the requirements of the client.
- The **Data Validation Coordinator** is responsible for data review, data package preparation, review and coordination, and preparation of case narratives (based on the information provided by the laboratory).

- The **Disposal Technician** is responsible for coordinating for the appropriate disposal of spent chemicals, sample extracts and other hazardous wastes. In addition, the Disposal Manager has the responsibility for the proper disposal of solids, liquids and air samples in Tedlar bags and canisters.

5.1 Nominated Deputies

When either of the key positions listed below is vacant, the deputy assigned to that position assumes the duties and responsibilities of that position during their absence.

Acting Laboratory Manager/Technical Director ....Director of Research and Development
Acting Quality Assurance Program Manager.....Team Leader (VOA GC/MS-Air)

5.2 Provision Signatures, Technical Experience and Qualifications

The undersigned (Table 5-1) are key personnel responsible for planning, implementing, maintaining and improving the Quality Assurance (QA) activities conducted within Columbia Analytical Services.

Table 5-1
Technical Staff Summary

Name / Title	Signature	Initials	Years of Experience
John Yokoyama, B.S. *Laboratory Manager*		JY	21
Lynne Nelson, B.S. *Quality Assurance Program Manager*			16
Michael Tuday, B.S. *Director of Research and Development / Project Manager*		MT	27
Ku-Jih Chen, B.S. *Director of Technology Development*		KJC	32
Wade Henton, B.S. *Team Leader (Volatiles GC - Air)*		WH	21
Chris Parnell, B.S. *Team Leader (Volatiles GC/MS – Air)*		CP	21
Madeleine Dangazyan, B.S. *Team Leader (Semi-Volatiles/ Industrial Hygiene)*		MD	12
Sue Anderson, B.S. *Project Manager / Team Leader (General Chemistry)*			17
Karen Ryan, B.S. *Project Manager / Team Leader (Volatiles - Soil and Water)*		KR	16
Rusty Bravo, B.S. *Chemist*			15
Aristotle Bragasin, B.S. *Chemist*			12
Roger Wong, B.S. *Chemist*		RW	3
Regan Lau, B.S. *Chemist*		RL	6
Zheng Wang, B.S., M.S. *Chemist*		ZW	19
Chaney Humphrey, B.S. *Chemist*		CH	3
Liliana Marghitoiu, B.S. *Chemist*		LM	3
Takashi Miyake, PhD *Chemist*		T.M	5
Simon Cao, B.S. *Chemist*			14
Kristiana Miller, B.S. *Chemist*	ON FILE		6

Name / Title	Signature	Initials	Years of Experience
Wida Ang, B.S., M.S. *Chemist*			22
Sadia Terranova, B.S. *Chemist*			7
David Castillo, B.S., M.S. *Chemist*		DC	1
Robin Gill *Data Validation Coordinator; Team Leader (Sample Management and Reporting)*	Robin Gill	RG	27
Michelle Sakamoto, B.A. *Data Validation Coordinator*	Michelle H. Sakamoto	MS	11
Kelly Horiuchi, B.A. *Project Manager*	Kelly M. Horiuchi	KMH	7
Kathleen Aguilera, B.A. *Project Manager*	ON FILE		18
Indian Tyler, B.S., M.S. *Business Development*			3
Robert De La O *Systems Analyst / IT*	ON FILE		17
Richard Adams, B.S. *Systems Analyst / IT*			30
Shreejana Singh, B.S. *Systems Analyst*		SSM	2
Manny Zamora *Sample Management Custodian*			5
Lonnie Kukita, A.A. *Sample Management Custodian*			12
Llensenia Cercado *Team Leader – Canister Cleaning and Shipping, Alternate Sample Management Custodian*		LC	7

6.0 STATEMENT OF PROFESSIONAL CONDUCT AND LABORATORY PRACTICE

One of the most important aspects of the success of CAS/SIMI is the emphasis placed on the avoidance of involvement in any activity that would diminish confidence in the laboratory's competence, impartiality, judgment, operational integrity, or integrity of the data provided and services rendered. The laboratory's success is reliant on both the professional conduct of all employees within CAS/SIMI as well as established laboratory practices. CAS has a policy entitled *CAS Commitment to Excellence in Data Quality*, requiring certain stated standards of conduct and ethical performance among our employees. This policy includes all aspects of data production, analysis, review and reporting and is required to be reviewed and signed upon hire and annually thereafter by every employee, regardless of responsibility.

The success of quality assurance requires a commitment by everyone in the organization, individually within each operating unit and throughout the entire laboratory, to ensure that CAS personnel are free from any commercial, financial, and other undue pressures, which might adversely affect the quality of the work. An ombudsman program is available to handle any conflict of interest, disagreements, and problems within any CAS laboratory as specified in Section 6.4. Additional information regarding professional conduct and laboratory practice is included in the following sections.

6.1 Professional Conduct

To promote quality, CAS/SIMI requires certain standards of conduct and ethical performance among employees. The following examples of documented CAS/SIMI policy are representative of these standards, and are not intended to be limiting or all-inclusive:

- Under no circumstances is the willful act of fraudulent manipulation of analytical data condoned. Such acts are to be reported immediately to senior management for appropriate corrective action.
- Unless specifically required in writing by a client, alteration, deviation or omission of written contractual requirements is not permitted. Such changes must be in writing and approved by senior management.
- Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented, and appropriate remedies and punitive measures will be taken toward those individuals responsible.
- Unauthorized release of confidential information about the company or its clients is taken very seriously and is subject to formal disciplinary action. A corporate *Confidentiality and Conflicts of Interest Employee Agreement* is reviewed and signed upon hire and on an annual basis. Refer to Sections 8.5 and 8.6 for additional information.

6.2 Prevention and Detection of Improper, Unethical or Illegal Actions

It is the intention of CAS/SIMI to proactively prevent and/or detect any improper, unethical or illegal action conducted within the laboratory. This is performed by the implementation of a program designed for not only the detection but also prevention of such acts. Prevention consists of educating all laboratory personnel in their roles and duties as employees, company policies, inappropriate practices, and the corresponding implications as described in Section 6.3 of this document.

In addition to education, appropriate and inappropriate practices are included in SOPs such as manual integration, data review, data integrity, and specific method procedures. Other aspects of this program include electronic data tape audits, post-analysis and whenever possible single blind and/or double blind analyses. All aspects of this program is documented and retained on file according to the company policy on record retention.

6.3 Laboratory Ethics Training Plan

Laboratory ethics training (approximately 8-hours) is held annually for every new CAS employee including all full and part time personnel; however, as part of the new hire process a one hour ethics course is given which incorporates a summary of the topics listed below. This session has been incorporated as interim training to ensure that new employees are aware of the commitment of CAS/SIMI to laboratory ethics. The training session includes at a minimum the following legal and ethical topics:

- Triggers and types of unethical behavior
- CAS Employee Handbook (overview including mechanism for reporting and seeking advice on ethical decisions)
- CAS' Commitment to Excellence in Data Quality (overview including legal consequences)
- Measures taken to prevent and detect fraud
- Examples of data falsification or misrepresentation
- Acceptable and unacceptable solutions to typical laboratory problems
- Data validation
- Implications of laboratory data fraud
- Potential punishments and penalties for improper, unethical or illegal actions

It is the responsibility of the Quality Assurance Program Manager to ensure that the training plan as retained on file and briefly described in this section including content and frequency is conducted. All employees may review the mechanism for reporting and seeking advice on ethical decisions as well as the legal consequences of unethical behavior in the CAS Employee Handbook & CAS Commitment to Excellence in Data Quality Statement, both of which are available to all employees. In addition, the Excellence in Data Quality Statement is reviewed and signed on an annual basis by all laboratory personnel. Also, all employees are required to complete two ethics "refresher" training (approximately 1-hour) sessions annually. The subject and content are generally at the

discretion of the Corporate Quality Assurance Department and are retained on file in the QA Department.

6.4 Laboratory Practices Affecting Personnel

CAS/SIMI makes every attempt to ensure that employees are free from any commercial, financial, or other undue pressures that might affect their quality of work. This is accomplished by utilizing each of the following policies, programs and procedures, wherever necessary. In instances of ethical concern, laboratory management is informed of a need for further detailed investigation to ensure that complete and accurate information is obtained.

- Ombudsman Program – CAS has implemented an external ombudsman/hotline program through EthicsPoint, a phone and internet-based reporting system, to enhance communication and empower employees to promote safety, security, and ethical behavior. Employees can file a report anonymously to address issues in the workplace and to cultivate a positive work environment.
- Open Door Policy – Employees have the right and obligation for open door communications to ask questions, seek guidance, and report incorrect practices and wrong doing without fear of retribution. As described in the CAS Open Door Policy (CAS Employee Handbook), CAS believes in using the chain-of-command channels for this dialogue. However, if there is fear or a concern that using this approach is not appropriate, employees are free to take their concerns to the President, Director of Human Resources, the Chief Quality Officer, use the EthicsPoint program as listed above. Employees may do any of these options without fear of retribution.
- Project Scheduling – Jobs are scheduled (when prior notice is available) according to the *Standard Operating Procedure for Project Management and Business Development* as well as Section 11 of this Quality Assurance Manual. The scheduling is done not only to prevent missed holding times and on-time deliveries but as a way for management and analysts to be prepared for incoming samples and to utilize flexible work schedules, whenever necessary.
- Laboratory Capacity – The maximum number of samples that can be analyzed on a single instrument in a typical eight-hour day (per analysis) has been determined. This number is located in each specific method Standard Operating Procedure and is useful in informing both analysts and management of the number of samples which can typically be analyzed in an eight hour day. This is used to evaluate analysts against unethical practices, impossible work expectations as well as project scheduling.
- Flexible Work Hours – Analysts are able to work flexible work hours (with management approval). Additionally, analysts may "team" with a co-worker (again with approval) and work split shifts in order to extend the work day and increase the number of samples that can be analyzed, whenever necessary.
- Gifts and Favors (CAS Employee Handbook) – To avoid possible conflict of interest implications, employees do not receive unusual gifts or favors to, nor accept such gifts or favors from, persons outside the Company who are, or may be, in any way concerned with the projects on the Company is professionally engaged. Anything beyond an occasional

meal, an evening's entertainment, or a nominal holiday gift is considered an "unusual gift or favor".

6.5 Fraud, Waste and Abuse

6.5.1 Fraud Under no circumstances is the willful act of fraudulent manipulation or falsification of analytical data, or deviations from contractual requirements of the client is condoned. Any attempt by management or by an employee to compromise this commitment presents a case for serious disciplinary action. Actions against an employee violating this policy can ultimately lead to termination of employment.

While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented, and appropriate remedies and punitive measures will be taken toward those individuals responsible. It is the responsibility and right of all employees to report any situation, which may impact the final quality or integrity of data produced for our clients.

6.5.2 Waste Samples are characterized as non-hazardous or hazardous based upon the results of the analyses performed by the laboratory and other information supplied by the customer. This characterization assumes contaminants requested for analyses are the only hazardous substances contained in the sample. Procedures for sample treatment and disposal are written in the SOPs for the treatment of foreign soils and waste disposal.

6.5.3 Abuse CAS recognizes the importance of maintaining a safe work environment. The abuse of alcohol or drugs by employees, either on or off the job, can impair the ability of employees to perform their jobs or may also result in accident and/or other failures which may pose serious risks to employees, co-workers, clients, and the general public. Details of CAS' Substance Abuse Policy can be found in the appropriate section of the Employee Handbook.

6.6 Data Integrity

An integral part of the CAS/SIMI Quality System is the data integrity procedures. These procedures provide assurance that a highly ethical approach to testing is a key component of all laboratory planning, training and method implementation. There are four elements to the laboratory's procedures for data integrity. These include 1) data integrity training (conducted initially and at least annually); 2) signed data integrity documentation for every employee (*CAS Commitment to Excellence in Data Quality* agreement); 3) in-depth periodic monitoring of data integrity (QAPM electronic and hard-copy data audits); 4) data integrity procedure documentation (*Standard Operating Procedure for Ensuring Data Integrity*), which is reviewed and updated at least annually and is signed and dated by senior management and this document, as well as all associated implementation records are available for review.

The training conducted includes discussions regarding all data integrity procedures, in-depth data monitoring and data integrity procedure documentation. There is specific emphasis on the importance of proper written narration on the part of the analyst with respect to those cases where analytical data may be useful, but are in one sense or another partially deficient. A signature attendance sheet of data integrity training including their understanding of their obligations related to data integrity and as specified in the training is generated for each attendee and maintained on file for review.

CAS has a policy entitled *CAS Commitment to Excellence in Data Quality*, requiring certain stated standards of conduct, ethical performance and data integrity among our employees. This policy includes all aspects of data production, analysis, review and reporting and is required to be reviewed and signed upon hire and annually thereafter by every employee, regardless of responsibility. Laboratory procedures and requirements with respect to data integrity are completely defined in the *Standard Operating Procedure for Ensuring Data Integrity*. Refresher data integrity training will be conducted annually as part of ethics training (Section 6.3) or in addition to this training.

The QAPM is responsible for monitoring data integrity through periodic electronic data and hardcopy data audits. Internal systems and data audits are conducted periodically in addition to external agency and client audits. The data audits include a detailed in-depth review of hardcopy data and electronic data to ensure compliance with CAS Quality program (refer to Section 14.0 for additional information).

CAS Quality and Ethics Policy Statement, which is on file and maintained in the laboratory includes a commitment by CAS Corporate senior management to sponsor and support the quality and ethics program.

7.0 LABORATORY FACILITIES AND SECURITY

COLUMBIA ANALYTICAL SERVICES maintains 20,000 square feet of laboratory and office space at 2655 Park Center Drive, Suite A in Simi Valley, California. The space is divided into volatiles and semi-volatiles and general/wet chemistry laboratories, sample preparation laboratory, workshop, canister conditioning laboratory, sample receiving/sample log-in room and sample storage area and administrative areas.

Carrier, make-up, purge and detector gases are supplied to the laboratory instruments via a gas delivery system located in the warehouse portion of the facility. The gas delivery system is comprised of four (4) two-cylinder manifolds, which allow tanks to be changed without interruption to the gas supply. Gas purification devices and indicator tubes are housed in an enclosure located in close proximity to the instruments. In addition, a liquid nitrogen bulk tank is utilized to provide cryogenic cooling to specific instrumentation.

CAS/SIMI maintains a satellite extraction facility located at 8030 Remmet Avenue in Canoga Park, California. The 1300 square foot unit contains three eight-foot fume hoods and a three-ton air conditioning unit. The facility is designed with the expressed purpose of performing semi-volatile organics extraction of air, liquid and solid matrices. The extraction facility is equipped with approximately sixty-five linear feet of bench space, glassware washing equipment and materials, flammable solvent storage, sample/extract storage refrigerators and an electric kiln.

The laboratories are designed and constructed to provide safeguards against cross-contamination of samples and are arranged according to work function, which enhances the efficiency of analytical operations. In addition, the facilities are maintained in such as way as to facilitate correct performance of the environmental tests. Precautions are taken to ensure that the environmental conditions do not bring into question or invalidate the results or adversely affect the required quality of any measurement. Constant and consistent test conditions (both instrumental and environmental) where required by the test method are monitored in accordance with Sections 9.7, 12.1.1 of this document and *Standard Operating Procedures for Handling Consumable Materials* and *Laboratory Storage, Analysis and Tracking.* The segregated laboratory areas are designed for safe and efficient handling of a variety of sample types. Specialized areas and/or segregated laboratories include:

- Sample Management Office; Shipping and Receiving
- Records Archival
- Volatile Organics Laboratory (GC and GC/MS)
- Semi-Volatiles Laboratory (GC, GC/MS and HPLC)
- Ultra Low Level Volatile Organics GC/MS
- General/Wet Chemistry Laboratory
- Sample Preparation Laboratory
- Canister Conditioning and Maintenance
- Flow Controller and Critical Orifice Calibration Station

- Controlled-access (when necessary) Sample Storage Walk-in Refrigerator
- Sample, Standards and Media Storage
- Laboratory Deionized Water System
- Laboratory Management, Client Service, Report Generation and Administration
- Information Technology (IT)
- Waste Disposal

Within the designated areas for sample receiving and storage, there are refrigerated and non-refrigerated sample storage, dedicated sample container preparation, and shipping area, provided for the efficient and safe handling of samples. Figures 7-1 and 7-2 show the facility layouts of our analytical and extraction/preparation laboratories respectively.

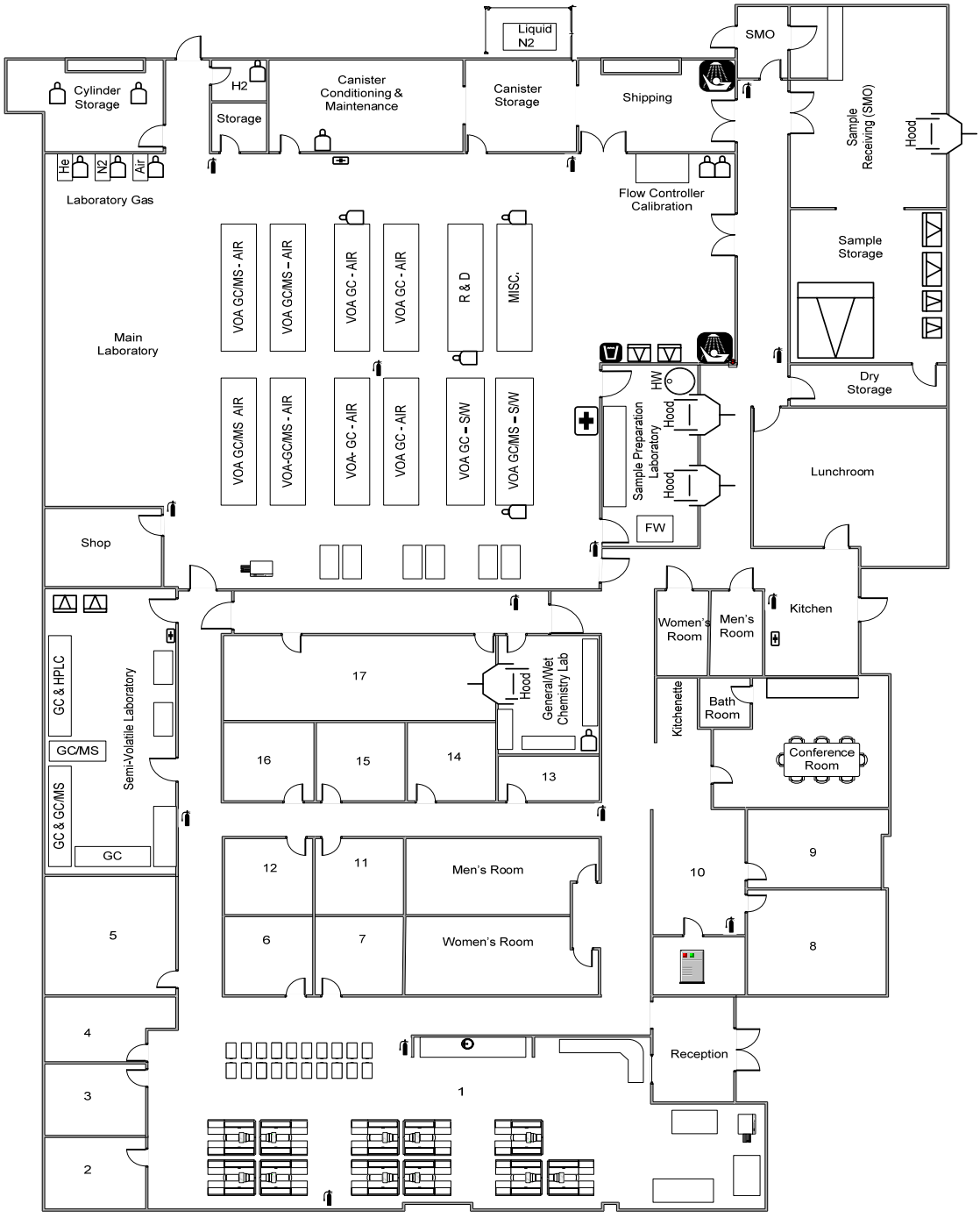
The laboratory is equipped with state-of-the-art analytical and administrative support equipment. Appendix B lists the major equipment at the analytical and extraction/preparation laboratories, illustrating the laboratory's depth and overall capabilities.

7.1 Facilities Security

Laboratory security utilizes physical and administrative controls to protect data (electronic and hardcopy), samples, digestates, and extracts from unauthorized or unnecessary access or intentional modification. Physical entry to the laboratory is limited to authorized personnel only. All visitors must sign-in at the front desk and the sample storage area is limited to authorized CAS personnel only. No visitors are allowed beyond the entry area of the building without being accompanied by a CAS employee. The laboratory is secured every night by locked gates, doors, windows, and electronic alarms.

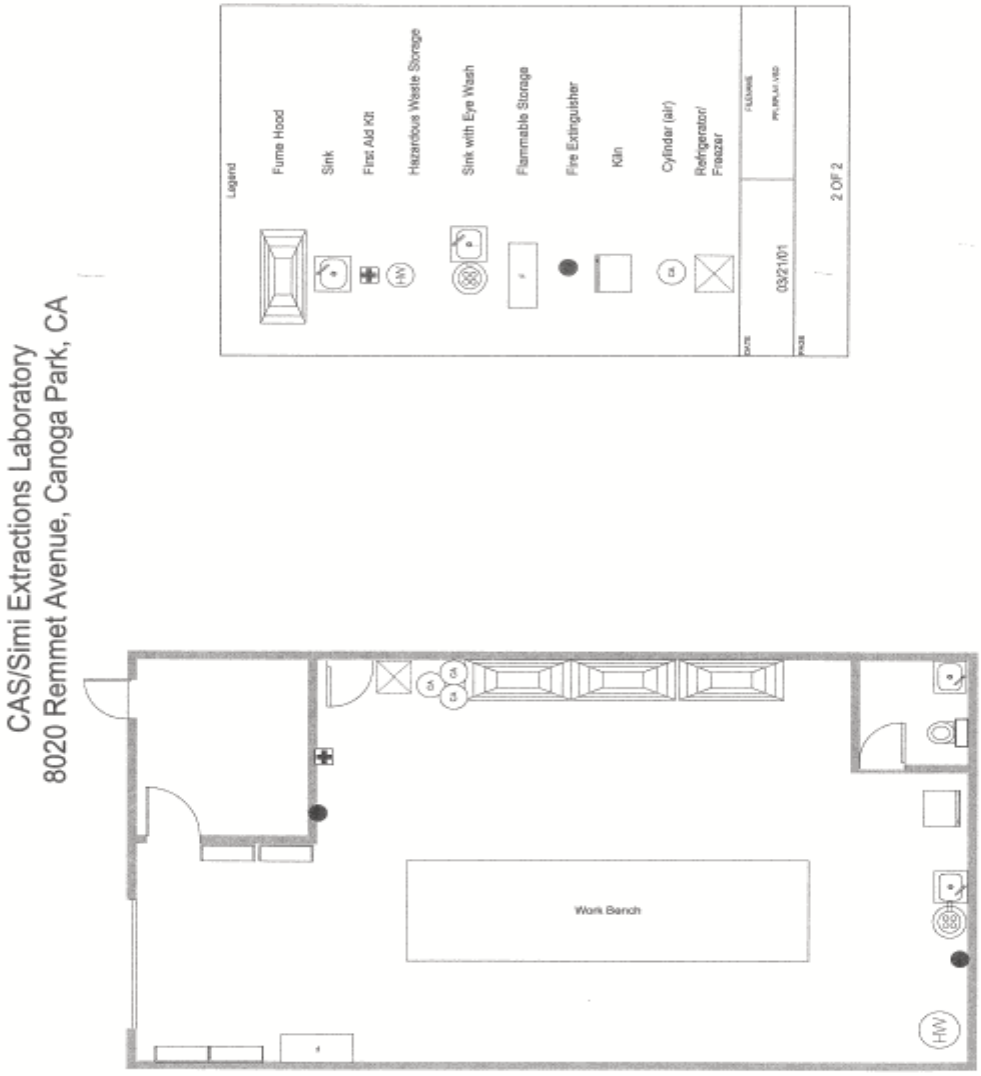
CAS/SIMI is a secure facility with laboratory access limited and controlled to protect the integrity of in-house samples. All entrances, with the exception of the front door, shall remain locked and secure during business hours. Also, the receptionist must monitor the front entrance for all incoming persons.

Figure 7-1



CAS SIMI VALLEY FLOOR PLAN		
2655 Park Center Drive, Suite A, Simi Valley, California 93065		
Rooms 1-17 -Administrative Offices	**-First Aid**	**HW -Hazardous Waste Cabinet**
-Network Server Room	**-Emergency Shower**	**FW -Flammable Waste Cabinet**
-Fire Extinguisher	**-Gas Cylinder(s)**	
-Refrigerator/Freezer	**-Deionized Water**	

Figure 7-2


CAS/Simi Extractions Laboratory
8020 Remmet Avenue, Canoga Park, CA
Legend
Fume Hood
Sink
First Aid Kit
Hazardous Waste Storage
Sink with Eye Wash
Flammable Storage
Fire Extinguisher
Kiln
Cylinder (air)
Refrigerator/ Freezer
03/21/01
2 OF 2
Work Bench
HW

8.0 DOCUMENT AND RECORD CONTROL, STORAGE AND SECURITY

This section outlines and/or references procedures for the proper control, storage and security of all documents and records which include both hardcopy and electronic versions. In addition, procedures required for protecting the electronic storage and transmission of results, and clients' confidential and proprietary rights are detailed.

8.1 Documentation

The laboratory maintains a document and records system that ensures all laboratory documents and records relevant to the work of the laboratory are retained and are made readily available to personnel, where applicable. These include quality assurance manuals, standard operating procedures, forms, result and reporting templates, software and any external source documents such as reference methods, equipment manuals, raw data, reports, supporting records, instructions, and reference data are. All equipment manuals regarding the use and operation of all relevant equipment are maintained and are readily available to personnel regardless of discipline.

The necessary certifications and approvals administered by external agencies (refer to Attachment E), as well as, all records required to document the existence of and compliance with CAS/SIMI policies and procedures including both internal and external audit reports and managerial reviews are maintained.

Procedures for the control and maintenance of documents that form part and are required to maintain an effective quality system are described in *Standard Operating Procedure for Document Control* and includes distribution, tracking and filing procedures. The requirements of the SOP apply to all logbooks, standard operating procedures, quality assurance manuals, and other controlled CAS documents including forms and reference tables. All records and documents reference the date or dates for which the document and/or record was in force, where applicable.

In addition, a master list of all documents (manuals, forms, procedures, etc.) is maintained and includes information (dependent on type of document) such as title, revision and location. Each list is revised in order to ensure that the most recent authorized document is retained and is being utilized. Authorized editions of appropriate documents are available at all locations where operations essential to the effective functioning of the laboratory are performed. In addition, this manual and all standard operating procedures are reviewed at least annually and, where necessary, revised to ensure continuing suitability and compliance with applicable requirements. Changes may be made to SOPs prior to revision and distribution as long as the changes are noted on all copies including the original and are approved (initialed and dated) by at least two signatories including the QAPM for local documents and the QAPM and Laboratory Manager for corporate QA issued documents.

8.2 Documentation and Data Storage

All related quality documentation such as the quality manual, standard operating procedures, temperature, and balance records, maintenance logs, etc. are controlled and retained by the laboratory for 5-10 years depending upon the program (refer to the *Standard Operating Procedure for Document Control).* Analysis data is retained for 5 years from the report date unless contractual terms specify a longer retention time and include the final reports/data packages sent to the client, chain-of-custody records and associated sample receipt documentation logs, extraction logs, standard and reagent preparation logs, analytical logs, data system printouts, corrective action reports, data review documentation, and instrument maintenance logs. Hard copies are filed in the most logical manner usually be document type and date or job number. Hard copies of all other documents, which are batch-specific (i.e. QC data), are indexed by dates, instrument and/or method. All physical records are stored onsite for at least one year, after which they are moved and stored offsite for the remainder of the storage period. Once archived, an access log is used to document access.

8.3 Records Maintenance (Security, Storage, Archival, Access, and Retention)

This section describes both specific and general procedures for the identification, collection, indexing, access, filing, storage, maintenance, retention, archival and disposal of quality and technical records. A record is any documentary material, regardless of physical form or characteristics created or received by the laboratory in connection with conducting business such as procedural evidence, observations and notations.

Records are collected, maintained, stored and archived in a logical retrievable manner. Records, excluding electronic records (described later in this section) and quality records are maintained in a manner whereby access is limited to laboratory personnel. This system includes (but is dependent upon the type of record) type, date, job number or other unique identifying manner. For example, individual sets of analyses are identified and stored by analysis date and/or analytical method identification. Service request files (client job files) are filed by service request number (job number) and additional/supporting records are all retained in (or referenced) the associated client job file. Reference to additional information is also included such as the date and the instrument on which the samples were analyzed, the standard(s) identifications, etc and from this information supporting records may be obtained for review.

Quality records include reports from all audits, management reviews, records of corrective actions, complaints, preventive actions and other records collected and/or maintained by the Quality Assurance Program Manager including those associated with the laboratory quality system and other documents required under laboratory accreditation programs. These documents and records are maintained on file in the Quality Assurance Department, where access is controlled by the Quality Assurance Program Manager. Training records are stored by person, type of training and date; whereas audits consist of type of audit (internal or external), auditing body (where applicable), year and unique audit identification (date). Both complaints and

nonconformities are maintained and archived separately and by a unique identification number, which includes the date of occurrence and a sequential number for that date.

All records, both hardcopy and electronic, are held by the laboratory for a minimum of five years or as specified by the client after the date of analysis. However, the laboratory shall retain records of analyses for ten years if the client specifically identifies the job as being performed because of epidemiological or public health concerns. Jobs/projects requiring an archival of greater than five years (per the client's written request) are pulled and properly stored and identified for the appropriate duration. All records that have met the minimum retention duration are destroyed or erased, whichever is applicable. This is executed in such a manner as to conserve all applicable requirements of confidentiality.

Any revisions or changes to original data as well as the original data must be retained in the same file and appropriately marked with the reason and where appropriate initials and date of the person responsible. Records are kept in a secure location where they can be retrieved when necessary. Access to all hardcopy files is documented with an access card that includes the initials of the person retrieving the file, date out and date in as well as the initials upon return of the file.

For archival purposes, job files, along with other records such as obsolete SOPs, training records, method detection limit studies, and logbooks are placed in uniquely identified file boxes. For example, job file boxes are identified by the year in which the job was completed as well as a sequential number for each box (for that year).

A master logbook is maintained which identifies the box number and the contents of each box. A notation is made in the log once a box is moved to the remote sample preparation laboratory for continuing storage and when the files in the file box are destroyed (by shredding). Prior to destroying any year of job files, client/project archival requests are reviewed and those client jobs in which the required archival duration exceeds five years are filed, appropriately labeled and stored. Additionally, other related boxes, such as those specific to quality assurance are destroyed upon approval by the Quality Assurance Program Manager (at no less than five years). When retrieval of any physical record is needed, a storage and retrieval (access) log is completed and kept in each drawer or file box.

8.4 Tape Backup, Archival and Restoration

The plan for backup, archival and restoration of electronic data is written in the *Standard Operating Procedure for Electronic Data Tape Backup, Archiving & Restoration.* This document covers the steps necessary to perform the tape backup of local area networks and the archiving of these backup tapes, to solve common problems, and to ensure a minimal loss of data in case of a disaster, as well as the procedure necessary for restoration of such data.

Persons requesting access to electronic data is detailed with the use of a logbook and is maintained by the person responsible for Information Technology. Electronic data files which have been revised are given a unique file number or directory and both files are retained as detailed in this section. All electronic records are saved using a tape backup system administered by the local information technology supervisor, with adequate redundancy to allow for possible media failure. The laboratory maintains computer systems that allow archived records and the access to such records to be controlled for the duration of the retention period. Refer to the *Standard Operating Procedure for Electronic Data Tape Backup, Archiving & Restoration* for additional information.

8.5 Maintenance of Client Confidentiality and Proprietary Rights

It is the responsibility of all CAS/SIMI employees to safeguard sensitive company and client information (including national security). The nature of our business, the economic well-being of our company and of our clients is dependent upon protecting and maintaining proprietary company/client information. All information, data, and reports (except that in the public domain) collected or assembled on behalf of a client is treated as confidential. No information may be given to third parties without the written consent of the client. As a condition of employment, all employees are required to sign and adhere to *Confidentiality and Conflicts of Interest Employee Agreement* set forth in the Corporate "Employee Agreement" at date of hire.

8.6 Transmission of Test Results and Reports

Transmission of test results by telephone, facsimile, telex, or other electronic or electromagnetic means must follow the procedures detailed in this document to ensure that the client's confidentiality is preserved as best as possible. Refer to the *SOP for Data Integrity* for additional information on the transmission of results.

Telephone – The laboratory may not give results or discuss any results to any persons other than the client. However, the client may request, in writing to have results released to another individual or company. This request must be specific with regards to information, to whom the information is to be released and must be on the Client's letterhead or email.

Facsimile – Results may be faxed (as confidential) to the number supplied to the laboratory by the client. If the results are to be released to another individual or company the same procedure as specified above must be followed. Results may only be faxed following review by the laboratory and Data Validation.

Electronic – Results may be sent electronically (as confidential) to the address supplied by the client. However, results requested by other parties may not be sent without prior written consent of the client. Results may only be transmitted following review by the laboratory and Data Validation.

A copy of the report may not be released or the results discussed with another party without the prior written consent of the client, no verbal requests will be accepted. Another party may not request the release of report/results. The laboratory must convey the fact that all reports generated are confidential and results may only be released at the request of the client and they must be in writing on the Client's letterhead to be considered acceptable and in compliance with laboratory policy. A client may request to have results released on an on-going basis by the submittal of a single consent letter stating the details of the release.

8.7 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, laboratory records shall be maintained for a minimum of five years or for the contracted period (if exceeds five years) or transferred according to the clients' instructions. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records shall be followed.

9.0 SAMPLE HANDLING PROCEDURES

Standard operating procedures have been established for all aspects of sample management within the laboratory including sample receiving, acceptance, log-in, storage, shipping, and disposal. These procedures ensure that samples are handled properly and that all associated documentation is complete and consistent. The sample handling factors that must be taken into account to ensure accurate, defensible analytical results include but are not limited to:

- Amount of sample taken (sampling)
- Type of container used
- Existence and type of sample preservation
- Holding time
- Proper custodial documentation
- Sample storage, tracking and/or transfer
- Disposal

A record of all procedures to which a sample is subjected while in the possession of the laboratory including acceptance, rejection, login, identification, preservation checks, storage, tracking, and disposal are documented and maintained. In addition, all indirect procedures which supports each record of a sample and protects the integrity of a sample is documented and maintained (i.e., refrigerator and freezer temperature checks, thermometer calibrations, etc.).

9.1 Sampling

The quality of analytical results is highly dependent upon the quality of the procedures used to collect, preserve and store samples. CAS/SIMI provides localized and limited sampling services. The laboratory only provides sampling for aqueous samples; therefore, CAS/SIMI recommends that clients follow sampling guidelines described in the specific reference methods including 40 CFR 136 and/or USEPA SW-846, NIOSH, OSHA, ASTM, CARB and SCAQMD as appropriate for other matrices.

Samplers follow the procedures, preservation, transport and sampling and custody documentation requirements stated in the most recent version of the laboratory *SOP for Sampling*. This SOP along with client provided sampling plans and the EPA Handbook for Sampling and Sample Preservation of Water and Wastewater provide the procedures necessary to perform the sampling activities currently being provided. In addition, all sampling activities are clearly detailed in the final report and the applicable chain of custody and sampling documents included.

Since a number of tests performed are for compliance to federally promulgated rules and regulations, it is important to consult and obtain approval and requirements for sampling and analytical guidelines from the client, appropriate state or local regulatory agency prior to

sampling. When transporting samples to the laboratory, the most expedient but lawful route of transport should be utilized. Also, the hazardous potential of the samples needs to be considered when shipping samples via air freight or passenger airlines.

9.2 Preservation

CAS/SIMI uses sample preservation, container, and holding time recommendations published in a number of referenced documents including, but not limited to USEPA SW-846, USEPA 600/4-79-020, USEPA-600/R-94-111 (metals), USEPA 600/r-93-100 (inorganic substances), 600/4-91-010, and EPA/625/R-96/010b (air samples) and the US EPA Methods Update Rule effective 4/11/07. The complete citation for each of these and other references can be found in Section 18.0 of this document. The appropriate container, preservation and holding time information are summarized in Tables 9-1 and 9-2. However, additional information on this matter is addressed in each corresponding method SOP and the specific references are included in Section 18.0.

9.3 Shipping of Container and Samples

CAS/SIMI routinely provides sample containers to clients via media requests for all matrices (soil, water, air) with the appropriate preservatives (where necessary). These containers include 40mL vials, Summa canisters, silica-gel tubes, etc (Refer to Tables 9-1 and 9-2). CAS/SIMI keeps client-specific shipping requirements on file and utilizes all major transportation carriers to guarantee that sample shipping requirements (same-day, overnight, etc.) are met. CAS/SIMI also provides its own courier service that makes scheduled courier runs in the greater Los Angeles metropolitan area. The procedures for all requirements directed toward media requests follow the requirements detailed in the *Standard Operating Procedure for Media Request Fulfillment*.

9.3.1 Soil and Water Samples The containers are purchased as "precleaned", and conform to the requirements for analytical samples as established by the USEPA. Certificates of analysis for the sampling containers are available to clients upon request, where available. The soil and/or water sample kits typically consist of foam-lined, precleaned shipping coolers, (decontaminated inside and out with appropriate cleaner, rinsed thoroughly and air-dried), specially prepared and labeled sample containers individually wrapped in bubble wrap, (VOC vials are placed in a specially made, foam rubber holder), chain-of-custody (COC) forms, and custody seals (when required).

Figure 9-1 is a copy of the chain-of-custody form (soil and water) used at CAS/SIMI. For extremely large sample container shipments, the containers may be shipped in their original boxes. Such shipments will consist of several boxes of labeled sample containers and sufficient materials (bubble wrap, COC forms, custody seals, shipping coolers, etc.) to allow the sampling personnel to process the sample containers and return them to CAS/SIMI. The proper preservative will always be added to the sample containers prior to shipment, unless otherwise instructed by the client. If any returning shipping cooler

exhibits an odor or other abnormality after receipt and subsequent decontamination by laboratory personnel, a second, more vigorous decontamination process is employed. Containers exhibiting an odor or abnormality after the second decontamination process are promptly and properly discarded.

9.3.2 Air Samples Figure 9-2 is a copy of the chain-of-custody form for air samples used at CAS/SIMI. Certificates of Analysis are retained (where available) for purchased media. Each canister is permanently labeled with a unique identifier, which is used to tract canister shipments to and from the field.

9.4 Sample Receiving and Acceptance

It is the policy of CAS/SIMI to check and record the condition of each sample (i.e. temperature, preservation, etc.) delivered to the Sample Management Office (SMO) and received by the Sample Management Custodian or alternates against certain acceptance criteria as documented in the *Standard Operating Procedure for Sample Receiving, Acceptance and Log-In*. This policy is available to all sample management personnel for reference. Any samples, which deviate from these outlined areas, will be clearly flagged with the nature and substance of the deviation. The following are the assessments and conditions checks utilized by CAS/SIMI for the acceptance or rejection of samples. This verification of sample integrity is conducted by the Sample Custodian and may be dependent on the matrix (i.e., temperature, preservation, and headspace) being submitted and includes the following activities; Tables 9-1 and 9-2 or if applicable, the specific Quality Assurance Project Plan (QAPP) is available for a complete and accurate assessment:

- Assessment of custody seal presence/absence, location and signature
- Adherence to specified holding times
- Appropriate containers (size, type) are received for the requested analyses
- Proper temperature of sample, if applicable
- VOA vials (liquids) are inspected for the presence/absence of headspace (bubbles).
- Adequate sample volume
- Assessment of proper sample preservation, where applicable. SMO personnel perform no assessment of proper preservation in order to preserve the integrity of the sample prior to analysis.
- Sample containers checked for integrity (broken, leaking, Tedlar® bags are received flat, under inflated or with the valve open, Summa canisters are received under substantial vacuum or with the valve open, etc.)
- Sample submission documents are properly used, fully completed (in indelible ink) and shall include the client, sample identification, project name or location, date and time of collection, collector's name, sample type, preservation type (if applicable), required

analyses, relinquishing signature and data, was well as any special remarks concerning the sample.

- Samples are clearly marked with unique client sample identification (ID), durable labels (labels that are not easily removed) and the use of indelible ink, and preservation notation (where applicable).
- Sample container labels and/or tags agree with the sample documentation entries (i.e., canister & client IDs; preservation; required analyses, etc.).

Any abnormalities or discrepancies observed during the initial assessment including signs of damage are documented and are addressed by informing the appropriate Project Manager (PM). The Project Manager is to notify the client regarding specific integrity issues documented during sample receipt. The PM must document any decision made by the client with regards to proceeding with the requested analyses, where possible or cancellation. However, there may be a need to inform the client that a sample(s) is rejected and cannot be accepted for analysis into the laboratory. This situation includes, but is not limited to loss of sample or insufficient volume. The procedures for sample documentation, handling acceptance requirements and deviations from the sample acceptance policy are discussed in detail in the *Standard Operating Procedure for Sample Receiving, Acceptance and Log-in.* This procedure is also in place to ensure samples are received and properly logged into the laboratory, and that all associated sample documentation, including COCs (if utilized), is complete and consistent with the samples received. All associated documentation, including chain of custody forms, memos, transmittal forms, and phone logs, are kept with each project file.

9.5 Sample Log-in

Since the laboratory is in the process of implementing a Laboratory Information Management System (LIMS), each sample will temporarily be logged into the laboratory utilizing duel systems. The sample login is conducted on both systems in such a way as to ensure traceability and cross-reference with regards to the unique laboratory job number, sample identifications and client sample identifications. Additional information is provided in the *Standard Operating Procedure for Sample Receiving, Acceptance and Log-in.*

9.5.1 Service Request (SR) Status Each sample is given a computer generated unique laboratory code when sample log-in is completed. This code is given based upon the order of sample log-in. The service request contains the laboratory code, client information, client sample descriptions/identification, sample matrix information, requested analyses, sample collection dates, and analysis due dates as well as other useful information.

A laboratory code label is generated and affixed to the sample, where possible. Certain sample containers, such as solid adsorbent cartridges, are placed in a sealed bag identified with the service request number and all laboratory codes (samples) associated with that

particular service request number. If replicate samples are submitted, the following procedure is used to differentiate between the separate containers of the submitted field sample:

e.g. Original Sample ..... Laboratory Code P2701952-001
Replicate One..... Laboratory Code P2701952-001B
Replicate Two..... Laboratory Code P2701952-001C

P CAS/SIMI Laboratory Network Identifier
27 Year 2007
01952 Job Number (1952nd job logged in Year 2007)
01 1st sample logged in for specified job

Note: LIMS allows for samples to be logged in the same manner except the year code is 07 instead of 27 and replicate samples are designated with ".01", ".02" ".03", etc.

Each group of received samples is sequentially assigned a Service Request (SR) number and using this service request number, a laboratory sample ID code is generated uniquely for each sample and its containers. Once the login procedure has been completed a SR summary is generated for each project. The appropriate Project Manager reviews this login information for accuracy, completeness, and consistency with the requests for the client's project. Once the login has been approved, the sample analyses information is distributed to the appropriate laboratory personnel.

9.5.2 LIMS Information pertaining to the samples is entered into the Laboratory Information Management System (LIMS) and a unique laboratory code is for the job is generated. Each sample is assigned a unique laboratory code and a Chain-of-Custody Summary and a Service Request Summary are generated for each project folder. These summaries contain client information, sample descriptions, sample matrix information, required analyses, sample collection dates, analysis due dates and other pertinent information. The appropriate Project Manager reviews the login information for accuracy, completeness, and consistency with the requests for the client's project. Once the login has been approved, the sample analyses information will appear in the analysts' responsibility List. The analysts use the information from this list to schedule their work.

9.6 Custody of Samples

9.6.1 External Chain-of-Custody (COC)

CAS/SIMI uses two Chain-of-Custody forms, one for air matrices and the other for soil and water matrices (Figures 9-1 or 9-2) (or clients may submit samples using a similar form) to document the handling of the samples by all individuals from sample collection to sample receipt by the laboratory. When packages are sent by outside couriers, receipts are retained as part of the permanent chain-of-custody documentation. The original Chain of Custody (COC) forms are retained and kept with the job file. In some cases, the client requests that the original custody form be submitted with the final report.

Chain-of-Custody records are used to establish the legal custody of samples, showing the continuous possession of samples from sample collection and transportation to final destination at the laboratory. Custody of each sample is maintained from receipt through disposal. When environmental samples are shipped by CAS/SIMI to other laboratories for analysis, the sample management office (SMO) follows formalized procedures for maintaining the chain of custody, which is written in *Standard Operating Procedure for Chain of Custody for Sample Transfer between Laboratories.*

9.6.2 Legal Chain-of-Custody

Legal (internal) Chain of Custody protocols are followed at the request of clients. For the purposes of litigation, it is necessary to have an accurate written record to trace the possession and handling of samples from collection through reporting. The procedures defined here represent a means to satisfy this requirement.

A sample is in someone's "custody" if:

1. It is in one's actual physical possession;
2. It is in one's view, after being in one's physical possession;
3. It is one's physical possession and then locked up so that no one can tamper with it;
4. It is kept in a secured are, restricted to authorized personnel only.

The laboratory is considered a secured area, restricted to authorized personnel only (CAS/Simi Valley employees).

Sample control procedures are necessary in the laboratory from the time of sample receipt to the time the sample is discarded. The following procedures are followed in this laboratory.

1. The samples are received by the sample custodian or alternate (designated to act as custodian in the custodian's absence). The custodian indicates receipt of samples by signing the accompanying custody/control forms and the signed forms are retained as permanent records.
2. The custodian must maintain a record for each sample of the person delivering the sample, the person receiving the sample, date and time received, source of sample, date the sample was taken, sample identification number, how transmitted to the laboratory, and condition received (sealed, unsealed, broken container , or other pertinent remarks). This is accomplished during the sample log-in procedure, which is performed in accordance with the *SOP for Sample Receiving, Acceptance and Log-In* (by the generation of the Service Request form and Sample Acceptance Check form, refer to Sections 9.0 through 9.5 for additional information). Also, an internal chain of custody form (as included in the *SOP for Sample Receiving, Acceptance and Log-In*) is generated at the time of sample login to show the movement of each sample within the laboratory. This internal chain of custody is utilized to document

all sample custody transfers through the secure laboratory (initial receipt through final disposal).

3. The custodian ensures that all heat-sensitive samples, light-sensitive samples, or other sample materials having unusual physical characteristics, or requiring special handling, are properly stored and maintained prior to analysis.
4. Laboratory personnel are responsible for the care and custody of the sample once it is received by them and must be prepared to testify that the sample was in their possession and view or secured in the laboratory at all times from the moment it was received from the custodian or other laboratory personnel relinquishing custody until the time that the applicable procedure(s) are completed; i.e., canister pressurization and/or analyses.
5. Once the sample analyses are completed the unused portion of the sample, together with all identifying labels, must be returned to the custodian (for soil and water samples) or sample disposal personnel (for canister samples). The returned tagged sample must be stored in the secured laboratory in the proper storage area until permission to destroy the sample is received. All labels are kept intact until which time the sample is properly disposed.
6. Samples will be destroyed only upon the order of the responsible laboratory official (Data Validation Coordinator for air samples and Project Manager for soil and water samples), when it is certain that the information is no longer required, as specified by the client or the when the samples have deteriorated. Sample tags for canisters are retained in the job file and maintained for a period of no less than five years.

When samples are removed from the fixed lab and transported to the off-site extraction facility for sample preparation, internal chain of custody procedures still apply. Relinquishing and receiving signatures, date and time of transfer and reason for the transfer (i.e., sample extraction) are required from the custodian and extraction technician to document transfer of the samples. When sample preparation is completed, sample extracts are returned to the laboratory and the extraction technician and the analyst will sign and date the internal chain of custody and give reason for the transfer to document and complete the custody transfer of the extract(s).

9.7 Sample Storage, Analysis and Tracking

The procedures and requirements for documenting the storage, analysis and tracking as well as maintaining integrity of samples are detailed in the *SOP for Laboratory Storage, Analysis and Tracking.*

9.7.1 Sample Storage Documented procedures are in place, which detail the laboratory facilities and methods used to avoid deterioration, contamination, or damage to the sample during storage, handling, preparation, and testing. Samples shall be stored away from all standards, reagents, food and other potentially contaminating sources. Also, samples are stored in such a manner as to prevent cross contamination.

To prevent a preservation error the refrigerators and freezers are labeled and segregated according to matrix type and in some cases method of analysis. CAS/SIMI has one walk-in refrigerator, which houses the majority of soil and water samples received at the laboratory. Any specialized storage requirements including those for encore and sediment samples are maintained. The temperature of each thermal storage unit used at CAS/SIMI is monitored daily (business days), using a NIST traceable calibrated thermometer, and the data is recorded in a bound logbook. However, a number of laboratory thermometers include a temperature range and for certain projects, the temperature compliance must be monitored every day of the week, which may be done so by recording the range following weekends and holidays.

9.7.2 Sample Analysis and Tracking A unique laboratory sample ID code is assigned to each sample upon sample login. Each sample is referred to by this unique laboratory sample ID code on all laboratory documents (e.g., run log, analysis benchsheets, and report). When a sample has more than one container, each container is further identified by a numerical suffix at the end of the laboratory sample ID code and the same documentation requirements apply. All extracts and digestates are traceable to the parent sample(s) by identifying them with the same unique identifier.

All pertinent information generated during sample analysis is maintained for each instrument (where applicable) and test method. Hard copies of data are initialed and dated by the analyst performing the test. The sequence log shows each analytical sequence in chronological order. For each sequence, the standards, field samples, and quality control samples are noted in the order analyzed. Results of manual analytical measurements are also recorded. All notebooks, instrument printouts, and benchsheets showing sample identification are also made part of the laboratory records.

9.8 Sample Retention and Waste Disposal

Upon completion of all analyses, the laboratory samples are retained in accordance with the requirements specified in the method SOPs and the *Standard Operating Procedures for Waste Disposal* and *Foreign Soils Handling and Treatment*. The samples are either returned to the client or disposed of according to approved disposal practices. All samples are characterized according to hazardous/non-hazardous waste criteria and are segregated accordingly. This evaluation is generally based on results from analyses performed on the sample by CAS/SIMI or a subcontracted laboratory. It should be noted that all wastes produced at the laboratory, including the laboratory's own various hazardous waste streams, are treated in accordance with all applicable local, State and Federal laws. Complete documentation is maintained for samples from initial receipt through final disposal. This ensures an accurate record of the samples from "cradle to grave."

9.9 Transfer of Samples

When environmental samples (usually soil and water only) are shipped by CAS/SIMI to other laboratories for analyses (e.g., for dioxin or radiological analysis, etc.), they are properly packed for shipment and preserved in accordance with Table 9-1 and 9-2 and the *Standard Operating Procedure for Solid Sample Preparation.* Unless otherwise specified by the client or receiving laboratory, each sample bottle is wrapped in bubble wrap and placed in a plastic bag, preferably Ziploc® to avoid any possible cross-contamination of samples during the transportation process. Blue or wet ice is used for temperature preservative, where necessary. The sample management office (SMO) follows formalized procedures for maintaining the chain of custody of the sample(s) (*Standard Operating Procedure for Chain of Custody for Sample Transfer between Laboratories).*

9.10 Subcontracting

Analytical services are subcontracted when CAS/SIMI needs to balance workload and/or CAS/SIMI does not perform the requested analyses. Subcontracting is done only with the approval and full knowledge of the client and review and approval by the Quality Assurance Program Manager. Subcontracting to another CAS laboratory is preferred over other laboratories. Where possible, work is placed with a laboratory accredited under NELAP for the tests to be performed or with a laboratory that meets applicable statutory and regulatory requirements for performing the tests and submitting the results of the tests performed. In addition, the subcontract laboratory must be capable of meeting the Data Quality Objectives (DQOs) of the project. Prior to shipment, a chain of custody is completed which includes all pertinent information such as laboratory sample identification, required method(s)/analytes of analysis, preservation, comments, etc.

When data are returned from the subcontract laboratory, the Project Manager reviews the data to ensure quality control requirements are met and the report is included with the in-house report. All subcontract work is clearly identified in the final report generated by CAS/SIMI. The laboratory maintains a register of all approved subcontractors and their corresponding methods/analytes for analysis. Established procedures are followed to qualify external subcontract laboratories and are found in *SOP for Qualification of Subcontract Laboratories Outside of CAS Network.*

Table 9-1
Soil and Water Sample Preservation and Holding Times[a]

Determination	Method	Matrix[b]	Container[c]	Preservation	Holding Time
Bromide	300.0	W	P,FP,G	None required	28 days
	9056			Cool, 4°C	ASAP
	9056	S	G	Cool, 4°C	ASAP
Chloride	300.0	W	P,FP,G	None required	28 days
	9056	W/S			ASAP
Color	110.2	W	P,FP,G	Cool, ≤6°C	48 hours
Color	SM 2120B	W	P,FP,G	Cool, ≤6°C	48 hours
Specific Conductance	120.1	W	P,FP,G	Cool, ≤6°C	If not completed w/in 24hours filter thru 0.45 micron
Specific Conductance	SM 2510B	W	P,FP,G	Cool, ≤6°C	28 days
Specific Conductance	9050A	W	P,FP,G	Cool, ≤6°C	28 days
Fluoride	300.0	W	P	None required	28 days
	9056	W/S		Cool, 4°C	ASAP
Hydrogen Ion (pH)	SM4500-H+ B	W	P,FP,G	None required	Analyze within 15 mins.
	150.1				In field or ASAP
	9040B/ 9040C				ASAP
	9045C/9045D	S			ASAP
Nitrate	300.0	W	P,FP,G	Cool, ≤6°C	48 hours
	9056	W/S		Cool, 4°C	ASAP
Nitrite	300.0/SM 4500-NO2-B/354.1	W	P,FP,G	Cool, ≤6°C	48 hours
	9056	W/S		Cool, 4°C	ASAP
Orthophosphate	300.0	W	P,G	Cool, ≤6°C	48 hours
	9056	S		Cool, 4°C	ASAP
Residue, Total	160.3	W	P,FP,G	Cool, 4°C	7 days
Residue, Total	SM 2540B	W/S	P,FP,G	Cool, ≤6°C	7 days
Residue, Total	SM 2540G	S	G	Cool, ≤6°C	7 days
Residue, Nonfilterable (TSS)	160.2	W	P,FP,G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS)	SM 2540 D	W	P,FP,G	Cool, ≤6°C	7 days
Residue, Settleable	160.5	W	P,FP,G	Cool, 4°C	48 hours
Residue, Settleable	SM 2540 F	W	P,FP,G	Cool, ≤6°C	48 hours
Sulfate	300.0	W	P,FP,G	Cool, ≤6°C	28 days
Temperature	170.1	W	P,FP,G	None Required	Field
Temperature	SM 2550 B	W	P,FP,G	None Required	Field
Turbidity	180.1	W	P,FP,G	Cool, ≤6°C	48 hours
Turbidity	SM 2130B	W	P,FP,G	Cool, ≤6°C	48 hours

Table 9-1
Soil and Water Sample Preservation and Holding Times[a]

Determination	Method	Matrix[b]	Container[c]	Preservation	Holding Time
Chromium VI	218.6/SM 3500-Cr D	W	P,FP,G	Cool, ≤6°C or Cool, ≤6°C, Ammonium Sulfate Buffer to pH = 9.3-9.7	24 hours 28 days
	7196A/7199			Cool, 4°C	24 hours
	3060A/7196A/ 3060A/7199	S	P,G	Cool, 4 ± 2°C	30 days to digest; 7 days after digestion
Petroleum Hydrocarbons, Volatile (Gasoline-Range Organics)	5030B/8015B	W	G, Teflon-Lined Septum Cap	Cool, 4°C, No Headspace Cool, 4°C, HCl to pH<2; No Headspace	7 days 14 days
	5035/8015B	S	Encore Unit or Pre-weighed VOAs	Cool, 4°C Freeze MeOH or NaHSO4	NP – 48 hours 7 days 14 days
Petroleum Hydrocarbons, Volatile (Gasoline-Range Organics) – AZ samples	5030C/8015D	W	G, Teflon-Lined Septum Cap	Cool, 4°C, No Headspace Cool, 4°C, HCl to pH<2; No Headspace	7 days 14 days
	5035A/8015D	S	Encore Unit or Pre-weighed VOAs	Cool, 4°C Freeze MeOH or NaHSO4	NP – 48 hours 14 days 14 days
Volatile Organics / Purgeable - Halocarbons & Aromatic Hydrocarbons	5030B/8260B & 624	W	G, Teflon-Lined Septum Cap	Cool, 4°C, No Headspace No Residual Chlorine Present: HCl to pH<2, Cool, 4°C, No Headspace Residual Chlorine Present[g]: 10% Na2S2O3, HCl to pH<2, Cool, 4°C, No Headspace	7 days 14 days 14 days
	5035/8260B	S	Encore Unit or Pre-weighed VOAs	Cool, 4°C,	NP – 48 hours; Freeze – 7 days; MeOH or NaHSO4 – 14 days

Table 9-1
Soil and Water Sample Preservation and Holding Times[a]

Determination	Method	Matrix[b]	Container[c]	Preservation	Holding Time
Volatile Organics / Purgeable - Halocarbons & Aromatic Hydrocarbons (AZ Samples)	5030C/8260B & 624	W	G, Teflon-Lined Septum Cap	Cool, 4°C, No Headspace No Residual Chlorine Present: HCl to pH<2, Cool, 4°C, No Headspace Residual Chlorine Present[g]: 10% Na2S2O3, HCl to pH<2, Cool, 4°C, No Headspace	7 days 14 days 14 days
	5035A/8260B	S	Encore Unit or Pre-weighed VOAs	Cool, 4°C,	NP – 48 hours; Freeze – 14 days; MeOH or NaHSO4 – 14 days

Sub-Contracted Methods*

Determination	Method	Matrix[b]	Container[c]	Preservation	Holding Time
Alcohols and Glycols	8015B	W,S	G, Teflon-Lined Cap	Cool, 4°C[g]	14 days until extraction and analysis;
Coliform, Fecal and Total	SM 9221 B, C, E	W	PA,G	Cool, <10°C, 0.0008% $Na_2S_2O_3$[d]	6-24 hours[e]
Fecal Streptococci	SM 9230B	W	PA,G	Cool, <10°C, 0.0008% $Na_2S_2O_3$[d]	6-24 hours[e]
Acidity, as $CaCO_3$	SM 2310 B	W	P,FP,G	Cool, ≤6°C	14 days
Alkalinity, as $CaCO_3$ (Automatic titration)	310.2	W	P,FP,G	Cool, ≤6°C	14 days
Alkalinity, as $CaCO_3$ (Manual titration)	SM 2320 B	W	P,FP,G	Cool, ≤6°C	14 days
Ammonia (Automated Phenate)	350.1/SM 4500-NH3 G	W	P,FP,G	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Ammonia (Electrode)	SM 4500-NH3 D or E	W	P,FP,G	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Biochemical Oxygen Demand (BOD)	405.1/ SM 5210 B	W	P,FP,G	Cool, ≤6°C	48 hours
Cyanide, Total (manual distillation followed by) Titrimetric Spectrophotometric (Semi-Automated) Spectrophotometric (Manual) Ion Selective Electrode	SM-4500 CN D 335.4 SM-4500 CN E SM-4500 CN F	W	P,FP,G	[h]Cool, <6°C, NaOH to pH>12, plus 0.6 g Ascorbic Acid	14 days

Table 9-1
Soil and Water Sample Preservation and Holding Times[a]

Sub-Contracted Methods*					
Determination	**Method**	**Matrix[b]**	**Container[c]**	**Preservation**	**Holding Time**
Chemical Oxygen Demand (COD)	410.4/SM 5520 D	W	P,FP,G	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Chlorine, Total Residual	SM-4500 Cl G	W	P,G	None required	Analyze within 15 minutes
Cyanide, Total & Amenable to Chlorination	9010B followed by 9012 or 9014	W S	P,FP,G G	[h]Cool, ≤6°C, NaOH to pH>12, plus 0.6 g Ascorbic Acid Cool, 4°C	14 days
Cyanide Amenable to Chlorination	SM-4500 CN G	W	P,FP,G	[h]Cool, ≤6°C, NaOH to pH>12, plus 0.6 g Ascorbic Acid	14 days
Cyanide, Weak Acid Dissociable	SM 4500-CN I	W	P,G	[h]Cool, 4°C, NaOH to pH >12	14 days
Ferrous Iron	SM 3500-Fe D	W	P,G	No headspace, cool, 4°C	24 hours
Hardness by Calculation Titration	 SM 2340 B SM 2340 C	W	P,FP,G	HNO_3 or H_2SO_4 to pH<2	6 months
Kjeldahl and Organic Nitrogen – Digestion & Distillation followed by: Titrimetric Ion Selective Electrode Automated Phenate Semi-automated block digestor colorimetric	SM-4500 NH_3 B SM-4500 NH_3 C SM-4500 NH_3 D or E 351.1 351.2	W	P,FP,G	Cool, ≤6°C, H2SO4 to pH<2	28 days
Nitrate-Nitrite	353.2	W	P,FP,G	Cool, <6°C H2SO4 to pH<2	28 days
Odor	140.1	W	G	No headspace, cool, 4°C	24 hours
Oxygen, Dissolved (Probe)	SM 4500-O G	W	G, Bottle & top	None required	Analyze within 15 minutes
Oxygen, Dissolved (Winkler)	SM 4500-O C	W	G, Bottle & top	Fix on site and store in dark.	8 hours

Table 9-1
Soil and Water Sample Preservation and Holding Times[a]

Sub-Contracted Methods*					
Determination	**Method**	**Matrix[b]**	**Container[c]**	**Preservation**	**Holding Time**
Phenolics, Total	420.1	W	G	Cool, 4°C, CuSO4, H_2SO_4 to pH<2 If chlorinated, $Fe(NH4)_2(SO4)_2$	28 days
Phenolics, Total	9065/9066	S	G	Cool, 4°C	28 days
Phosphorus, Total	365.1/365.3/365.4	W	P,FP,G	Cool, <6°C, H_2SO_4 to pH<2	28 days
Residue, Filterable (TDS)	160.1	W	P,FP,G	Cool, 4°C	7 days
Residue, Filterable (TDS)	SM 2540 C	W	P,FP,G	Cool, <6°C	7 days
Sulfide, Dissolved	SM 4500-S^{2-}D	W	P,FP,G	Cool, <6°C, Sodium Hydroxide, pH>9	7 days after Aluminum Hydroxide Floc, decant or filter steps and addition of Zinc Acetate
Silica (as SIO2)	200.7	W	P Only	Cool, 4°C	28 days
Sulfide, Total	SM 4500-S^{2-}D	W	P,FP,G	Cool, <6°C, Add Zinc Acetate plus Sodium Hydroxide to pH>9	7 days
Sulfide, Total	9030 followed by 9034	S	P,FP,G	Cool, 4°C	14 days
Surfactants (MBAS)	SM 5540 C	W	P,FP,G	Cool, <6°C	48 hours
Tannin and Lignin	SM 5550B	W	P,G	Cool, 4°C	28 days
Mercury	7470A/245.1	W	P,FP,G	HNO_3 to pH<2	28 days
	7471A	S	G, Teflon-Lined Cap	Cool, 4°C	28 days
Organic Carbon, Total (TOC)	SM 5310 B, C or D 9060	W	Amber G, Teflon-Lined Cap	Cool, 4°C, H_2SO_4 to pH<2 Cool, 4°C	28 days
Metals, except Chromium VI and Mercury	6010B/200.7/6020/ 200.8/7060/206.2/ 7421/239.2/7740/2 70.2/7841/279.1	W	P,FP,G	HNO_3 to pH<2	6 months
	6010B/6020/7060/ 7421/7740/7841	S	G, Teflon-Lined Cap	Cool, 4°C	

Table 9-1
Soil and Water Sample Preservation and Holding Times[a]

Sub-Contracted Methods*					
Determination	**Method**	**Matrix[b]**	**Container[c]**	**Preservation**	**Holding Time**
Organic Halogens, Total (TOX)	9020B	W	G, Teflon-Lined Cap	Cool, 4°C, H_2SO_4 to pH<2	28 days
Organic Halogens, Adsorbable (AOX)	1650	W	G, Teflon-Lined Cap	Cool, 4°C, HNO_3 to pH<2[g]	28 days
Petroleum Hydrocarbons, Extractable (Diesel-Range Organics)	8015B	W, S	G, Teflon-Lined Cap	Cool, 4°C; Adjust to pH <2 w/H2SO4 or HCl (water)	14 days until extraction; 40 days after extraction
EDB and DBCP	504	W	G, Teflon-Lined Cap	Cool, 4°C, No Headspace	14 days
Semivolatile Organics	8270C/625	W	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark[g]	7 days - extraction[f]; 40 days - analysis
		S			14 days – extraction[f]; 40 days – analysis
Polynuclear Aromatic Hydrocarbons (PAH)	8270-SIM/8310	W	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark[g]	7 days - extraction[f]; 40 days - analysis
		S			14 days – extraction[f]; 40 days – analysis
Organochlorine Pesticides and PCBs	8081/8082/608	W	G, Teflon-Lined Cap	Cool, 4°C	7 days - extraction[f] 40 days – analysis
	8081/8082	S	G, Teflon-Lined Cap	Cool, 4°C	14 days – extraction[f]; 40 days – analysis
Organophosphorus Pesticides	8141A	W	G, Teflon-Lined Cap	Cool, 4°C[g]	7 days - extraction[f] 40 days – analysis
	8141A	S	G, Teflon-Lined Cap	Cool, 4°C	14 days – extraction[f]; 40 days – analysis
Chlorinated Herbicides	8151A	W	G, Teflon-Lined Cap	Cool, 4°C[g]	7 days - extraction[f] 40 days – analysis
	8151A	S	G, Teflon-Lined Cap	Cool, 4°C	14 days – extraction[f]; 40 days – analysis

a See Section 18.0 for sources of information.
b W = Water; S = Soil or Sediment; HW = Hazardous Waste
c P = Polyethylene; G = Glass; FP = fluoropolymer (PTFE; Teflon) ir other fluoropolymer; PA =
d For chlorinated water samples
e The recommended maximum holding time is variable, and is dependent upon the geographical proximity of sample source to the laboratory.
f Fourteen days until extraction for soil, sediment, and sludge samples.
g If the water sample contains residual chlorine, 10% sodium thiosulfate is used to dechlorinate.
h per requirements of Table II in the 40 CFR 136
* Refer to Section 9.10 for information on the approval process for subcontract laboratories. .

TABLE 9-2
Sample Preservation and Holding Times[a]

Determination/Method	Matrix	Container	Preservation	Holding Time	Sample Vol.[d]
Amines	Air	Treated Alumina Tubes	Laboratory Storage, 4°C±2°C	30 days	100L
BTEX / Modified CARB 410	Air	Tedlar Bag, Mylar Bag, Summa Canister	No Direct Sunlight	Bag – 72 hours; Canister[b] – N/A	Bags - 500mL; Canisters – 6.0L
BTU / ASTM D 3588 (SULFUR, ASTM D 5504; C1-C6+, TO-3M; FIXED GASES, 3C)	Gaseous Fuels	Tedlar Bag, Mylar Bag, Summa Canister	N/A	Sulfur (Bag – 24 hours; Canister[c] – 7 days)	Bags - 500mL; Canisters – 6.0L
				C1-C6+ (Bag – 72 hours; Canister[b] – N/A)	
				3C (Bag – 72 hours; Canister[b] – N/A)	
C_1-C_6+ / Modified TO-3	Air	Tedlar Bag, Mylar Bag, Summa Canister	N/A	Bag – 72 hours; Canister[b] – N/A	Bags – 500mL; Canisters – 6.0L
Carbonyl Compounds/ TO-11A	Air	DNPH-Coated Silica Gel Cartridge w/ Polypropylene Cap; SKC UME[x] and Bacharach GMD 570 Passive Monitors (formaldehyde only)	Sample Receipt, 4°C±2°C; Laboratory Preservation, 4°C±2°C	14 days until extraction; 30 days for analysis	100 – 150L
Carboxylic Acids	Air	Treated Silica Gel Tubes	Laboratory Storage, 4°C±2°C	30 days	100L
EPA 25C/Total Gaseous Non-methane Organics (TGNMO)	Air	Tedlar Bag, Mylar Bag, Summa Canister	N/A	Bag – 72 hours; Canister[b] – N/A	Bags - 500mL; Canisters – 6.0L
Fixed Gases / EPA 3C & ASTM D 1946	Air	Tedlar Bag, Mylar Bag, Summa Canister	N/A	Bag – 72 hours; Canister[b] – N/A	Bags – 500mL; Canisters – 6.0L

TABLE 9-2 (Continued)
Sample Preservation and Holding Times[a]

Determination/Method	Matrix	Container	Preservation	Holding Time	Sample Vol.[d]
Helium & Hydrogen	Air	Tedlar Bag, Mylar Bag, Summa Canister	N/A	Bag – 72 hours; Canister[b] – N/A	Bags – 500mL; Canisters – 6.0L
Massachusetts Air-Phase Petroleum Hydrocarbons, Public Comment Draft 1.0	Air	Summa Canister	N/A	28 days	6.0L
Modified EPA Method 8315A (Procedure 1)	Aqueous, Soil	Glass w/Teflon- Lined Lid	All samples @ 4°C±2°C	Aqueous – prep. - 72 hours, analysis - 72 hours; Soil – prep. minimum, analysis - 72 hours	(2) 40mL Vials
NCASI – DI/MeOH 94.03/Methanol	Aqueous – Effluent	Glass w/Teflon- Lined Lid	No Headspace; 4°C±2°C; HCl to pH 2-3 (Effluent only)	30 days	(1) 40mL Vial
NCASI-DI/HAPS-99.01	Aqueous – Effluent	Glass w/Teflon- Lined Lid	No Headspace; 4°C±2°C	14 days	(1) 40mL Vial
NCASI-IM/CAN/WP-99.02	Air	Summa Canister	N/A	3 Weeks	3.0L
Organic Vapors / NAPHTHAS (Diesel; etc.) NIOSH 1550 / OSHA 7	Air	Charcoal Tube; 3M 3500 or 3520 Badge; Silica Gel Tube w/ plastic caps	N/A	14 days	Various
RSK 175/Methane, Ethane, Ethene, Propane, Propene,	Aqueous	Glass w/Teflon- Lined Lid	No Headspace; HCl to pH<2; 4°C±2°C	14 days	(3) 40mL Vials
RSK 175/Carbon Dioxide	Aqueous	Glass w/Teflon Lined Lid	No Headspace; neutral pH (5-8); 4°C±2°C	14 days[c]	(3) 40mL Vials
Sulfur / In-House Method	Aqueous	Glass w/Teflon- Lined Lid	No Headspace; pH>4; 4°C±2°C	Following pH adjustment – 24 hours	(2) 40mL Vials
Sulfur Gases / Modified SCAQMD 307 & ASTM D 5504	Air	Tedlar Bag, Fused Silica Lined SS Canister	No direct sunlight	Bag – 24 hours; Canister[c] - 7 days	Bags – 500mL; Canisters – 6.0L

TABLE 9-2 (Continued)
Sample Preservation and Holding Times[a]

Determination/Method	Matrix	Container	Preservation	Holding Time	Sample Vol.[d]
TO-13A/Polycyclic Aromatic Hydrocarbons (PAHs)	Air	Polyurethane Foam (PUF) plugs, XAD Tube, PUF / XAD-2	Sample Receipt, <4°C; Laboratory Preservation, 4°C±2°C	7 days until extraction; 40 days after	130 – 400 m^3
TO-14A & TO-15/VOC	Air	Tedlar Bag, Mylar Bag, Summa Canister	N/A	Bag – 72 hours; Canister - 30days	Bags - 500mL; Canisters – 6.0L
TO-17/VOC	Air	Sorbent Tubes w/Swagelock Caps & PTFE Ferrules	<4°C; organic solvent free environment; Laboratory Storage, 4°C±2°C	30 days	1-4L
TO-2 (as Modified TO-15)/VOC	Air	Sorbent Tubes w/Swagelock Caps & PTFE Ferrules	<4°C; organic solvent free environment; Laboratory Storage, 4°C±2°C	Desorb into Tedlar Bag- 7 days; Analyze – 72 hours	10L
TO-3 Modified/Methanol, Ethanol, Isopropyl alcohol, Freon, and Methylene chloride	Air	Tedlar Bag, Mylar Bag, Summa Canister	N/A	Bag – 72 hours; Canister[b] – N/A	Bags – 500mL; Canisters – 6.0L
TO-3 Modified/Total Petroleum Hydrocarbons (TPHG)	Air	Tedlar Bag, Mylar Bag, Summa Canister	N/A	Bag – 72 hours; Canister[b] – N/A	Bags – 500mL; Canisters – 6.0L
TO-4A & TO-10A/Pesticides and Polychlorinated Biphenyls (PCBs)	Air	Glass PUF and PUF/XAD-2 Cartridge; TO-4A (High Volume); TO-10A (Low Volume)	Sample Receipt, 4°C±2°C; Store sample and extract @ 4°C±2°C	7 days until extraction; extract – 40 days	2 m^3

a Refer to Section 18.0 for reference information
b Some methods do not specify the utilization of canisters; therefore, there is no required hold time and this will be noted in the case narrative.
c Laboratory recommended hold time; therefore, samples analyzed outside this hold time will be noted in the case narrative accordingly.
d Sample volumes are the minimum, which should be received by the laboratory; however, canister volumes should match the canister size utilized.

Figure 9-1
Water & Soil - Chain of Custody Record & Analytical Service Request

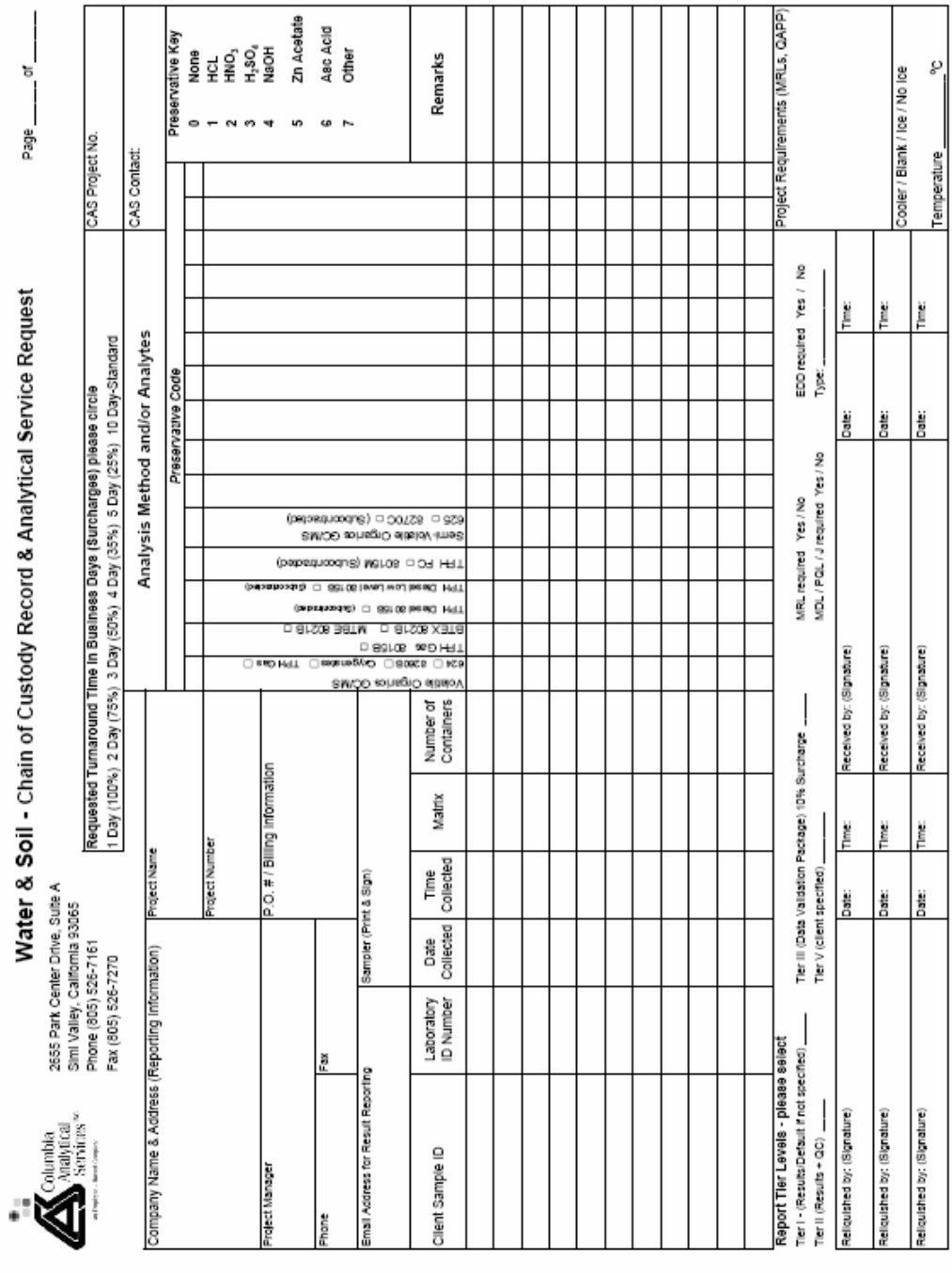


Figure 9-2
Air - Chain of Custody Record & Analytical Service Request

Columbia Analytical Services

Air - Chain of Custody Record & Analytical Service Request

Page ______ of ______

2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Requested Turnaround Time in Business Days (Surcharges) please circle 1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard	CAS Project No.

Company Name & Address (Reporting Information)		Project Name	CAS Contact:	Comments e.g. Actual Preservative or specific instructions
		Project Number	Analysis Method and/or Analytes	
Project Manager		P.O. # / Billing Information		
Phone	Fax			
Email Address for Result Reporting		Sampler (Print & Sign)		

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Sample Type (Air/Tube/ Solid)	Canister ID (Bar code # - AC, SC, etc.)	Flow Controller (Bar code - FC #)	Sample Volume					Comments

Report Tier Levels - please select
Tier I - (Results/Default if not specified) ____ Tier III (Data Validation Package) 10% Surcharge ____ EDD required Yes / No
Tier II (Results + QC) ____ Tier V (client specified) ______ Type: ____________ EDD Units: _________

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank Temperature ________ °C

10.0 QUALITY CONTROL CAPABILITIES AND OBJECTIVES

A primary focus of the CAS/SIMI Quality Assurance (QA) Program is to ensure the accuracy, precision, reliability, legality, and comparability of all analytical results. CAS/SIMI has established Quality Control (QC) objectives that are used to determine the acceptability of the generated data. The actual types of QC samples required for each analysis is discussed in corresponding method standard operating procedures and are further discussed in Section 11.0 of this manual.

All quality control measures are assessed and evaluated on an on-going basis and quality control acceptance criteria are used for verification (to determine the usability of the data). Quality control data is analyzed (per method procedures) and, where they are found to be outside pre-defined criteria, planned action is taken to correct the problem (where possible) and to prevent incorrect results from being reported. The laboratory provides validity of environmental tests undertaken through a number of procedures including:

- Initial calibrations and continuing calibrations as specified in method SOP;
- These include regular use of certified reference materials and secondary reference materials;
- Participation in proficiency testing programs (where applicable);
- Replicate tests using the same or different methods as specified in method SOP;
- Retesting of retained samples;
- Correlation of results for different characteristics of a samples (where applicable);
- Analysis of client supplied double blind samples (where available).

10.1 Demonstration of Capability

Prior to the utilization of any analytical method, specified method performance as defined in the analytical method must be demonstrated by a qualified analyst, whose training has been documented in accordance with *SOP for Documentation of Training.* Additional information concerning analyst training and qualification is detailed in Section 17.0.

As required by mandatory test method, regulation, or accreditation protocols, a demonstration of capability (DOC) is performed. This demonstration is made following regulatory, accreditation, or method specified procedures. In general, this demonstration does not test the performance of the method in real world samples, but in the applicable clean matrix, free of target analytes and interferences.

The following steps are performed annually to document the demonstration of capability.

1. A quality control sample will be prepared independently from those used in instrument calibration.
2. The analyte(s) is (are) diluted in a volume of clean matrix (for analytes which do not lend themselves to spiking, e.g. air samples, the demonstration of capability may be performed using quality control samples) sufficient to prepare four aliquots at the concentration

specified. If not specified, use a concentration approximately 1-4 times the method stated or laboratory calculated method reporting limit.

3. Four aliquots are prepared and analyzed according to the test procedure either concurrently or over a period of days.
4. The mean recovery and standard deviations (population sample, n-1) are calculated for each parameter of interest.
5. Compare the information from #4 to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory-specified acceptance criteria (if no established mandatory criterion exists). All parameters must be met in order for the demonstration to be considered successful. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter. The DOC must be repeated for all parameters that fail to meet criteria. A repeated failure confirms a general problem with the measurement system. The problem must then be located and corrected at the source and the DOC repeated. A demonstration of capability must be completed and approved each time there is a change in instrument type, personnel, or method, where possible and/or applicable. A demonstration of capability certification statement is completed indicating acceptability and including information such as date of demonstration, analyst, method, parameters, and matrix. The DOC is reviewed and approved by the Quality Assurance Program Manager and retained on file, along with the raw data for the capability.

In addition, acceptable PT results may also be used to demonstrate capability as long as all of the measured analytes are present and found to be acceptable. In accordance with AIHA requirements, acceptable performance must be demonstrated every six months.

10.2 Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Certain method portions are monitored to assure accuracy. These include the analysis of initial calibrations, continuing calibrations, laboratory-fortified blanks (blank spikes or laboratory control samples), and proficiency test samples (Section 14.1.3), and use of certified reference materials. In addition, laboratory-fortified (i.e. matrix-spiked) samples may also measured; depending on the method/matrix, and indicates the accuracy or bias in the actual sample matrix. Refer to Section 11.4 and each method SOP for additional information regarding these measures.

Accuracy is expressed as percent recovery (% REC) of the measured value, relative to the true or expected value. If a measurement process produces results whose mean is not the true or expected value, the process is biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction or desorption efficiencies) or caused by an artifact of the measurement system (e.g., contamination). CAS/SIMI utilizes several quality control measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples and initial calibration verification standards. Because bias can be positive or negative, and because

several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

The percent recovery (%R) is calculated as:

$$\%R = \frac{Amount\ Recovered}{True\ Value} x\ 100$$

The average percent recovery *(Ave.%R)* is calculated as:

$$\%R = \frac{\Sigma\ Ri}{N}$$

where: R_i = The individual recovery values
N = Number of determinations

10.3 Precision

Precision is the ability of an analytical method, instrument, and analyst to reproduce a measurement of the same parameters under prescribed similar conditions. It is a measure of the variability, or random error, in sampling, sample handling and laboratory analysis.

The American Society of Testing and Materials (ASTM) recognizes two levels of precision: repeatability - the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions, and reproducibility - the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material.

At CAS/SIMI, our "within-batch" precision is measured through the analysis of either duplicate quality control (QC) sample analyses (LCS/LCSD) or injections of field samples aliquots (LD) as detailed in each method SOP and is expressed as the relative percent difference (RPD) between the measurements.

$$RPD = \frac{|D_1 - D_2|}{\overline{D}} x100$$

where: D_1 = Original Result
D_2 = Duplicate Result
$\overline{D}$ = Average

In addition, the precision of an analytical method is calculated as the standard deviation of the percent recoveries calculated as described above in determining the accuracy of the method, and then expressed as percent relative standard deviation (RSD) of the recoveries.

The standard deviation(s) is calculated as:

$$SD = \sqrt{\sum_{i=1}^{N} \frac{(X_i - X)^2}{N-1}}$$

where:
X_i = The individual recovery values
X = Arithmetic average of the recovery values
N = Number of determinations

Percent relative standard deviation (%RSD) is then calculated as:

$$\%RSD = (S / X) \times 100$$

where S and X are as defined above.

10.4 Acceptance Limits and Control Charts

The acceptance limits for each method are available based on statistical evaluation of the data generated by the analysis of quality control check samples, unless specific acceptance limits are established by the method or there are not enough points available (non-routine analyses and/or analytes). Control charts are used to record quality control data and compare them with acceptance limits. For new methods, where internal control limits have not been established and method required/recommended control limits are not available, fixed limits (based on method, QC type, analyte, instrumentation and detector type, and linearity) will be utilized until such time that enough points are available. The QC limits are either specified in the methodology, or are statistically derived based on the laboratory's actual historical data obtained from control-charting the various QC measurements for each analytical method.

The Quality Assurance Program Manager updates control charts on an annual basis and semi-annually for selected methods, where applicable and as specified in the appropriate method standard operating procedure. In addition, method conformity is assessed using the calculated values. If trends in the data are perceived, various means of corrective action may then be employed in order to prevent future problems with the analytical system(s). The procedure for generating control charts and implementing limits is detailed in the *Standard Operating Procedure for Control Limits.*

Note: There is no widely accepted procedure for spiking Summa canister and Tedlar bag samples with analytical surrogates, which is not specifically addressed in referenced air methods. Therefore, for the analyses of air samples utilizing surrogates, which are added to the sample

stream during pre-concentration, these are not considered true surrogates and therefore, are assessed utilizing fixed limits.

10.5 Method Detection Limits / Method Reporting Limits

The Method Detection Limits (MDL) is the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the analyte. Method detection limit studies are determined annually or semi-annually (as dictated by the method) for all the target compounds in a quality system matrix in which there are neither target analytes nor interferences at a concentration that would impact the results. MDL studies are determined in accordance with the *Standard Operating Procedure for the Determination of Method Detection Limits and Limits of Detection* which is based on the procedure outlined in 40 CFR 136, Appendix B. Note: For multi-component analyses, the appropriate spiking compounds and concentrations varies among analytes and are specified in method procedures, where applicable.

MDL studies are performed on each instrument (with identical configurations) for which the method is performed. Where multiple instruments are used, the MDL used for reporting purposes represents the least sensitive instrument. However, if a lower detection limit is reported, then the samples must have been run on that specific instrument on which the lower MDL was generated. If more than seven replicates are analyzed, all results must be used to calculate the MDLs, unless exclusion of a result is technically justified and documented. MDLs are established for each matrix, method and extraction/cleanup method combination employed for samples. No results are reported below the determined MDL and results reported outside the quantitation range of the initial calibration are reported as estimated.

The Method Reporting Limit (MRL) or Practical Quantitation Limit (PQL) is generally the lowest quantitation level of a given analyte that can be reliably achieved within the specified limits of precision and accuracy of a given method during routine operating conditions. The MRLs used at CAS/SIMI are the reported lower limits of quantitation (at or above the low point in current initial calibration and above the method detection limit or as designated below), which take into account day-to-day fluctuations in instrument sensitivity as well as other factors. These MRLs are the levels to which CAS/SIMI reports results in order to minimize false positive or false negative results. The MRL is generally two to ten times the method detection limit (MDL), but differs between methods. However, in some cases the MRL is less than two times, but always higher than the calculated MDL. Measures are taken to ensure that the data reported to the client at low levels is both accurate and real including the requirement that the low concentration level of the initial calibration be at or below the MRL. A successful initial calibration also confirms the validity of MRL values. However, the MRL for each analysis may be influenced by the regulatory limits set by local, state, or federal agencies, and specific projects. *For example*, for Navy (Department of Defense Manual) samples the method reporting limit must be at least 3 times (AFCEE, 2 times) the current verified method detection limit.

10.6 Method Detection Limit Verification

Upon completion of the method detection limit study, the method detection limit (also referred to as limit of detection, LOD) for each target analyte of concern in the quality system matrices is verified, where applicable. MDL verifications shall be performed on all instruments (performing a given method) immediately following the MDL study. The analyte concentrations are verified at approximately 1-4 times the detection limit for multiple analyte tests and 2-3 times for single analyte tests (or approximately 2 times the MDL for Navy and AFCEE samples) and taken through all preparatory and analytical steps. Every effort must be made to verify the MDL by spiking at an appropriate concentration. If the MDL is not verified, per the stated spike requirements, spikes at successively higher concentrations are performed until the verification criteria are met. However, due to variances in the determined MDLs (by analyte per study) and the target analyte list, this may not be feasible. Therefore, in cases where the spike concentration from the method detection limit study would comply with the above stated requirement(s), the last replicate may be used for the verification. Regardless, if the MDL verification is not analyzed, with a spike meeting the above stated criterion, the reported MDL must be raised according to the actual spike performed and any necessary adjustments also made to the MRL (to meet the Navy 3 times the MDL requirement).

If the method has no confirmation criteria, the MDL verification is acceptable if the analyte can reliably be detected and identified by the method-specific criteria (i.e, ion confirmation) and produce a signal that is at least 3 times the instrument's noise level (3:1 signal to noise ratio) or acceptable percent recovery (as in the case of specific conductance where there is no ratio to measure). All verification documentation and acceptability information is retained on file with the method detection limit study.

MDL verification is not required for any component for which spiking solutions or quality control samples are not available such as temperature, or, when test results are not to be reported to the detection limit.

10.7 Desorption Efficiency and Method Reporting Limits (Industrial Hygiene)

The desorption efficiency (DE) is the ability of the analytical method to recover the analyte from the collection media. Desorption efficiencies are determined initially and for each analyte to be reported. In addition, a DE study is performed each time there is a change in the test method, or with each new lot of media. Desorption efficiency shall be determined using sorbent media from the same lot number used for the field samples, if possible, and of the identical size and type. The DE values are used to correct the sample results (for all samples except passive samplers) before reporting.

Minimum-reporting limits for each reportable analyte are determined initially by the analysis of spiked media, prepared at the desired reporting limit and carried through the entire analytical process. The reporting limit is verified or re-established annually (or if there is a change in

methodology or instrumentation) and instrument performance (at the reporting limit) is checked with each analytical batch through the analysis of an analytical standard prepared at the reporting limit.

10.8 Completeness

Completeness is a measure of the amount of valid data that is obtained, compared to the amount that is expected. For purposes of this plan, completeness is calculated by dividing the number of samples having valid data by the total number of samples in the project, expressed as a percentage. The CAS/SIMI objective for completeness is 100% for air samples, 95% for aqueous, and 90% for soil samples, although other less stringent criteria may be utilized if specified in a project specific QA plan.

10.9 Representativeness

Representativeness is the degree to which a sample aliquot that is analyzed gives results identical to analysis of the whole. CAS/SIMI has sample preparation procedures (where necessary) to ensure that the sample that is to be analyzed is representative of the entire sample before the aliquot of sample is removed for analysis. Furthermore, analytical SOPs specify appropriate sample sizes to ensure the sample aliquot that is analyzed is representative of the whole. However, air samples received by the laboratory in canisters and bags are considered to be homogenous and therefore, no special sample preparation procedures are necessary.

10.10 Comparability

Comparability expresses the confidence with which one data set can be compared to another. To ensure comparability, procedures are in place for the preservation, handling, and analysis of all samples. Data is reported in units specified by the client.

10.11 Initial Test Method Evaluation

As part of method development, and to ensure continuous quality of data, the laboratory proposes standard QC requirements consistent with similar methods or technology. At a minimum these QC requirements deal with (where applicable): Calibration, Contamination, Precision and Bias, Interference and Analyte Identification (including retention times). Upon initial method setup, the laboratory performs an initial calibration with verification, method detection limit study and verification (or desorption efficiency study, where appropriate), and a precision and bias study.

The laboratory addresses precision and bias utilizing replicate QC samples. Examples of a systematic approach to evaluate precision and bias is by analyzing QC samples in triplicate containing all of the analytes in question (at three levels of interest over three days). The acceptability is contingent on percent recovery, mean recovery and relative standard deviation, and standard deviation.

11.0 QUALITY CONTROL PROCEDURES

The specific types, frequencies, processes, procedures, acceptance, corrective actions, and results qualifications for quality control sample analyses are described in detail in method-specific standard operating procedures or client project plans, where applicable. These sample types and frequencies have been adopted for each method and a definition of each type of QC sample is provided below. In addition, a number of other quality control processes which may impact analytical results are also described below.

11.1 Procurement and Approved Vendors

Purchasing of critical items and services is performed in such a way as to ensure that the items and/or services purchased/performed are of the necessary quality to uphold the standard by which the laboratory operates and/or by which analytical methods require. The laboratory evaluates all vendors of critical consumables, supplies and services that may affect the quality of testing. Records of these evaluations and the list of approved suppliers are available to the appropriate personnel. The following are the minimum requirements for approval.

- Consumables and Laboratory Supplies – All reference materials received at CAS/SIMI are traceable to the vendors that have fulfilled the requirements for ISO9001 certification and/or are accredited by A_2LA, and the standard also came with certificates of analysis to verify standard purity and concentration. However, there may be instances, particularly with obscure standards or reagents that finding a certified vendor is not possible. In these cases, the vendor shall be approved if a history is available indicating the minimum quality or through independent testing that shows that the quality conforms to the minimum requirements of the method (the use of applicable QC data is sufficient). Primarily, vendors are ISO certified to an appropriate standard. In addition, items may be purchased from distributors (that are not ISO certified), but that supply materials from ISO certified companies that have previously been approved. However, in some instances, those vendors for which CAS/SIMI has a history and found those vendors to supply materials with the necessary quality are considered acceptable without such an evaluation. Materials are handled in accordance with the *Standard Operating Procedure for Handling Consumable Materials*. They are inspected for container integrity upon receipt and any material with suspected integrity problems is returned to the vendor. The SRMs are stored under conditions that provide maximum protection against deterioration and contamination.
- Services – Critical services within the laboratory are the calibration of equipment such as weights and balances, pressure/vacuum gauges, thermometers, and flowmeters. The procedure for evaluating such suppliers of critical services is performed using a checklist, and whenever possible, obtaining certifications of NIST traceability for specific calibrations/certificates supplied to CAS/SIMI by said vendor. In addition, if ISO certification is available, this certificate is also obtained. The requirement for approval for such metrology laboratories is that they must conform to the following requirements:

- All calibrations must be NIST traceable.
  - Perform calibrations in accordance with the appropriate standards (to be determined during evaluation).
  - Whenever possible, be ISO certified or conform to the requirements of appropriate ISO standards.

All evaluations and approvals are on file and shall be retained for a period of five years or longer if they are still being used by the laboratory for the services for which they were originally approved. All current approved vendors are made available to all the appropriate personnel who order from or use the services of suppliers of critical consumables, supplies or services.

11.2 Standard Reference Materials (SRM)

All certificates are retained on file for a minimum period of five years. In addition, refer to Section 11.1 for information regarding selection criteria, approval and maintenance of lists of approved service suppliers and vendors for Standard Reference Materials (SRMs).

11.2.1 Metrology All analytical measurements are performed using materials and/or processes that are traceable to a Standard Reference Material (SRM). Metrology equipment (analytical balances, weights, pressure/vacuum gauges, thermometers, etc.) is calibrated against primary laboratory SRMs traceable to the National Institute of Standards and Technology (NIST) or are sent to an approved service supplier as specified in Section 11.1 of this document. These primary SRMs are themselves recertified, by an approved service supplier, on an annual basis. Each piece of equipment is labeled with the associated calibration status and certificates are retained on file for a period of at least five years. The frequencies and procedures for calibration are specified in the *SOP for Calibration and Use of Laboratory Support Equipment*. Refer to Section 12.1 for additional information.

11.2.2 Consumable Standard Reference Materials Consumable primary stock standards are obtained from certified commercial sources. All standard reference materials (SRMs) that are received at CAS/SIMI are recorded by the technical staff in the appropriate notebook(s) according to the *Standard Operating Procedure for Making Entries into Logbooks and onto Benchsheets* and *Standard Operating Procedure for Handling Consumable Materials.* In addition, information required in this SOP is recorded on certificates and labels.

SRMs are stored under conditions that provide maximum protection against deterioration and contamination. Stock solutions and/or calibration standard solutions are prepared fresh as often as necessary according to their stability and are specifically stated in method SOPs. After preparation, all standard solutions are properly labeled as to analyte concentration, date, analyst, and expiration date. Generally, expiration dates are assigned per the guidance information provided in the *Standard Operating Procedure for Handling Consumable Materials.*

Prior to introduction into the analytical system/process, all reference materials are verified with a second, independent source of the material. Once the reference material has been verified to be accurate, it may then be used for the deemed purpose. In addition, the independent source of reference material is also used to check the calibration standards for signs of deterioration.

11.3 Reagents

Upon receipt, all chemical containers are inspected for integrity and recorded in an inventory log. The "date received," "date opened," and "date expired" are noted on the container label. Placing the date on the container label facilitates use of chemicals on a first-in, first-out basis.

There is a control system for the receiving and the releasing of lots of reagents. For critical chemical reagents, such as organic solvents and acids used for sample preparation, each lot is tested for analytes of concern prior to use. Reagents from a certain lot cannot be used until the lot has been released. Refer to the SOPs for *Checking New Lots of Chemicals for Contamination* and *Handling Consumable Materials* for additional information on the necessary quality verification procedures. Once the solvent or acid is opened for use, the date opened is documented on the container label and in the inventory log.

All reagents used in the laboratory are of sufficient quality to support the intended use as specified in the referenced method and method SOP. Typically reagents are prepared from Analytical Reagent Grade (AR) chemicals or higher purity grades, unless such purity is not available. The preparation of all reagents is documented in bound, laboratory notebooks including source, mass, and dilutions. Each reagent is clearly labeled with the composition, concentration, date prepared, date opened, analyst initials, expiration date, and special storage requirements, if any. Solvents and reagent solutions are routinely checked for contamination by analyzing them as method and/or instrument blanks for each analysis in which they are used.

Reagents are stored in appropriate glass, plastic, or metal containers under conditions designed to promote safety and maintain integrity (refrigerated, dark, etc.). Shelf life is listed on the label. All reagents are properly disposed of after the expiration date. Dry reagents, such as sodium sulfate, silica gel, and glass wool are either heated to dryness at 400°C or extracted with the appropriate solvent prior to use for organic analyses.

11.4 Analytical Batch

The basic unit for analytical quality control is the analytical batch. There are two types of analytical batches defined by CAS/SIMI and (Field) samples are assigned to batches commencing at the time that sample processing begins. These definitions are described in the *Standard Operating Procedure for Sample Batches*. The overriding principle of describing an analytical batch is that all the samples in a batch, both field samples and quality control samples are to be handled and processed in exactly the same manner.

Specific program requirements or method requirements may be exceptions to particular requirements stated in the above mentioned SOP. These exceptions will be addressed in program-specific Quality Assurance Project Plans (QAPPs) or in method Standard Operating Procedures (SOPs).

The following shall apply to all analytical batches and sequences; however, exceptions and/or additions may be made and are dependent on the matrix, method and method standard operating procedure.

- Initial calibration or calibration verification standard (if ICAL not performed in batch). Refer to Section 12.2 for additional information on initial calibrations.
- A method blank (however named) shall be analyzed to assess contamination.
- A duplicate sample (laboratory duplicate, laboratory control sample duplicate, matrix spike duplicate) shall be analyzed to assess batch precision. A sample identified as a field blank, an equipment blank, or a trip blank is not to be duplicated.
- Laboratory control sample shall be analyzed, as best defined by the corresponding method SOP to assess method performance.
- Matrix spiked (field) sample shall be analyzed to assess method performance with regards to matrix, including interferences. A sample identified as a field blank, an equipment blank, or a trip blank is not to be spiked. Due to limitations, certain analytical batches for air matrices cannot include a matrix spike.

In all instances the following requirements shall be observed:

- The number of (field) samples in a batch is not to exceed 20 including duplicates and matrix spikes.
- All (field) samples in a batch shall be of the same matrix
- A single lot of reagents, whenever possible, are used to process the batch of samples
- Field samples are to be prepared and analyzed along with the corresponding QC samples as described in the method specific SOP
- Where possible, all samples in a batch (field and QC) are analyzed on the same instrument or otherwise specified in the final report. All samples are to be handled and processed in exactly the same way, and all of the data from each analysis is to be manipulated in exactly the same manner.

11.5 Collection Efficiency

In the case of sampling trains (consisting of one or more multi-section sorbent tubes), which are received intact by the laboratory, the "front" and "back" sections shall be separated if required by the client. Each section shall be processed and analyzed separately and the analytical results reported accordingly.

11.6 Method Blanks

A method blank (MB) is an analyte-free matrix and is included with the analysis of every analytical batch of 20 or fewer samples, or as stated in the method, whichever is more frequent. The method blank is analyzed to evaluate the process for contamination. The analyte concentration in the sample is not to be corrected for the method blank concentration, except as specified in the SOP for the analysis.

When a method blank fails the method standard operating procedure stated criteria (see note below), the cause of contamination must be investigated and measures taken to minimize or eliminate the problem. Ideally, in such cases the associated method blank and samples should be re-prepared and/or reanalyzed; however, constraints such as holding time or sample quantity may preclude reanalysis. If a sample is past the recommended holding time, the Project Manager must be consulted prior to determining if reanalysis is necessary. When reanalysis is not practical or possible, the method blank result(s) will be reported as described below:

- The MRL for an analyte is not to be increased when the analyte is found in the method blank above the MRL.
- Samples associated with the same batch are evaluated as to the best corrective action (e.g., re-analyze sample or qualify data). The procedure for the qualification of data is considered to be the inclusion of a flag to the affected analyte in the MB, MB and sample(s), and/or a notation in the case narrative. The selection is generally dependent on the concentration of the analyte in the MB and affected sample(s).

Note: For Navy projects only, the threshold for qualification is <1/2 the MRL.

11.6.1 Air Matrices The method blank is an analyte-free matrix, usually ultra high purity nitrogen, helium, humidified zero air, or an unused solid sorbent cartridge, impinger solution, or extracts solvent, and subjected to the entire analytical process. In the case of industrial hygiene samples, blank sampling media are analyzed, when applicable, by the same procedure as that used for field samples.

A method blank may be otherwise named as in the case of RSK analysis, where water naturally contains both oxygen and carbon dioxide. In this case, the method blank is referred to as a method control sample (MCS). In addition, a TO-15 QC canister may serve as a method blank as long as the requirements of the method SOP are fulfilled.

11.6.2 Soil and Water Matrices A method blank is an analyte-free matrix, usually ASTM Type II water or analyte-free soil (Ottawa sand or Sodium Sulfate, depending on methods), to which all reagents are added in the same volumes or proportions as used in the entire analytical process. The method blank is analyzed to demonstrate that the analytical system is not contaminated with the analyte(s) being measured.

11.7 Calibration Blanks

Calibration blanks are prepared with analyte free water or solvent, used to provide the zero point of the calibration in many of the inorganic analyses. The frequency, processes, procedures, acceptance, corrective actions, and results qualifications are described in detail in method-specific standard operating procedures or client project plans, where applicable.

11.8 Initial and Continuing Calibration Blanks

Initial Calibration Blanks (ICB) and continuing calibration blanks (CCBs) are solutions of either analyte-free water or solvent that is analyzed in order to verify the zero point of the analytical system. These calibration blanks are usually associated with inorganic method analyses, but the frequency, processes, procedures, acceptance, corrective actions, and results qualifications are described in detail in method-specific standard operating procedures or client project plans, where applicable. In the case of air samples where there may or may not be a sample preparation step required, the CCB and method or reagent blanks may be the same sample and referred to as any one of these.

11.9 Calibration Standards

Calibration standards are vapors, liquids or solutions of known concentration obtained from vendor-purchased sources or prepared from in-house stock standard materials. Calibration standards are used to calibrate the instrument response with respect to analyte concentration. Standards are purchased, prepared and analyzed in accordance with the requirements stated in the corresponding method standard operating procedure being used.

11.10 Initial (or Independent) Calibration Verification Standards

Initial (or independent) calibration verification standards (ICVs) are standards that are analyzed *after* calibration but *prior to* sample analysis, in order to verify the calibration of the analytical system. This standard must be prepared from materials obtained from a source (manufacturer or lot) other than that used for preparing the calibration standards. The ICV is used to verify the standard calibration curve prior to sample analysis. The frequency, processes, procedures, acceptance, corrective actions, and results qualifications are described in detail in method-specific standard operating procedures or client project plans, where applicable.

11.11 Continuing Calibration Verification Standards

When an initial calibration is not performed on the day of analysis, the validity of the initial calibration shall be verified prior to sample analysis by a continuing calibration verification (CCV) standard. The percent recoveries of the CCVs, or the percent difference calculated between the true and the expected value must meet the acceptance criteria specified in the method SOP. The frequency of CCV analysis is either once every ten samples, every 12-hour period, or as indicated in the method SOP. The frequency, processes, procedures, acceptance,

corrective actions, and results qualifications are described in detail in method-specific standard operating procedures or client project plans, where applicable. Unless otherwise specified in the applicable method and method SOP, the quantitation of all results must be performed utilizing the initial calibration and are determined using the CCV.

11.12 Internal Standards (IS)

Internal standards consist of known amounts of specific compounds that are added to each sample, standard and QC sample following sample preparation or extraction. Internal standards are generally used for GC/MS procedures to correct sample results that have been affected by changes in instrument conditions or changes caused by certain matrix effects.

11.13 Surrogates

Surrogate standards are chosen to have properties similar in chemical composition and chromatographic behavior to the analytes of interest, but which are not normally found in environmental samples. Depending on the analytical method, one or more of these compounds is added to method blanks, calibration and check standards, and samples (including batch QC samples) prior to sample preparation; e.g., extraction or purging. The surrogate results are compared with the true values spiked into the sample matrix prior to sample preparation and analysis (percent recovery) and are used to monitor the method performance on each sample.

The following are specific requirements for surrogates depending on the sample matrix of interest.

- Air Samples – Surrogates shall be used as specified in each method SOP.
- Aqueous, Soil, etc. Samples – Surrogate compounds must be added to all samples, standards, blanks, and QC samples prior to extraction and analysis, for all organic chromatography methods except when the method or matrix precludes its use or when a surrogate is not available.

Note: There is no widely accepted procedure for spiking Summa canister and Tedlar bag samples with surrogates, which is not specifically addressed in referenced air methods (specifically TO-15) for these sampling containers. Therefore, surrogates, which are added to the sample stream during pre-concentration, are not considered true surrogates.

11.14 Matrix Spikes (Laboratory Fortified Sample Matrix)

Matrix spiked (MS) samples are aliquots of samples to which a known amount of the target analyte (or analytes) has been added. The samples are prepared and analyzed in the same analytical batch and in exactly the same manner, as are routine samples. The stock solutions used for spiking the sample(s) are prepared independently of calibration standards. The spike recovery measures the effects of interferences caused by the sample matrix and reflects the accuracy of the method for the particular matrix in question. Spike recoveries are calculated as follows:

Recovery (%) = (S - A) x 100 ÷ T

Where: S= The observed concentration of analyte in the spiked sample,
A= The analyte concentration in the original sample, and
T= The theoretical concentration of analyte added to the spiked sample.

Generally, the matrix spiked samples are prepared and analyzed at a minimum frequency of one per batch or one spiked sample (and one duplicate spiked sample, if appropriate) per twenty samples or fewer samples, whichever is more frequent.

The following are specific requirements for the analysis of the matrix spikes depending on the matrix of interest.

- Air Samples – Matrix spiked samples are often not feasible for air matrices. Therefore, the MS shall be used as required by the test method and as specified by the corresponding SOP.
- Aqueous, Soil, etc. Samples – If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components. However, a representative number (at a minimum 10%) of the listed components may be used to control the test method if the components interfere with an accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs), the test method has an extremely long list of components, the components coelute or the components are incompatible. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period, unless the spiking list is specified by the referenced method.
- For industrial hygiene samples, a laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) are typically analyzed in lieu of MS/MSD, due to the lack of replicate samples submitted. This is the case in a number of other methods and is discussed in each method standard operating procedure.

11.15 Duplicates

The laboratory duplicate (LD) is defined as an aliquot of a sample taken from the same container under identical laboratory conditions and processed and analyzed independently. The analysis of laboratory duplicates give a measure of the precision associated with laboratory procedures, but not with sample collection procedures.

Depending on the matrix and/or method of analysis, either a laboratory duplicate, duplicate matrix spiked sample (DMS), or duplicate laboratory control sample (DLCS) are analyzed at a frequency of 1 per batch of 20 or fewer samples. The relative percent difference between duplicate analyses is a measure of the precision for a given method and analytical batch. The relative percent difference (RPD) for these analyses is calculated as follows:

Relative Percent Difference (RPD) = (S1 - S2) x 100 ÷ S_{ave}

Where:

S1 and S2 = The observed concentrations of analyte in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike, and

S_{ave} = The average of observed analyte concentrations in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike.

Generally, if a client requests a MS/MSD to be processed with their samples and provides adequate sample volume to do so, that MS/MSD will be used for the analytical batch. Whenever possible, the laboratory will randomly select samples for processing the MS/MSD. When insufficient sample is received from the client(s) to perform the necessary duplicate sample analyses or MS/MSD on any sample in the analytical batch as prescribed in the method, a duplicate LCS will be extracted and analyzed to assess the precision of the method.

Note: Submitted field duplicates are treated as separate samples and reported accordingly.

11.16 Laboratory Control Samples (Laboratory Fortified Blanks)

A laboratory control sample (LCS) is a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is used to assess the performance of all or a portion of the measurement system (NELAC). The percent recovery (%R) of the target analytes in the LCS assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate measurements at the required reporting limit. The following are general requirements, which apply to the preparation and analysis of laboratory control samples; however, SOPs will preclude those listed below.

- Spiking standards are purchased or prepared independently of calibration standards.
- A commercially purchased standard reference material (SRM) of known matrix type, containing certified amounts of target analytes, may also be used as an LCS.
- An LCS is prepared and analyzed at a minimum frequency of one LCS per 20 or fewer samples, or as stated in the method, whichever is more frequent.
- The LCS sample is prepared and analyzed in the same analytical batch, and in exactly the same manner, as field samples.

The following are requirements for the analysis of the LCS depending on the matrix of interest.

- Air Samples – The laboratory control sample is usually an aliquot of ultra high purity nitrogen, helium or humidified zero air, unused extract solvent, blank sorbent cartridge, etc. to which known amounts of the method analyte(s) is(are) added. If a spiking solution is not available, a

calibration solution whose concentration approximates that of the samples shall be included in each batch and with each lot of media.

- Aqueous, Soil, etc. Samples – The laboratory control sample (LCS) is an aliquot of analyte-free water (ASTM Type II) or analyte-free soil (or anhydrous sodium sulfate or equivalent) to which known amounts of the method analyte(s) is (are) added.

- Industrial Hygiene Samples - Desorption efficiency studies are performed for each batch of samples received for a given analytical method. Spiking standards are prepared at known concentrations, and blank sorbent media (same lot as the sampling media if possible) are spiked at a minimum of two concentration levels.

Laboratory control samples with large number of analytes are statistically likely to include a few analytes that will be outside control limits. This may not indicate that the system is out of control; therefore, corrective action may not be necessary. For this reason, upper and lower marginal exceedance (ME) limits may be established and used to determine when corrective action is necessary. A ME is defined as being between 3 and 4 standard deviation around the mean. The number of analytes allowable to fall within this marginal exceedance is based on the number of analytes in the LCS. If more analytes exceed the LCS control limits than is allowed, or if any one analyte exceeds the ME limits, the LCS fails, and proper corrective action is necessary. This marginal exceedance approach is relevant for methods with long lists of analytes. It will not apply to target analyte lists with fewer than 11 analytes.

The number of allowable marginal exceedances is as follow:

>90 analytes in LCS, 5 analytes allowed in ME of the LCS control limit;
71-90 analytes in LCS, 4 analytes allowed in ME of the LCS control limit;
51-70 analytes in LCS, 3 analytes allowed in ME of the LCS control limit;
31-50 analytes in LCS, 2 analytes allowed in ME of the LCS control limit;
11-30 analytes in LCS, 1 analytes allowed in ME of the LCS control limit;
<11 analytes in LCS, no analytes allowed in ME of the LCS control limit;

Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systemic problem. The source of the error must be located and corrective action taken. Affected samples and laboratory control samples will be re-extracted and/or reanalyzed if necessary. Due to certain restrictions detailed in client specific project plans, State, Federal or other Agency requirements, the use of marginal exceedances may not be allowed and are only utilized for those methods where it is deemed appropriate.

11.17 Field and Trip Blanks

Field and trip blanks are analyzed when they are submitted to the laboratory for analysis. The actual field samples are flagged (when analytes are found in the blank) if and only if the

laboratory is able to analyze the samples in the same analytical sequence as the corresponding field or trip blank. If this is not possible due to client submission restrictions then the results for the samples and blanks shall be reported independently with no flag. However, an explanation of this is included in the final report. This laboratory does not feel that Summa canisters are suitable for use as field blanks. It is for this reason that the results for these types of containers are reported as separate samples and flagging is not considered appropriate, except for project specific requirements.

11.18 Glassware Washing

The use of glassware at this facility is at a minimum; however, all glassware that is to be used undergoes a rigorous cleansing procedure following every usage. Glassware cleaning at the main laboratory and remote sample preparation laboratory are performed in accordance with the *Standard Operating Procedure for Cleaning Glassware.* In addition, other equipment that is routinely used at the laboratory is also cleaned following instructions in the determinative method SOP.

12.0 CALIBRATION PROCEDURES AND FREQUENCY

For the purposes of this laboratory, equipment calibration requirements are applicable to both support equipment and instrumentation. The requirements for instrument calibration include initial and continuing calibration verification. Prior to being placed into service and on a consistent basis, CAS/SIMI ensures that all equipment and applicable software is capable of achieving the required accuracy relevant to the environmental test(s) of concern.

All equipment used at CAS/SIMI are operated, maintained, calibrated, and/or recertified according to the manufacturer's guidelines and recommendations, as well as to criteria set forth in the applicable methodology. Depending on equipment and instrument type, calibration techniques are either performed by CAS personnel who have been properly trained in accordance with the standard operating procedures or performed by an approved service supplier (on or off site). Documentation of calibration information is maintained in the appropriate reference files.

Any instrument or piece of equipment that has been subjected to overloading, mishandling, or has been shown by verification or otherwise to be defective; is taken out of service until it has been repaired (see Section 15.0). The equipment is placed back in service only after verifying by calibration that the equipment performs satisfactorily and is labeled or marked to indicate calibration status. Brief descriptions of the calibration procedures for the major laboratory equipment and instruments are described below. Refer to Section 11.1 for information on the approval process for service suppliers.

12.1 Support Equipment

Certain support equipment is vital to laboratory operations and quantitative results are dependent on their accuracy. The equipment list includes, but is not limited to: balances, ovens, refrigerators, freezers, and flow meters, temperature measuring devices, pressure/vacuum gauges, volumetric dispensing devices, and a water purification system. If the use of any support equipment is deemed to be non-vital with regards to the need for accuracy, it is labeled accordingly. All necessary instructions and/or manuals for the use and operation of the equipment are maintained on file and are readily available to personnel. All support equipment shall be maintained in proper working order and records of all repair, maintenance, calibration, and recertification are maintained on file for review. The acceptability for use or continued use is in accordance to the requirements of the analysis or application for which the equipment is intended. For additional information on the calibration and calibration verification of laboratory support equipment, refer to the *Standard Operating Procedure for Calibration and Use of Laboratory Support Equipment*.

12.1.1 Temperature Control & Measuring Devices Temperatures are monitored and recorded for all critical measurement temperature-regulating devices including freezers, refrigerators and ovens. Each piece of equipment is labeled with a unique identifier, the required temperature or range of use according to the needs of the analysis or application. Bound record books are kept which contain equipment identifier, daily-recorded temperatures (if in use, business days), acceptance criteria and the initials of the

laboratory staff member who performed the checks for all temperature-regulating devices in daily use. A number of thermometers include a temperature range and per certain project requirements (complies with Department of Defense Quality Systems Manual for Environmental Laboratories), this range is recorded to document consistent compliance with required temperatures for refrigerators and freezers.

All thermometers are identified by a unique identifying number (i.e., serial number), and the calibration of these thermometers is checked annually against a National Institute of Standards and Technology (NIST) certified thermometer. All corresponding correction factors are noted on the device as well as in the thermometer calibration logbook. The NIST thermometer is recertified by an approved professional metrology organization on an annual basis and the certificate is retained on file for review. All temperature monitoring is conducted in accordance with the *Standard Operating Procedure for Sample Receipt, Acceptance and Log-in* and thermometer calibration requirements are performed in accordance with the *Standard Operating Procedure for Calibration and Use of the Laboratory Support Equipment.*.

12.1.2 Volumetric Dispensing Devices The accuracy of pipettes used to make critical-volume measurements is verified on a quarterly basis. Typically, the indicated volume or range (where applicable) of the pipette is checked and both the accuracy and precision verification are performed using the above-mentioned procedure. The calibrations are evaluated against the intended use (volume or range) of the pipette and if the calibration is not approved for the specified volume(s) it is tagged accordingly (i.e. "Do Not Use Below 5uL"). The results for all calibration verifications are recorded and maintained.

Note: Glass microliter syringes including gas-tight syringes are considered in the same manner as Class A glassware and are not held to the calibration/verification requirements as are other volumetric dispensing devices.

12.1.3 Analytical Balances and Weights Analytical balances and weights are calibrated / recertified and certificates issued annually by an approved professional metrology organization. The calibration of each balance is checked once each day of use in the expected range, utilizing the calibrated weights. Bound record books are kept which contain the identification of balance (serial number), recorded measurements and the initials of the analyst who performed the check. All certificates for the balances and weights are available for review.

12.1.4 Pressure/Vacuum Gauges CAS/SIMI digital pressure/vacuum gauges are used in a number of critical measurements within the laboratory. The following is a list of the uses for this gauge type.

- Canister cleaning and conditioning
- Measure the vacuum on canisters before they are sent to the client for sampling.
- Measure the initial/final vacuum/pressure of canisters prior to analysis.

- Measure pressure during the preparation of selected standards.

Digital pressure/vacuum gauges are calibrated and certificates issued once per year by an approved metrology organization. All calibrations are performed against standards traceable to the National Institute of Standard and Technology (NIST) or other recognized national metrology institutes. In addition, CAS/SIMI performs a calibration check for each gauge six months following the calibration date. The laboratory retains all corresponding calibration and verification documentation for review.

12.1.5 Water Purification System Purified water is utilized for a number of functions including instrument and method blanks, trip blanks, sample dilutions, and washes for the General chemistry department. The water purification system utilizes a mixed-ion bed exchange mechanism supplied by three mixed resin bed, constant water recirculation, four filters, and resistively lights. It is designed to produce deionized water of ASTM Type II quality, with 16-18 megohm-cm resistance @25°C and is checked and recorded daily (prior to and if in use). Maintenance and repair on the system is conducted by an approved service supplier and all records including purification checks/verifications are maintained on file for review. For procedures on additional purification (i.e., boiling and/or purging) and purification checks/verifications, refer to the applicable method standard operating procedures.

12.2 Instrumentation Calibration

The laboratory specifies the procedures and documentation for initial instrument calibration and continuing calibration verification in the applicable method standard operating procedures to ensure that data is of known quality and is appropriate for a specific regulation and/or client requirement. The procedural steps for calibration including, frequency, number of points, integration, calculations, acceptance criteria (appropriate to the calibration technique employed), corrective action, associated statistics, and data qualifications are included in applicable methods, method standard operating procedures and/or client project plans. The essential elements that define the procedures and required documentation for initial instrument calibrations are specified below.

- Sufficient raw data records are retained to permit reconstruction of all calibrations.
- If a reference or mandated method does not specify the number of calibration standards, the initial calibration range shall consist of a minimum of 5 contiguous calibration points for organics and a minimum of 3 contiguous calibration points for inorganics. The actual numbers of points utilized is specified in the corresponding method SOP.
- The concentrations should bracket the expected concentration range of samples.
- Initial instrument calibration procedures referenced in test methods (either directly or indirectly) are retailed by the laboratory and are readily available to the analysts.
- All samples results are quantitated from the initial instrument calibration and are not

quantitated from any continuing instrument calibration verification unless otherwise specified by regulation, method or program.

- The initial instrument calibration is verified with a standard obtained from a second manufacturer or lot and traceability to a national standard is maintained, where available.
- The acceptance criteria utilized is appropriate for the calibration technique employed.
- The lowest calibration standard in the initial calibration is at or below the lowest concentration for which quantitative data are to be reported and is referred to at this laboratory the method reporting limit (MRL). Some programs and/or agencies refer to this limit as the practical quantitation limit (PQL) (or level).
- Any data reported below the MRL or above the highest calibration standard is considered to have an increased quantitative uncertainty and is appropriately qualified in the report.
- The lowest calibration standard is above the limit of detection or method detection limit (MDL).

12.2.1 Internal and External Calibrations

Internal standard calibration involves the comparison of instrument responses from the target compounds in the sample to the responses of specific standards added to the sample or sample extract prior to injection. The ratio of the peak area of the target compound in the sample or sample extract to the peak are of the internal standard in the sample or sample extract is compared to a similar ratio derived for each calibration standard. The ratio is termed the response factor (RF) or relative response factor (RRF) in some methods.

External standard calibration involves comparison of instrument responses from the sample to the responses from the target compounds in the calibration standards. Sample peak areas are compared to peak areas of the standards. The ratio of the detector responses to the amount (mass) of analyte in the calibration standard is defined as the calibration factor or in some cases it may be referred to as response factor.

12.2.2 Continuing Calibration Verification

The essential elements that define the procedures and required documentation for continuing instrument calibration verification are specified below.

- When an initial calibration is not performed on the day of analysis, continuing instrument calibration verification is analyzed with each batch.
- Calibration is verified for each reported compound, element or parameter; however, for multi-component analytes such as aroclors or total petroleum hydrocarbons a representative chemical related substance or mixture may be used. The allowance for this exception is dependent on applicable regulatory, method, or client project plans.
- Generally, the instrument calibration verification is performed at the beginning, end and every ten samples of each analytical batch (except, if an internal standard is used, only one verification needs to be performed at the beginning of the analytical batch);

whenever it is or expected that the analytical system may be out of calibration; if the time period for calibration or most previous calibration verification has expired; or for analytical systems that contain a specific calibration verification requirement. Specific requirements for the frequency of continuing calibration verification, for a particular method, is specified in the corresponding method standard operating procedure.

13.0 DATA RECORDING, REDUCTION, VALIDATION, AND REPORTING

The success of a result is dependent on the credibility of the data collected and the controlled processes used to establish data quality. If controlled processes are not in place, the assurance of the data may be questioned. The data users need to be assured of the integrity of the processes performed during data recording, reduction, validation and reporting of the final results. For detailed information on these processes refer to the *Standard Operating Procedures for Software and Data Quality Assurance; Data Review and Reporting; Ensuring Data Integrity*.

CAS/SIMI reports the analytical data produced in its laboratory to the client via the certified analytical report. This report generally includes a transmittal letter, case narrative, client project information, specific test results, quality control data, chain of custody information (where available), and any other support and project-specific support documentation including sample receiving information. The actual documentation (report) provided differs depending on the needs of the client; therefore, refer to Section 13.5.1 for reporting requirements and format and Table 13-1 specified data deliverables. The following sections describe an overview of the procedures required for data recording, reduction, validation and reporting.

13.1 Data Acquisition and Recording

Data are acquired and recorded (either electronically or hardcopy by laboratory personnel) in such a way that allows historical reconstruction of all laboratory activities which produce or supports the production of analytical results. All computers, software and automated equipment utilized by the laboratory for data acquisition and recording are of sufficient quality to protect the integrity and confidentiality of data entry or collection. Such computers or equipment are maintained to ensure proper function necessary to uphold the integrity of environmental test data.

To identify the personnel involved in each step of the process, initials and dates are documented (either electronically or handwritten) for the activities performed. A list of employee signatures and initials used to identify personnel are compiled and retained on file by the QA Program Manager. To ensure that all information is legible, any manual entries or correction on logbooks and data records follow procedures written in the *Standard Operating Procedure for Making Entries into Logbooks and Onto Benchsheets*. In addition, the information required for a specific record is detailed in the corresponding standard operating procedure.

13.2 Data Reduction

Data reduction is the process of transforming raw data by arithmetic or statistical calculations into a more useable and complete form. The data reduction, calculations and statistical interpretations specified by each method and/or method standard operating procedure are followed. All data are initially processed by analysts using appropriate methods (e.g. chromatographic software, instrument printouts, hand calculation, etc.). Software developed by CAS for the purpose of data reduction/calculation is subject to validation as written in the *Standard Operating Procedure for Ensuring Data Integrity* and *Standard Operating Procedure for Software*

and Data Quality Assurance. Some of the information and procedures necessary for the reduction of data include retention time windows, analyte confirmation, data qualifiers, and calculations and are generally described in this section.

13.2.1 Qualitative Identification Qualitative identification of an analyte is specified in each method (e.g., Section 7.7 of EPA Method 8082 and Section 7.6 of EPA Method 8260) and method standard operating procedure. The criteria used for GC or GC/MS methods in qualitative identification are summarized below:

- GC Methods – Retention time windows are calculated, where appropriate, in accordance with method standard operating procedures and are used in the qualification of target analytes. In most cases the windows are generated from either the initial calibration or a standard analyzed over a 72-hour period.
- GC/MS Methods - The qualitative identification of each compound is determined by:
    1. The retention time of target analytes as compared with that of the standard.
    2. The mass spectrum of the analyte in the sample must, in the opinion of a qualified analyst or the department manager, correspond to the characteristic ions in the spectrum of the standard or the current GC/MS reference library.

13.2.2 Analyte Confirmation Confirmation is performed as specified in method and/or corresponding SOPs, as well as the *Standard Operating Procedure for Confirmation of Organic Analyte Identification and Quantitation.* However, identification criteria for GC/MS methods as well as multi-component analytes are summarized below:

- GC/MS Methods – Confirmation is not necessary for MS analyses. However, mass spectral confirmation must meet the criteria stated in the applicable method and the analyte in the sample must, in the opinion of a qualified analyst, correspond to the spectrum of the analyte in the standard or the current GC/MS reference library.
- Multi-Component Analytes – Confirmation is not necessary for analytes such as gasoline, diesel, and other "pattern" generating analytes (except when required by the method).
- Gas Chromatograph and Liquid Chromatographic Analyses - For gas chromatographic (GC) and liquid chromatographic (LC) analyses, all positive results are generally confirmed by a second column, a second detector, or by GC/MS analysis, unless exempted by one of the following situations:

    - The sample is analyzed for benzene, toluene, ethylbenzene and xylenes (BTEX), and the sample is found, by a separate analysis, to contain gasoline. In a sample containing no gasoline, the presence of BTEX compounds will be confirmed.
    - The sample meets all of the following requirements:
        1. All samples (liquid or solid) come from the same source (e.g., groundwater samples from the same well) for continuous monitoring.

samples of the same matrix from the same site, but from different sources (e.g., different sampling locations) are not exempt.

2. All analytes have been previously analyzed, identified and confirmed by a second column or by GC/MS. The documents indicating previous confirmation must be available for review.
3. The resulting chromatogram is relatively simple and does not contain complex or overlapping peaks.
4. The chromatogram is largely unchanged from the one for which confirmation was carried out.

13.2.3 Calculations The calculations utilized to obtain a final reportable result must contain all dilutions, volumes analyzed, pressure dilution factors, etc., where applicable. The calculations are specified in the corresponding method standard operating procedures.

All manual calculations including manual integrations are documented to ensure both traceability and integrity of the result. The documentation for manual integrations follows the requirements specified in the *Standard Operating Procedure for Manual Integration of Chromatographic Peaks*.

13.3 Data Validation

All analytical records (e.g., strip charts, printouts, computer data files, notebooks, and logbooks) include information that allows the events of the analyses to be reconstructed and validated. The analytical records include information such as sample ID, date of analysis, instrument ID, sample type, sample preparation and analysis method, and any observations and calculations preformed on the sample, analyst initials, dates, and standard ID, etc. as specified in the applicable standard operating procedures.

The integrity of the data generated in the laboratory begins with the initial laboratory validation of test methods as specified in Section 10.11 of this manual. Additionally, the assessment is achieved through the use of a variety of measures that may include reagent blanks, laboratory control samples, duplicates, matrix spikes and other QC samples. The numerical criteria for evaluation of these QC samples are listed within each method-specific Standard Operating Procedure and include method and statistically derived limits (refer to Section 10.4 for additional information).

Other validation measures of the data include a check of the linearity of the calibration curve, an accuracy check of the QC standards and a system sensitivity check. Data transcriptions and calculations are also reviewed. Additional information and procedures used to validate and verify the quality of reported data are described below.

13.3.1 Data Qualifiers Whenever necessary, data qualifiers are included on the final report as a means to describe out of control situations, estimated concentrations,

interferences, and other pertinent information. The table included in Appendix D of this document is a list of qualifier flags available for use at CAS/SIMI. Modifications and/or additions to the list, and designations and/or wording may be made as long as both the flag and corresponding definition is included in the report. If there is not a specific flag included, the final report shall contain a sufficient explanation of the data provided to the client.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s) and/or case narrative explanations.

13.3.2 Computers and Electronic Data Related Requirements The plan for assuring the quality of computer software and integrity is written in *the SOP for Software and Data Quality Assurance Plan.* It covers the policies for procurement, configuration, development, validation/verification, security, maintenance, and use of computer software.

13.3.3 Estimation of Uncertainty of Measurement Uncertainty is associated with most of the results obtained in laboratory testing. The laboratory ensures that a reasonable estimation (based on laboratory records) is attempted and that the form of reporting does not give a wrong impression of the uncertainty of a result. An estimation of the uncertainty of the measurements is available upon request using the procedures written in the *Standard Operating Procedure for Estimation of Uncertainty*.

13.4 Data Review

The data review procedure is conducted in such a manner as to ensure that all reportable and supporting data:

- are correct and complete;
- have met the data quality objectives of the method, corresponding standard operating procedure (against data review checklist) and/or client;
- anomalies have been clearly qualified in an acceptable fashion
- does not misrepresent the quality of the results

The data review procedure is conducted in accordance with the requirements detailed in the *Standard Operating Procedure for Data Review and Reporting*; however, an overview is described below.

Depending on the processing software utilized for a particular method (i.e., Enviroquant, STEALTH, etc.), the resulting raw data are manually or otherwise entered into an electronic report, spreadsheet or processed by a program that electronically reviews the data against the appropriate

set of acceptance criteria and transfers the data into a reportable format. Once the data have been entered into the appropriate form (final report form, results spreadsheet, or other), it is then printed and the analyst reviews all raw data, quality control results, field sample(s) results, and forms for both accuracy and acceptability. The analyst also makes notations of any analysis anomalies and data qualifiers (refer to above section).

After the primary review, a second level (peer or secondary) of review is conducted by an analyst, supervisor, or the department manager. The secondary review consists of checking for errors (against the same criteria as the initial review) and properly approving any manual integrations (refer to Section 13.2.3) for acceptability. The reviewer initials and dates the checklist when the review is complete and found to be acceptable.

Following the secondary or peer review, the data including hardcopy report forms goes through another review by a qualified person (either a Data Validation Coordinator or Project Manager). If one of the automatic reporting systems including STEALTH or Blackbird is not utilized, then the data report is reviewed by a Data Validation Coordinator (DVC); otherwise the Project Manager is responsible for the review. If a DVC is performing the review, a check of all GC/MS calculations, a verification of GC data against the analysis spreadsheet, check for data entry errors, and a review of quality control results associated with the sample are included, where applicable. Any analytical or typographical errors associated with the report will be flagged and the report with the associated data will be returned to the person who generated the report forms (Systems Analyst or analyst) for review and correction. The Project Manager must review the entire body of data for completeness and to ensure that any and all client-specified objectives were successfully achieved and any anomalies and qualifiers are properly included.

When the entire data set (report) has been found to be acceptable, the report is submitted for final approval and signatures of the persons authorizing the test report. A copy of the report is made and retained at the laboratory for a period of five years (unless otherwise specified by the client) while the original is forwarded to the client (refer to Section 8.6).

13.5 Data Reporting

The quality objective, with regards to data reporting, is that the laboratory shall report results accurately, clearly, unambiguously and objectively, and in accordance with any specific instruction in the referenced method(s). The report shall include all of the information requested by the client (Refer to Table 13-1 for available report tiers) and necessary for the interpretation of the results as well any additional information required by the method. All data are calculated and reported in units consistent with project specifications, to enable easy comparison of data from report to report.

The client is contacted in writing (email is sufficient) regarding any event that casts doubt on the validity or completeness of results. All information of this type is included in the final report and

the following describes each section of the CAS/SIMI final report and the information that should be consistently provided to the client for proper interpretation of the results. If the results have already been reported, refer to Sections 13.5.2 for information on report revision and 13.5.3 for amendments.

13.5.1 Laboratory Report Format and Contents The information included in the report issued by CAS/SIMI is listed below, which complies with the NELAC requirement. CAS/SIMI certifies that the test results meet all requirements of NELAC or will provide reasons and/or justification if they do not.

- A title, (i.e., Analytical Report);
- Name and address of laboratory, and location where the test was carried out if different from the address of the laboratory and phone number with name of contact person for questions;
- Unique identification of the report (such as serial number), and on each page an identification in order to ensure that the page is recognized as part of the test report and a clear identification of the end of the report;

  This requirement may be presented in several ways:

  - The total number of pages may be listed on the first page of the report as long as the subsequent pages are identified by the unique report identification and consecutive numbers, or
  - Each page is identified with the unique report identification, the pages are identified as a number of the total report pages (example: 3 of 10, or 1 of 20).
  - Other methods of identifying the pages in the report may be acceptable as long as it is clear to the reader that discrete pages are associated with a specific report, and that the report contains a specified number of pages.

- Name and address of client and project name if applicable;
- Description and unambiguous identification of the tested sample including the client identification code;
- Identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature;
- Date of receipt of sample, date and time of sample collection, date(s) of performance test, and time of sample preparation and/or analysis if the required holding time for either activity is less than or equal to 48 hours;

  The following are the laboratory criteria for evaluating compliance with required hold times.

1. If no sampling time is provided, hold times are considered valid until the end of the day. However, for projects that require compliance with theDepartment of Defense Quality Systems Manual for Environmental Laboratories, the most conservative time (earliest) will be utilized.
2. Time zones are not taken into consideration unless requested by the client.
3. Dates and times of collection must be taken into account when provided. If not provided, a notation will be made in the case narrative.
4. The start of sample preparation (e.g., addition of solvent), where applicable, is considered the end of the hold time.

- Identification of the test method used, or unambiguous description of any nonstandard method used;
- If the laboratory collected the sample, reference to sampling procedure;
- Any deviations from (such as failed quality control), additions to or exclusions from the test method (such as environmental conditions), and any non-standard conditions that may have affected the quality of results, and including the use and definitions of data qualifiers;
- Measurements, examinations and derived results, and any failures identified; identify whether data are calculated on a dry weight or wet weight basis; identify the reporting units;
- When required, a statement of the estimated uncertainty of the test result;
- A signature and title, or an equivalent electronic identification of the person(s) accepting responsibility for the content of the certificate or report (however produced), and date of issue;
- Statements to the effect that the results relate only to the items tested or to the sample as received by the laboratory and the report shall not be reproduced except in full, without the written approval of the laboratory;

    - The results included in this report relate only to the sample(s) submitted and identified herein, and in the documented condition received by the laboratory.
    - All results are intended to be considered in their entirety, and CAS is not responsible for utilization of less than the complete report.

- Clear identification of all test data provided by outside sources, such as subcontracted laboratories, clients, etc.; and,
- Clear identification of numerical results with values outside of quantitation levels.

13.5.2 Report Revision After issuance of a hard copy formal report (submitted to the client), the original laboratory report shall remain unchanged. However, a revised report or revised pages may be issued and regardless of the circumstances of the revision, the procedures described below shall be consistently followed. The issuance of either a revised report or revised pages is at the discretion of the laboratory.

1. The revised report shall be identified with an "R" following the original CAS/SIMI Project Number on every generated page. Previously revised reports shall be identified with an "R2".
2. The cover page of the report also includes a reference to the original report number.
3. The date of revision shall be included.
4. A revision letter (approved and signed by the Quality Assurance Program Manager) shall accompany the revised report and shall include:

    - CAS/SIMI report file number being revised
    - Identification of revision including all affected samples
    - Statement detailing that the enclosed is a revised report as indicated by the "R" identifier.
    - Statement that the revision letter should be kept on file
    - Statement that the original report is no longer valid and it must be destroyed or returned to the laboratory.
    - CAS/SIMI contact and phone number

Revised Page(s)

1. The revised page(s) shall be identified with and "R" following the original CAS/SIMI page number. Previously revised pages shall be identified with an "R2". Pages added will be denoted with "a", "b", etc.
2. A revision letter (approved and signed by the Quality Assurance Program Manager) shall accompany the revised pages and shall include:

    - Date of revision
    - CAS/SIMI report file number being revised
    - Page numbers that were revised
    - Identification of revisions
    - Statement detailing that the enclosed are revised pages as indicated by the "R" identifier.
    - Statement to the effect that the revised pages must be inserted into the original report.
    - Statement that the original report page(s) is no longer valid and it must be destroyed or returned to the laboratory.
    - Statement that the revision letter should be kept on file
    - CAS/SIMI contact and phone number

13.5.3 Report Addendum An addendum may be issued if there is an omission of data information from the original report such as quality control data or analytical results. The original report once issued shall remain unchanged. Therefore, the addendum shall be identified as a separate document and must reference the original report (an "A"

following the corresponding CAS/SIMI project number). This identification must be present on every generated page. Additionally, addendum pages may be added. The addendum pages shall be identified with an "A", "B" and "C", and so on following the original page number after which the page(s) is/are to be inserted.

An addendum letter (approved and signed by the Quality Assurance Program Manager) shall accompany the addendum report or pages and include:

- CAS/SIMI report file number
- Identification of addendum including all affected samples
- Statement detailing that the enclosed is an addendum report or pages and how they are identified.
- Statement that the letter should be kept on file
- CAS/SIMI contact and phone number

13.6 Documentation

CAS/SIMI maintains a records system which ensures that all laboratory records of analysis are retained and available. A service request number (project number) is electronically assigned to each project for reporting and filing purposes. Analysis data shall be maintained for a period of five years (from date of report issuance) unless the client has made other arrangements.

13.6.1 Documentation of Analysis Data

The analysis documentation system includes, but is not limited to, the following items (where appropriate) for each set of analyses performed:

- Instrument parameters; and
- Sample analysis sequence; and
- Analysis benchsheets, instrument printouts, results spreadsheets; and
- Chromatograms and peak integration reports for all samples, standards, blanks, duplicates and reruns; and
- Initial calibration and data review checklist(s); and
- Copies of report sheets submitted to the work request file; and
- Applicable standard identification numbers; and
- Chain of custody, service request and sample acceptance check forms; and
- Nonconformity and Corrective Action Report (NCAR) form.

13.6.2 Reporting Deliverables

In order to meet individual project needs, CAS/SIMI provides several levels of analytical reports. Basic specifications for each level of deliverable are described in Table 13-1. Variations may be provided based on client or project specifications.

13.6.3 Electronic Data Deliverables

When requested, CAS/SIMI provides Electronic Data Deliverables (EDDs) (as confidential) in the format specified by the CAS, client, project or specific EDD specifications, where appropriate. The EDD is prepared by either the Systems Analyst or Data Processor using the electronic version of the laboratory report to minimize transcription errors. In addition, any data not previously reviewed is reviewed and compared to the hardcopy report for accuracy.

Table 13-1
Descriptions of CAS Default Data Deliverables[1]

Deliverable	Tier I	Tier II	Tier III	Tier V[3]
Transmittal/Cover Letter[2]	■	■	■	■
Case Narrative[2]	■	■	■	■
Chain of Custody (COC) Document(s)	■	■	■	■
Cooler Receipt/Sample Acceptance Check Form	■	■	■	■
Sample Handling Records (Storage Records; Internal COC, etc.)			O	O
Sample Analysis Results with Preparation and Analysis Dates	■	■	■	■
Method Blank Results	■	■	■	O
Surrogate Recovery Report		■	■	O
LCS/DLCS Analyses with Recovery Report and RPD Results		4	4	O
Laboratory Duplicate Analysis with RPD Results		4	4	O
MS/DMS Analyses with RPD Results		4		O
MS/DMS Analyses with Recovery and RPD Results			■	O
Confirmation Summary Report			■	O
Tune Summary Report (for GC/MS Analyses)			■	O
Internal Standard Summary Report			■	O
Initial Calibration (ICAL) Summary Report			■	O
Initial Calibration Verification (ICV) Summary Report			■	O
Continual Calibration Verification (CCV) Summary Report			■	O
Continuing Calibration Blank (CCB) Summary Report			■	O
Standards Preparation Log			O	O
Instrument Run/Injection Log			■	O
Sample Preparation Benchsheet(s)			■	O
Raw Data including Analysis Benchsheet(s), Quantitation Reports, Chromatograms, Spectra, and Other Instrument Printouts			■	O

[1]Only those deliverables which are applicable to a particular matrix, method, standard operating procedure, analytical batch, and/or client-specific QAPP will be included.

[2]Inclusion is at the discretion of the laboratory (one or both will be included).

[3]The specific contents of a certified analytical report may be customized to satisfy client-specific requirements (Tier V).

[4]Precision data is to be reported from either sample duplicates, DLCS or DMS data and is dependent upon analytical batch, matrix, method, standard operating procedure, and/or client-specified requirements.

O – Optional, at the request of the Client

14.0 LABORATORY AUDITS, REVIEWS AND ACCREDITATIONS

Audits are an essential part of the QA program and two types of audits are used at this facility (system audits and performance audits). System Audits are conducted to qualitatively evaluate the operational details of the QA program. The Performance Audit is conducted to evaluate the analytical activities of an analyst, as well as the data produced by that analyst. Management reviews are conducted by individuals with executive responsibility to review the laboratory's quality system in order to ensure continuing suitability and effectiveness, and to introduce any necessary changes or improvements. These changes may include the addition and/or deletion of offered test methods and analytes. In addition, results from such laboratory audits (whether conducted internally or by an external entity) and managerial reviews, regardless of the severity, are shared with the appropriate laboratory personnel.

All audits are conducted to verify compliance with laboratory standard operating procedures and policies, AIHA policies, ISO/IEC 17025, and NELAC standards, Arizona Department of Health, and DOD Quality Systems Manual, where appropriate. In addition, it may be necessary to audit methods or systems in accordance with client specified requirements. If any findings from an audit or review cast doubt on the correctness or validity of the laboratory's calibrations or test results, the laboratory will take immediate corrective action and shall notify, in writing (within five business days), any client whose work was involved. Whenever testing discrepancies are detected, or departures from documented policies and procedures occur (as detected by client feedback, nonconformity reports or audits), the Quality Assurance Program Manager reviews all pertinent information/documentation to determine and/or implement the proper corrective action (i.e., training, procedural changes, etc.).

14.1 Audits

14.1.1 System Audit

The system audit examines the presence and appropriateness of laboratory systems. External system audits of CAS/SIMI are conducted regularly by various regulatory agencies and clients. Table 14-1 summarizes some of the major programs in which CAS/SIMI participates. The Quality Assurance Program Manager (QAPM) acts as a point of contact and coordination between the auditing group and the laboratory, and is responsible for working with the appropriate laboratory personnel to resolve any deficiencies and to prepare an audit response report. The final audit response report is then reviewed and signed by the Quality Assurance Program Manager and Laboratory Manager.

The internal system audits are scheduled and performed by the Quality Assurance Program Manager. These audits are conducted a minimum of four times per year with an additional comprehensive lab-wide system audit. Each audit examines one (or many) of the different quality assurance systems used at CAS, and the results of each audit and corrective actions are documented and retained by the QAPM. Any deficiencies noted by the auditor are

summarized in the audit report and corrective action is mandated within a specified length of time to provide closure for each audit.

The Laboratory Manager and other personnel are informed for review and comment of all audit findings, suggestions, and corresponding corrective actions, where appropriate. Should problems impacting data quality be found during an internal audit, any client whose data is adversely impacted will be given written notification (an email may be sufficient) if not already provided. Additional details of the internal audit program can be found in the *Standard Operating Procedure for Conducting Internal Laboratory Audits.*

14.1.2 Performance Audit

There are a number of separate reviews that can be considered part of the overall performance audit including a review of the analytical reports and generated data (hardcopy and electronic), logbook reviews and on-site analyst work reviews as well as electronic data audits (Refer to Section 14.1.4 for additional information).

14.1.3 Performance Evaluation Program

CAS/SIMI participates in a proficiency testing (PT) (minimum of twice per year per matrix per analyte) program from a NELAC approved provider. CAS/SIMI participates in PE studies that are required by programs listed in Table 14-1. The programs are water pollution (WP) for wastewater, underground storage tank (UST) for petroleum hydrocarbons, and hazardous waste (HW) for soil/hazardous waste. Results of the PT samples are sent directly to the appropriate state agencies by the PT vendor.

Successful quarterly participation in the American Industrial Hygiene Association (AIHA) PT program is a prerequisite to obtaining and maintaining accreditation for the analysis of industrial hygiene samples.

CAS/SIMI uses the results of PT samples to evaluate the accuracy of the analyses performed as well as analyst proficiency. Trends of acceptable and unacceptable results provide an assessment of the analytical performance of the laboratory. The PT reports are reviewed by the Laboratory Manager, QAPM, and the appropriate laboratory staff. Any "not acceptable' results in the PT final report is subject to corrective investigation. Corrective actions are documented and submitted to management for review. A response letter is sent to the appropriate agencies after the corrective investigation, explaining what action has been taken to correct the deficiency.

PE samples are processed in the same manner as field samples. At a minimum, the Laboratory Manager and QA Program Manager each review the results. The QA Program Manager reports the results to the appropriate agency or study coordinator. For

any results outside acceptance criteria, the analysis data is reviewed to identify a possible cause for the deficiency, and corrective action is taken and documented. The analysis of performance evaluation samples is performed according to the requirements specified in the *Standard Operating Procedure for Proficiency Testing Sample Analysis*.

Additionally, as a way to further monitor the quality of the laboratory's analytical activities, the laboratory may perform replicate analysis using the same method or where possible retest any retained samples.

14.1.4 Electronic Data Audit

Electronic data audits are conducted on a quarterly basis. A minimum of three electronic audits (initial calibration, analytical sequence and/or service request) should be performed per quarter. These audits include random selections of initial calibration, analytical sequence and/or service request for a method(s) and analyst. They are selected in such as way so that the same analyst or analysis is not audited in sequential quarters. However, this may be necessary if requested by the Laboratory Manager or other personnel, in relation to a complaint, or in conjunction (or as a result of) with an internal or external audit. These audits are conducted in accordance with the *Standard Operating Procedure for Electronic-Data Auditing.*

14.2 Quality Assurance Reports to Management

Quality assurance requires an active, ongoing commitment by CAS/SIMI personnel at all levels of the organization. Information flow and feedback mechanisms are designed so that analysts, supervisors and managers are aware of quality assurance issues in the laboratory.

The Quality Assurance Program Manager prepares a quarterly report to management detailing all QA activities from the past three months. The purpose of this report is to keep the Laboratory Manager and corporate QA Department apprised of these activities and to document the actions taken to correct problems that have impacted laboratory operations. This report includes discussion of the following issues related to laboratory QA/QC:

- Training
- QA Manual and SOP Reviews
- Audits (Internal and External)
- Corrective Actions (including patterns or persistent NCARs)
- Certifications, Accreditations, and Approvals
- Method Detection Limit (MDL) Studies Status
- Proficiency Documentation
- Statistical Control Limits Status
- Performance Evaluation Studies
- Current QA Issues, Priorities, and Accomplishments

Any problems noted by the Laboratory Manager are then discussed either during the regularly scheduled staff status meetings or at a specially scheduled management meeting. The Laboratory Manager performs an annual documented review of the quality system to identify any necessary changes or improvements to the quality system

14.3 Managerial Review

In accordance with a predetermined schedule and procedure, the laboratory's top management periodically (minimum – annually) conducts a review of the management system (quality system) including policies, procedures and testing activities to ensure their continuing suitability and effectiveness, and to recommend and introduce necessary changes and/or improvements. Management, through the use of this review, provides evidence of its commitment to the development and implementation of the management system and to continually improving its effectiveness.

This review takes into account, at a minimum, the suitability of policies and procedures, reports from managerial and supervisory personnel, internal audit reports, and assessments by external bodies, corrective and preventive actions, results of interlaboratory comparisons and proficiency tests, changes in the volume and type of work undertaken, feedback from clients, complaints, and recommendations for improvement, as well as other relevant factors (including quality control activities, resources and staff training). This review is conducted in accordance with the requirements stated in this document and in the *Standard Operating Procedure for Managerial Review.* Results of this review are incorporated into the laboratory's planning system and include goals, objectives and action plans for the coming year. Findings from this review are recorded and any actions are carried out within an appropriate and agreed upon timescale. Management shall ensure that appropriate communication processes are established within the laboratory and that communication takes place regarding the effectiveness of the management system.

Table 14-1

ACCREDITATIONS AND REGISTRATIONS

- American Industrial Hygiene Association (AIHA)
  Industrial Hygiene Laboratory Accreditation Program Laboratory
  Laboratory # 101661
- State of California, Department of Health Services, National Environmental Laboratory Accreditation Program (NELAP)
  Certification No. 02115CA
- State of New York, Department of Health
  Environmental Analyses/Air and Emissions (NELAP)
  Laboratory ID No. 11221
- State of Arizona, Department of Health Services
  License No. AZ0694
- State of New Jersey, Department of Environmental Protection (NELAP)
  Laboratory ID: CA009
- State of Oregon, Environmental Laboratory Accreditation Program (NELAP)
  Laboratory ID: CA200007
- State of Florida, Department of Health (NELAP)
  Laboratory ID No.: E871020
- Department of the Navy, Naval Facilities Engineering Service Center, Navy Environmental Restoration (ER) Quality Assurance (QA) Program
- Commonwealth of Pennsylvania, Department of Environmental Protection Bureau of Laboratories
  Registration Number: 68 3307

Note 1: Refer to Attachment E for the corresponding Certificates and Scope of Accreditations/Parameters.
Note 2: This Quality Assurance Manual is revised annually and the Certificates, Scope of Accreditations/Parameters are revised annually (where necessary). During this interim period Certificates may expire and the Scope of Accreditations/Parameters may change; therefore, these may not be updated until the annual revision. However, current Certificates and Scope of Accreditations/Parameters are on file and are on display in the front lobby. Updated accreditation documentation is also available upon request.

15.0 INSTRUMENTATION AND INSTRUMENT MAINTENANCE

All equipment is properly maintained, inspected and cleaned and all maintenance activities documented and retained on file. The laboratory furnishes all items of equipment required for the correct performance of tests. No instruments, outside the permanent control of CAS/SIMI, are used for sample analyses. Each item of equipment and its software that is significant to the results are uniquely identified and records maintained. All instructions and manuals regarding the use and operation of all relevant equipment are maintained and are readily available to personnel.

15.1 Instrument Maintenance / Preventive Maintenance

Preventive maintenance is a crucial element of the Quality Assurance program. Instruments at CAS/SIMI (e.g., GC/MS systems, gas and liquid chromatographs, etc.) are maintained by qualified, in-house personnel or outside service supplier, where necessary. All instruments are operated and maintained according to laboratory procedures and instrument operating manuals.

The preventive maintenance schedules are based primarily on manufacturer guidance, literature recommendations, and the experience of our analysts and supervisors. Some maintenance is performed as an integral part of each procedure (e.g., changing the injection port septum in GCs). Other preventive activities and maintenance schedules are followed as closely as possible, balancing between the workload and the urgency of the need for preventive maintenance (e.g., changing oxygen traps on GC's). Common sense and familiarity with the performance of each instrument will dictate whether the schedule needs to be advanced or delayed for that instrument. Trends within and excursions from control limits for QC sample results are monitored to determine if there is an instrument malfunction, and in such cases preventive maintenance is provided on an as-needed basis.

The Laboratory Manager has the responsibility for ensuring that all maintenance is performed. In the case of non-routine repair of capital equipment, the Laboratory Manager is responsible for providing repair, either by assigning the repair to a qualified analyst or by acquiring on-site manufacturer repair. Preventive maintenance procedures, frequencies, etc. are available for each instrument used at CAS/SIMI and are listed in Table 15-1, method SOPs or in the operating or maintenance manuals provided with the equipment at the time of purchase.

15.2 Documentation

All routine and special maintenance activities pertaining to the instruments are recorded in instrument maintenance logbooks. The maintenance logbooks used at CAS/SIMI contain extensive information about the instruments used at the laboratory.

Instrument downtime is minimized by keeping adequate supplies of all expendable maintenance items, where "expendable" means an expected lifetime of less than 1 year. A list of these items

includes gas tanks, gas line filters, syringes, septa, GC columns and packing, ferrules, printer paper and ribbons, pump oil, jet separators, and MS filaments. When performing maintenance on an instrument (whether preventative or otherwise), information about the problem, attempted repairs, etc. is also recorded in the notebook. Typical logbook entries include the following information:

- Details and symptoms of the problem
- Repairs and/or maintenance performed
- Description and/or part number of replaced parts
- Source(s) of the replaced parts
- Analyst's signature and date
- Demonstration of return to analytical control

Each instrument must be recalibrated following any instrument maintenance which may change or effect the sensitivity or linearity of the instrument or if the continuing calibration verification acceptance criteria have not been met as specified in the standard operating procedure. However, if an instrument is modified or repaired, a demonstration of return to analytical control is required before subsequent sample analyses can continue. Any instrument that cannot be repaired by maintenance procedures and has been shown to be defective is taken out of service.

15.3 New Instrumentation

An initial demonstration of analytical control is required on every instrument used at CAS/SIMI before sample analyses may begin and generally includes at a minimum an initial calibration and method detection limit or desorption efficiency study. When an instrument is acquired by the laboratory, the following information is noted in a bound maintenance notebook specifically associated with the new equipment:

- CAS/SIMI Instrument Identification No.
- Manufacturer’s name, model identification, and serial number or other unique
- Date the equipment was received.
- Major components associated with the instrument; e.g., autosampler or purge and trap units.
- Date the equipment was placed into service.
- Condition of equipment when received (new, used, reconditioned, etc.)
- Prior history of damage, malfunction, modification or repair (if known).

15.4 Out of Service Instruments

Samples are not analyzed on any instrument that is in need of repair. Any instrument that has been shown by verification or otherwise to be defective is taken out of service, clearly identified and wherever possible stored at a specified place until it has been repaired. All maintenance must be complete and the instrument either successfully calibrated or the calibration verified prior to the analysis of samples.

15.5 Contingency Plan for Analytical Emergencies

For most major analytical instruments in the organic department, the laboratory has at least one backup piece of identical instrumentation. This enables the laboratory to continue analytical work in that specific area while repairs are performed. In addition to the redundancy in instruments, the laboratory has the ability to off-load samples to other CAS laboratories if necessary.

TABLE 15-1

PREVENTIVE MAINTENANCE PROCEDURES		
Instrument	**Activity**	**Frequency**
Gas Chromatographs	Replace septum	As required
	Check system for gas leaks	With cylinder change/Open system
	Check for loose/fray wires and insulation	As required
	Replace injection port liner	As required
	Replace trap(VOA)	As required
	Polish PID lamp	As required
	Change PID O-rings	As required
	Clean PID lamp window	As required
	ECD wipe test	Every 3 years
	Replace ECD source	As required
	Clean FID	As required
	Hall detector electrolyte charge	As required
	Clean Hall detector cell	As required
	Replace Hall detector reactor tube/Teflon connecting tube	As required
	Change TCD assembly	As required
	SCD – Change reaction tube	As required
	FPD – Replace O-ring seal	As required
	PDD – Check for leaks	Annually
	Catalyst check	
GC/MS	Change Semi-VOA capillary column	Every 2 months or as required
	Change Semi-VOA injection port septum	As required
	Change Semi-VOA injection port liner	As required
	Replace trap (VOA)	As required
	Clean ionizer source	As required
	Change filament	As required
	Clean quadrupole rods	As required
	Adjust quadrupole rods	As required
	Change electron multiplier	As required
	Vacuum System: • Mechanical pumps: change oil, change trap pellets (HP only) • Diffusion pump: check oil • Turbo pump: change oil, check cooling fan	 Check every 6 months, check level monthly, change if necessary Annually, change as required As required
	Air Preconcentrators/Autosampler: • Change traps	 As required
	Computer System: • Clean cooling fans • All PCBAs: reseat boards, cables	 Quarterly As required

TABLE 15-1 (Continued)

PREVENTIVE MAINTENANCE PROCEDURES		
Instrument	**Activity**	**Frequency**
Purge and Trap Concentrators	Change trap Change transfer lines Clean purge vessel	As needed As needed As needed
HPLC	Replace/clean check valve filter Replace lamp UV/vis detector Replace flow cell Check flow	As required As required As required Quarterly
Analytical Balances	Clean pan and compartment Check with Class "S" traceable weights Field service	Prior to and after use Prior to use Annually
Refrigerators and Freezers	Monitor Temperature Adjust Temperature Clean	Daily As required As required
Ovens	Clean	As needed or if temperature is outside limit
pH probes	Condition probe	When fluctuations occur
Fluoride SIE	Store in storage solution	Between uses
Ammonia SIE	Store in storage solution	Between usees
UV-visible Spectrophotometer	Wavelength check	Annually
Ion Chromatographs	Change column bed supports Clean column Change column Change valve port face & hex nut Clean valve slider Change tubing Eluent pump	Monthly or as needed Monthly or as needed Every six months or as needed Every six months or as needed Every six months or as needed Annually or as needed Annually
Restek Thermal Gas Purifier	Check getter tube	Monthly, change as required

16.0 CORRECTIVE ACTION

Applicable problems, as well as the corresponding corrective actions taken, are documented on Nonconformity and Corrective Action Reports (NCAR) as a means to investigate and prevent recurrence (See Figure 16-1, form may be revised assuming all current topics are included) following the requirements in the *Standard Operating Procedure for Nonconformity and Corrective Action Documentation.* This SOP describes a systematic procedure for the identification of nonconformities, investigation into the causes, the necessary actions to take, as well as the procedures for notifying affected parties. The laboratory has implemented general procedures to be followed to determine when departures from documented policies, procedures and quality control have occurred. These procedures include specifying responsibility for adhering to and implementing standard operating procedures, defining how an analyst shall treat unacceptable QC measurements and procedures for the documentation and review of subsequent corrective actions.

An evaluation of nonconforming work including its significance and acceptability is performed and if it is determined that it could recur or that there is doubt about the compliance of the laboratory's operations with its own policies and procedures, appropriate and immediate corrective action procedures are followed starting with the determination of the root cause. The corrective actions taken are to a degree appropriate to the magnitude and the risk of the problem and are based on the nonconformity assessment. If is determined that the nonconformity has put data into question, the Laboratory Manager along with the Quality Assurance Program Manager has the responsibility and authority to ensure the client is notified (in writing) within five business days and that any affected data is recalled, test reports are withheld, and/or the corresponding work is halted. It is also the responsibility of the Laboratory Manager and the Quality Assurance Program Manager to authorize any resumption of work once the appropriate corrective action has been taken and it has been determined that data is no longer affected.

Every laboratory employee has the responsibility to initiate the process to restore normal function to the system. Therefore, anyone who identifies a nonconformity or problem may initiate a corrective action. The Quality Assurance Program Manager reviews all corrective actions, ensuring that the appropriate personnel have taken effective corrective action. If a potential problem develops that cannot be solved directly by the responsible analyst, the supervisor, Project Manager, Laboratory Management and/or the Quality Assurance Program Manager may examine and pursue alternative solutions.

In general, corrective action may take several forms and may involve a review of the calculations, a check of the instrument maintenance and operation, a review of analytical technique and methodology, and reanalysis of quality control and field samples. The NCAR form is electronically completed and approved and is utilized for all corrective action documentation including errors, deficiencies, deviations, laboratory events, or data that falls outside of established acceptance limits and their resolutions. The original form is printed and added to the raw data file of each affected job, if applicable and a copy is filed with the QAPM and other job files, where necessary. The QAPM periodically reviews all NCARs looking for chronic, systematic problems that require a more in-depth investigation and alternative correction action

consideration. The Quality Assurance Program Manager is also responsible for initiating corrective actions due to a performance audit, check sample problem or internal or external audit finding (Refer to the *Standard Operating Procedure for Conducting Internal Laboratory Audits* for the corrective action report form).

Each method standard operating procedure provides acceptance criteria and specific protocols for corrective actions for the method in question. In addition, the laboratory has implemented general procedures to be followed to determine when departures from documented policies, procedures and quality control have occurred. These procedures include but are not limited to the following:

1. Each QC data type is assessed by the performing analyst and the associated secondary reviewer;
2. The analyst, secondary reviewer and Team Leader are responsible for initiating and/or recommending corrective actions. The Quality Assurance Program Manager may recommend specific corrective actions;
3. Each standard operating procedure defines how the analyst must treat a data set if the associated quality control measurements are unacceptable;
4. The documentation of out-of-control situations and subsequent corrective actions are specified in this section (16.0), the *Standard Operating Procedure for Nonconformity and Corrective Action Documentation*, and each method SOP;
5. The supervisor (Team Leader), of the employee initiating the report, and QAPM reviews all nonconformity and corrective action reports for correctness, completeness including the extent and significance of the nonconformity, root cause analysis and the corrective action for acceptability measures.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s) and/or case narrative explanations.

16.1 Root Cause Analysis

Each investigation (root cause analysis) is different and is due to the type and source of the nonconformance, complexity of the problem and the range of impact. No data shall be reported until the root cause or causes have been determined and corrected or it has been demonstrated that the issue was random and that data is no longer affected. The procedure for determining root cause is dependent upon five basic areas and these areas are the primary cause for nonconformities and include personnel, samples, methods, controls and data. Depending upon the source of the nonconformance each one of these areas may need to be addressed and determined if any or all, had a contributing affect on the nonconformance. This is done on the NCAR, whenever possible. There are some cases where the nonconformance was beyond the control of the laboratory and this case is noted on the form. The chart presented below and the accompanying points are not intended to be all inclusive but to give guidance to the

investigator(s). The nature of the matter requiring corrective action will dictate the starting point in the investigation.

Work Flow

A - Personnel	B - Sample	C - Method	D - Controls	E - Data
Policies	Log-in	Validation	Preparation	Sample Trail
Procedures	Routing	Reagents	Handling/Storage	Logbook entries
Training	Storage	Instrumentation	Control Charts	Calculations
				Software
				Final Report

A. Personnel

- Interviews: Interviewing all employees involved in the work associated with the affected sample(s) is a key element of the investigation.
- Training: What was the level of expertise of the staff members involved in the matter under investigation? Could any training or skill deficiencies be a causal factor?

B. Sample

- Were all minimum sample receipt criteria met? Was anything unusual about the sample(s) noted upon receipt?
- Log-in: Check for discrepancies in the log-in records. Can the paperwork received with the sample(s) be reconciled with the log-in?
- Routing: Was the sample split or simply transferred from one employee to another? If split, was there a written procedure (record?)? If transferred, is the chain of custody intact? Were analyses performed by two or more units within the laboratory?
- Storage: Were the sample(s) stored properly upon receipt and up to the time of analysis?

C. Method

- Was the technical procedure followed? Are there deficiencies in the procedure as written?
- Validation: Review records compiled during the validation of the method? Have any of the established method parameters changed over time?
- Reagents: Check the preparation of standards, QC check of reagents and any test supplies having a critical impact on the test results.
- Instrumentation: Were the calibration procedure requirements carried out? If the event under investigation is occurring over a given time period, it is important to look back into the calibration history of the instrument. Review the instrument logbook records.

D. Controls

- Critically review all aspects of the QC data itself.
- Preparation: Review all preparation steps for the controls, e.g. if a spike was used, was the spiking procedure followed?

- Handling/Storage: Were control material(s) properly stored prior to use. Are there storage issues regarding the control samples during the analysis time frame? Had any control materials expired?
- Control Charts: Review the raw data and its transfer to the control charts carefully. Check the formulae embedded within the spreadsheet for automatic calculations.

E. Data

- Review the raw data carefully. Transcription or transposition errors can be culprits.
- Sample Trail: Check for gaps from sample receipt until the final report was issued.
- Logbook entries: Can the history of the sample be reconstructed from the logbook(s) used?
- Calculations: Recheck the calculations.
- Software: Insure the integrity of the formulas used for computer calculation steps.
- Final Report: Is all the information provided on the final report accurate? Are there any inconsistencies between the final report and the analytical history traced via the investigation?

16.2 Preventive Action

The identification of needed improvements, continual improvements and potential sources of nonconformance, either technical or concerning the quality system, are identified through a number of avenues including but not limited to managerial reviews, audits (both internal and external), client feedback and input from laboratory personnel. Additionally, this procedure involves the evaluation of analytical data, control charts (including any trends), proficiency test results, complaints and results from blind samples. If it is deemed necessary based on information provided, the laboratory shall develop an action plan, which will be implemented and monitored to reduce the likelihood of the occurrence. The procedure for preventive action includes a manner with which to determine the effectiveness of preventive action by monitoring the area in which the action occurred such as analytical data, control charts, proficiency test results and/or performing an internal audit (by the Quality Assurance Program Manager). Documentation may include the use of a Nonconformity and Corrective Action form or some other form or report as long as all documentation and outcomes are noted and approved.

Figure 16-1
Nonconformity and Corrective Action Report (CAS/SIMI)

CLIENT AFFECTED / JOB(S) / SAMPLES / SYSTEMS **NCAR No.:**_____

NONCONFORMITY

Procedure (SOP Affected): _____ Instrument/System: _____ Event Date: _____

EVENT: □ Missed Hold Time □ QC Failure □ Leaking Canister □ Pressurization Error □ Other

Detailed Description:

Originator: _____ Date: _____

CORRECTIVE ACTION AND IMMEDIATE ACTION TAKEN

Re-establishment of conformity must be demonstrated and documented. Describe the steps that were taken, or are planned to be taken to correct the particular Nonconformity and prevent its reoccurrence.

Immediate Action:
□ Flag Affected Data □ Revise Report □ Note in Case Narrative □ Other: _____

ROOT CAUSE ANALYSIS

□ Calculations □ Human Error □ Instrumentation □ Lab Control Charts □ Policies and/or Procedures □ Training
□ Sample Documentation □ Sample Log-in □ Sample Preparation □ Sample Storage □Software/Templates □ Other

Detailed Description:

NONCONFORMITY NOTIFICATION AND APPROVAL/ACCEPTANCE OF CORRECTIVE ACTION

Supervisor Notification & Approval of Corrective Action _____ Date_____

PM Notified? □ NO □ YES Customer Notified by □ Telephone □ Email □ Fax □ Narrative □ Not notified

Project Manager: _____ Date: _____ Comments:_____

_____

QUALITY ASSURANCE PROGRAM MANAGER - ASSESSMENT AND APPROVAL:

Error: □ Random □ Systematic Is Data Affected? □ Yes □ No Is Data Acceptable? □ Yes □ No
Is Corrective Action required, implemented and determined to be effective? □Yes □No □ NA

QAPM Verification and Approval of Corrective Action _____ Date: _____

Comments: _____

_____

17.0 PERSONNEL TRAINING

All laboratory employees, including part-time, full-time and contracted support personnel, whether employment is technical or key support, the laboratory ensures that such personnel are supervised and competent and that they work in accordance with the laboratory's quality system. When any staff member is undergoing training, appropriate supervision is provided. The training program is set up in such as way as to be relevant to both present and anticipated tasks of the laboratory. Evaluations of the effectiveness of training actions include but are not limited to the acceptance of quality control samples, initial and continuing proficiencies and PT samples.

17.1 Qualification

Technical position descriptions are available for all employees, regardless of position or level of seniority. These documents are maintained by the Human Resources personnel and are available for review. In order to assess the technical capabilities and qualifications of a potential employee, all candidates for employment at CAS/SIMI are evaluated, in part, against the appropriate technical job description. Any previously acquired skills or abilities of a new employee are entered into the database at the beginning of their tenure with CAS/SIMI. The Human Resources personnel also record the various technical abilities of all employees via a centralized database, and all skills acquired by an employee while in the employment of CAS/SIMI are added to the employee's permanent file. Information in the database includes the employee's name, a description of the skill including, where appropriate, the method reference, and the date the training was completed.

17.2 Employee Orientation

There is an employee orientation program given to every new employee. The program consists of the review of the Employee Handbook on the first day of employment which includes business ethics, confidentiality, conflict of interest and the laboratory's open door policy. Every employee is required to sign the Handbook Acknowledgment Form after reading the Employee Handbook. In addition, new employees are required to review and sign both the CAS Holdings Inc. Confidentiality and Conflicts of Interest Employee and Commitment to Excellence in Data Quality Agreements at the beginning of employment and every year there after. The Quality Assurance Program Manager provides a thorough quality assurance program orientation to each new employee, regardless of position, which includes overviews of the quality assurance program, policies and procedures, documentation practices and an understanding and compliance of the quality assurance manual, which they are required to read.

17.3 Initial and Continuing Proficiency

Training begins the first day of employment at CAS/SIMI when the company policies are presented and discussed. In addition, the new employee must become familiar with all

applicable administrative procedures, ethical behavior (refer to Section 6.0 for additional information) and the contents of this document. Training in analytical procedures typically begins with the reading of the standard operating procedure for the method they are expected to carry out. Hands-on training begins with the observation of an experienced analyst performing the method, followed by the trainee performing the method under close supervision, and culminating with independent performance of the method on quality control samples. A periodic demonstration of proficiency is required to demonstrate and maintain qualification, as described in the *Standard Operating Procedure for Documentation of Training.* However, documented demonstrations of proficiency are required every six months for those analysts which perform analyses associated with the laboratory's American Industrial Hygiene Association (AIHA) accreditation. Once training is complete the Quality Assurance Program Manager and/or the Laboratory Manager will document the authorization of certain personnel to perform specific analyses and operate any associated equipment as well as those personnel performing other critical job functions.

CAS/SIMI encourages its personnel to continue to learn and develop new skills that will enhance their performance and value to the Company. Ongoing training occurs for all employees through a variety of mechanisms. The "CAS University" education system, external and internal technical seminars and training courses, laboratory-specific training exercises and performance of external (independent) performance testing (PT) sample analyses are all used to provide employees with professional growth opportunities. Training records are kept in a file created for each employee. This file is kept and maintained in accordance with the guidelines contained in the *Standard Operating Procedure for Documentation of Training.* The department supervisor and other personnel, where appropriate, are responsible for the training and documentation of training activities. Also, the QAPM is responsible for maintaining employee training record files including those for both method and administrative procedures.

17.4 Environmental Health and Safety

Safety and QA/QC requirements are integral parts of all technical SOPs and, consequently, are integral parts of all training processes at CAS/SIMI. Safety training begins with the reading of the *Environmental, Health and Safety Manual*. All employees must receive a safety orientation, which includes a safety tour of the laboratory. In addition, technical employees are required to attend quarterly safety training sessions during which the various aspects of laboratory safety are discussed.

17.5 Training Needs

The policy for CAS/SIMI is to identify the ongoing training needs of all laboratory personnel and to provide relevant training with respect to continuing requirements of the laboratory. The identification of these needs is determined based on findings from proficiency testing, internal audits, external audits and managerial reviews (refer to Section 14.3), evaluations of industry including the volume and type of work undertaken, corrective actions, and personnel changes.

18.0 REFERENCES

The analytical methods used at CAS/SIMI generally depend upon the end-use of the data. Since some work involves the analysis of vapor phase samples for regulatory purposes, specified federal and/or state testing methodologies are used and followed closely. Several factors are involved with the selection of analytical methods to be used in the laboratory. These include the method detection limit, the concentration of the analyte being measured, method selectivity, accuracy and precision of the method, the type of sample being analyzed, and the regulatory compliance objectives. Typical methods used at CAS/SIMI are taken from the following references. In addition, applicable policies, quality standards and other reference documents have been included which are utilized as references for method performance and the continued maintenance of the laboratory's quality system.

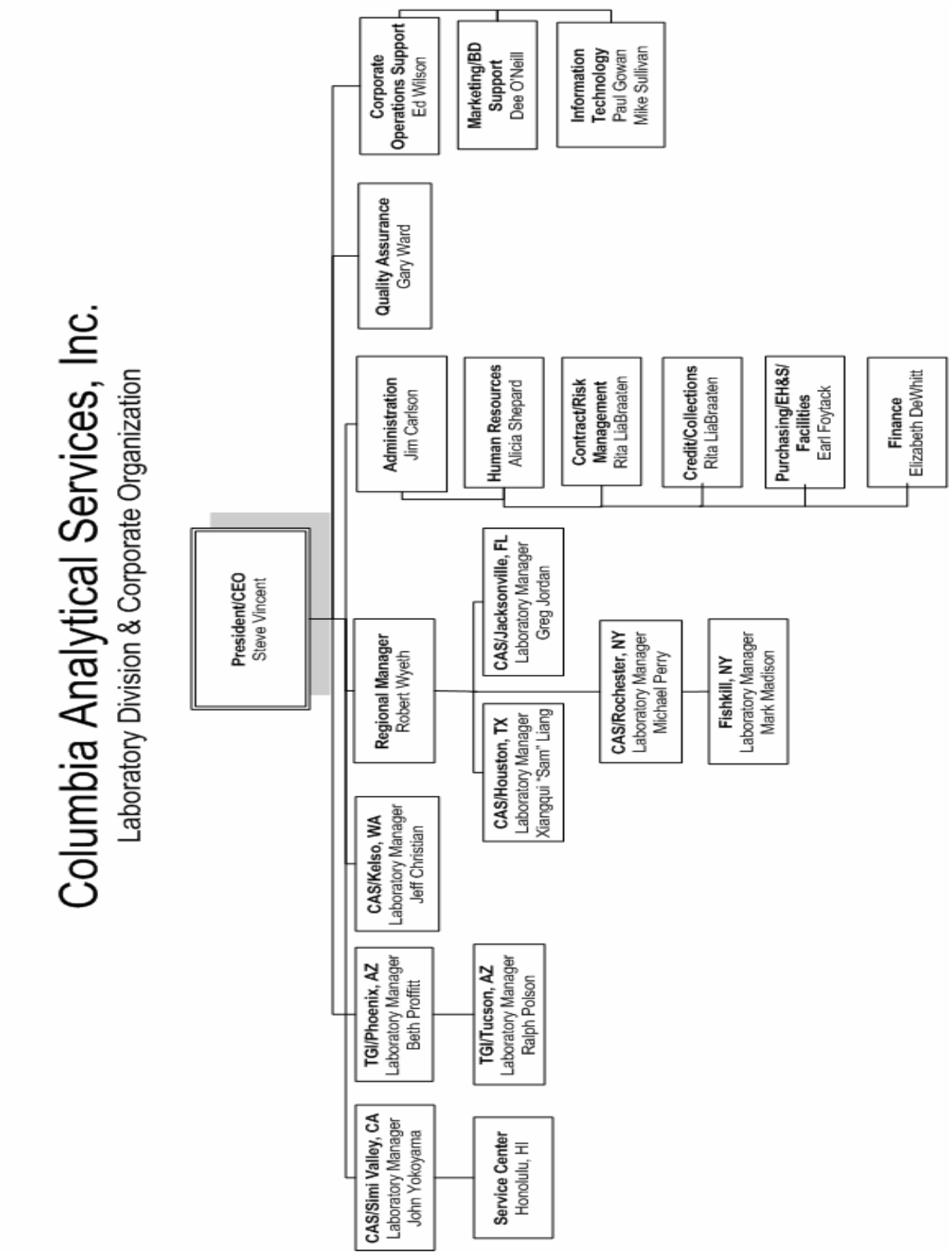
- 3M Organic Vapor Monitor Sampling and Analysis Guide, *Organic Vapor Monitors 3500/3510 and Organic Vapor Monitors 3520/3530*, September, 1996.
- 40 CFR Part 60, Test Methods for Standards of Performance for New Stationary Sources, Appendix A.
- 40 CFR Part 63, Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, Appendix A.
- 40 CFR Part 63, National Emission Standards for Hazardous Air Pollutants for Source Categories, Subchapter C.
- 40 CFR Part 136, Definition and Procedure for the Determination of the Method Detection Limit, Appendix B
- American Industrial Hygiene Association, *LQAP Policy Modules,* Effective Date: April 1, 2007.
- American Society for Testing and Materials (ASTM), *Gaseous Fuel, Coal and Cok*e, Volume 05.06, September 2006.
- American Society for Testing and Materials (ASTM). *Annual Book of ASTM Standards*. Part 31, "Water." Philadelphia, Pennsylvania. 1981.
- American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Philadelphia, PA.
- Arizona Administrative Code*, Department of Health Services – Laboratories,* Title 9, Ch. 14, Article 6. *Licensing of Environmental Laboratories,* R9-14-601 through R9-14-621, December 31, 2006 (Supp. 06-4).
- California Department of Health Services. *California Department of Health Services Leaking Underground Fuel Tank Field Manual*. May 1988.
- California Environmental Protection Agency Air Resources Board*, Methods for Determining Emissions of Toxic Air Contaminants from Stationary Sources,* Volume 3, July 28, 1997.
- *Department of Defense Quality Systems Manual for Environmental Laboratories*, DoD Environmental Data Quality Workgroup, Final Version 3, January 2006.
- Environmental Protection Agency, Methods Update Rule (MUR), Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; National Primary Drinking Water Regulations; Analysis and Sampling Procedures, Final Rule 3/12/07, Effective April 11, 2007.

- Environmental Protection Agency, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, 1986 and Updates I (7/92), II (9/94), III (12/96), IIIA (4/98), and IIIB (11/04). See Chapters 1, 2, 3, 4, 5, 6, and 8.
- Environmental Protection Agency, "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act." *Federal Register, 40 CFR Part 136*; April 11, 2007.
- Environmental Protection Agency, "*Methods for the Determination of Metals in Environmental Samples*", Publication No. EPA-600/R-94-111, 1994.
- Environmental Protection Agency, *Methods for Chemical Analysis of Water and Wastes,* EPA-600/4-79-020, 1983.
- Environmental Protection Agency, *Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA 600/R-93-100, August 1993.
- Environmental Protection Agency*, EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*, Second Edition, EPA/625/R-96-010b, January 1999.
- Environmental Protection Agency*, EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*, Second Edition Addendum, October 4, 2000.
- *Good Automated Laboratory Practices, Principles and Guidance to Regulations For Ensuring Data Integrity In Automated Laboratory Operations*, EPA 2185, August 1995.
- HQ Air Force Center for Environmental Excellence, Technical Services Quality Assurance Program, Guidance for Contract Deliverables, Appendix C: Quality Assurance Project Plan (QAPP), Final Version 4.0.02, May 2006.
- *Identification and Listing of Hazardous Waste,* California Code of Regulations, Title 22, Division 4.5, Chapter 11.
- ISO/IEC 17025:2005(E), *General Requirements for the Competence of Testing and Calibration Laboratories,* Second Edition 2005-05-15.
- National Environmental Laboratory Accreditation Conference, *Quality Standards Chapters 1-5,* June 5, 2003.
- *National Institute for Occupational Safety and Health (NIOSH) Manual of Analytical Methods*, U.S. Department of Health and Human Services, Third Edition (August 1987), Fourth Edition (August 1994).
- *NCASI Methods Manual,* July 2000.
- *SKC 575 Series Passive Sampler Rate/Selection Guide*, Form #37021, Rev 0012.
- *Standard Methods for the Examination of Water and Wastewater,* Twentieth Edition. 1998.
- *Standard Methods for the Examination of Water and Wastewater*. Nineteenth Edition. September 1995.
- South Coast Air Quality Management District, *Laboratory Methods of Analysis for Enforcement Samples*.
- U.S. Department of Labor, Occupational Safety and Health Administration *OSHA Analytical Methods Manual*.

APPENDIX A

ORGANIZATIONAL OUTLINE & RESUMES OF KEY PERSONNEL

Columbia Analytical Services, Inc.
Simi Valley, California Laboratory Organization



RICHARD B. ADAMS

2006 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position	**SYSTEMS ANALYST/PROGRAMMER** – 2006 to Present
Responsibilities	Responsible for coordination of local laboratory information systems implementation, computer systems, electronic data archiving, e-mail functions, and instrument analysis software. Also responsible for client spreadsheets and disk deliverables and computer maintenance/upgrades. Support on site personnel with their data processing needs (hardware and software) to produce hardcopy and electronic data deliverables.
Experience	**Systems Analyst/Programmer IV,** *Columbia Analytical Services, Inc., Canoga Park, CA,* 2001-2006. Responsible for computer systems, electronic data archiving, e-mail functions, and instrument analysis software. Also responsible for client spreadsheets and disk deliverables and computer maintenance/upgrades. Support on site personnel with their data processing needs (hardware and software) to produce hardcopy and electronic data deliverables. **Manager, Information Systems,** *Polymer Engineering Corp., Oxnard, California,* 1999-2001. Responsibilities included NT network management (WAN/LAN); selected computer-related equipment and contractors for all facilities; performance client and server hardware upgrades/repairs; software installation; created databases necessary for documentation; and maintained data security back-up functions. Trained personnel on software in use, and supervised the Document Control Department. **QC Manager,** *Polymer Engineering Corp., Oxnard, California,* 1995-1999. Responsible for product delivery system design and evaluation; involved with ISO 9000 implementation and documentation. Also responsible for computer and laboratory instrument troubleshooting, supervision of six employees and documentation control. **Environmental Lab Supervisor,** *Ventura Regional Sanitation District, Ventura, California,* 1989-1994. Responsible for all laboratory operation, including data review, method development, quality, troubleshooting, and budget. **Inorganic Lab Supervisor,** *ENSECO/CRL, Venture, California,* 1985-1989. Responsible for workload distribution, development and management of LIMS, data review, method development, instrument installation, and performance of non-routine tests.
Education	**CERTIFICATE, Microsoft Office'97,** *New Horizons Computer Learning Center, Thousand Oaks, California,* 1999. **CERTIFICATE, MCSE Track,** *New Horizons Computer Learning Center, Thousand Oaks, California,* 2000. **BS, Chemistry,** *California State College, San Bernardino, California,* 1977.

UNCONTROLLED COPY

KATHLEEN "KATE" AGUILERA

1989 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position	**PROJECT MANAGER** – 1997 to Present
Responsibilities	Responsibilities include interfacing with clients to provide technical project management and customer service, including project scheduling, tracking and consulting to determine appropriate sampling and analytical protocols. Coordinates with the laboratory and administration to ensure that analyses are properly executed and meets the clients' needs.
Experience	**GC/MS Analytical Chemist,** *Columbia Analytical Services, Inc., DBA Performance Analytical Inc., Los Angeles, California,* 1994-1997. Analysis of air samples using EPA compendium methods TO-1, TO-2 and TO-14 using cryogenic concentration and thermal desorption techniques on whole air samples collected in summa canisters, Tedlar bags, and solid sorbent air samples. Proficient in the interpretation of mass spectra. Responsible for the preparation and quality control verification of solid sorbent sampling media for EPA Compendium methods TO-1 and TO-2. **GC/MS Analytical Chemist,** *Performance Analytical Inc., Canoga Park, California,* 1992-1994. Responsibilities listed above. **GC Analytical Chemist,** *Performance Analytical Inc., Canoga Park, California,* 1989-1992. Performed analyses of air samples for reduced sulfur compounds, hydrocarbon distribution and speciation, fixed atmospheric gases and total gaseous non-Methane organics. Performed analyses of soil and water samples for TPHg (mod. 8015) and BTEX. Performed extractions and analyses of CARB, NIOSH, OSHA and EPA 8000 series methods. Also performed metals analysis using flame and graphite furnace atomic absorption spectrophotometry (AA, GFAA).
Education	**BA, Chemistry,** *California State University – Northridge, Northridge, California,* 1989
Affiliations	American Chemical Society

SUSAN "SUE" M. ANDERSON

2006 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

PROJECT MANAGER / TECHNICAL MANAGER (GENERAL CHEMISTRY) - 2006 to Present

Responsibilities

Responsibilities include interfacing with clients to provide technical project management and customer service, including project scheduling, tracking and consulting to determine appropriate sampling and analytical protocols. Coordinates with the laboratory and administration to ensure that analyses are properly executed and meets the clients' needs. Also responsible for the training of general chemistry staff, maintenance of MDL studies and standard operating procedures, data evaluation and report responsibility.

Experience

Technical Manager, General Chemistry, *Columbia Analytical Services, Inc., Canoga Park, CA*, 2002-2006. In addition to the Project Manger duties listed below, also responsible for the management of General Chemistry laboratory operations, including the financial aspects. This includes supervision and coordination of work load and training personnel as necessary as well as supervision of method development and certification, method troubleshooting, and instrument maintenance. Also responsible for training staff, maintenance of MDL studies & SOPs, data evaluation and report responsibility. Other duties include participation in the formulation of project strategy and meetings involving major technical issues, working with regional senior management in short- and long-range planning, and other duties as assigned.

Project Manager II, *Columbia Analytical Services, Inc., Canoga Park, California,* 2000-2002. Responsibilities include interfacing with clients to provide technical project management and customer service, including project scheduling and tracking from the delivery of sample bottles to client site to the delivery of the completed analytical report. Ensures that the client receives timely, appropriate, and quality analytical services. Coordinates with the CAS laboratory and administration to ensure that analyses are properly executed and meet the clients' needs. Coordinates sub-contracting with internal and external laboratories. Acts as a liaison for all client-related activities within Columbia Analytical Services, Inc. Interfaces with word processing staff to answer technical questions that arise during EDD completion. Has high level role in data evaluation and report responsibility. High level client and regulatoryagency contact.

Scientist I-III, *Columbia Analytical Services, Inc., Canoga Park, California,* 1992-2000. Responsible for performing inorganic analyses such as: alkalinity, ammonia, BOD, COD, cyanide, sulfide, reactivity, fluoride, pH, hardness, hexavalent chromium, phenols, surfactants, total-dissolved-suspended solid, conductivity, turbidity, nitrate, chloride by titration, turbidimetric sulfate, color, odor, organic lead, residual chlorine, settleable solids, specific gravity, carbon dioxide, TCLP/STLC metals and semi-volatile extraction. Also perform analyses for TRPH and oil and grease and occasionally perform metals digestion. Also ran the Graphite furnace for all furnace metals and was responsible for standard prep and maintenance.

Wet Chemist, *National Environmental Testing, Bartlett, Illinois,* 1990-1991. Responsible for the analyses for wastewater parameters and some inorganic analytes.

Education

BS, Biochemistry, *University of Illinois, Urbana-Champaign, Illinois*, 1989.

WIDAYATI "WIDA" ANG

2007 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

CHEMIST - 2007 to Present

Responsibilities

Analyzing indoor air, ambient air and source emission samples by GC/MS methods, standard preparation, perform maintenance on instruments when required, real time data reduction, participate in peer review process, and good practice of all QA/QC requirements.

Documentation of Demonstration of Capabilities is available for review.

Experience

Technical Manager, Organic Chemistry, *Columbia Analytical Services, Inc., Canoga Park, CA, 1999-2007*. Responsible for managing the organics department with regards to State and Federal regulatory requirements. Supervises and coordinates work load and trained personnel. Supervised method development and certification, as well as method troubleshooting and instrument maintenance. Responsible for mobile laboratory operations.

Data Validation, *Laboratory Data Consultants, Inc., Carlsbad, CA 1998-1999.* Responsible for retrieving analytical data from closed down labotarory operations , review and validation of data packages. Supervised other employees for data package assembly.

Assistant Quality Control Manager & Data Package Specialist, *VOC Laboratories, Inc., Glendale, CA,* 1996-1998. Responsible for overseeing data quality of final data validation packages. Managed production of data packages to meet various State and Federal analytical programs as well as customized client formats. Oversaw enforcement of the laboratory for implementation of corrective action measure. Interacted with chemists and project managers to ensure accuracy and completeness of data deliverables.

Technical Director and Department Manager, *Thermo Analytical, Monrovia, CA,* 1992-1996. Responsible for daily operations of the organic chemistry department. Developed standard operating procedures for various methods. Revewed analytical data generated for completeness and contractual requirements according to Contract Laboratory Program (CLP) and SW-846 methods. Organized and scheduled reports for project managers. Responsible for upgrading and purchasing new instrumentation. Provided technical support to QC coordinator and laboratory personnel. Assisted with proposal preparation and audits.

Department Supervisor & Chemist, *Thermo Analytical, Monrovia, CA,* 1988-1992. Responsible for training chemist and technicians in proper performance of various analytical methods. Ensured that data produced by chemists was in compliance with standard operating procedures and contractual requirements. Responsible for sample analysis of water, soil and air for volatile organics by GC and GC/MS. Assisted chemists in the analysis and interpretation of pesticides and PCBs.

Analytical Chemist, *Shankman Laboratories, Los Angeles, CA,* 1986-1988. Prepared and analyzed soil and water samples using GC, GC/MS, HPLC, IR, IC and UV spectrophotometic techniques.

Education

BS, Chemistry, *Technical University of West Berlin, Germany*, 1984.

MS, Chemistry, *Technical Un*iversity of West Berlin, Germany, 1982.

ARISTOTLE B. BRAGASIN

2004 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

CHEMIST – 2004 to Present

Responsibilities

Analyzing indoor air, ambient air and source emission samples by GC/MS methods, standard preparation, perform maintenance on instruments when required, real time data reduction, participate in peer review process, and good practice of all QA/QC requirements.

Documentation of Demonstration of Capabilities is available for review.

Experience

Scientist II, GC/MS VOA Laboratory, *Columbia Analytical Services, Canoga Park, California, 1998-2004.* Responsible for Volatile GC/MS sample analysis of soil, groundwater and wastewater according to SW-846 Method 8260B and EPA 624. Utilize Tekmar 2016, OI Analytical DPM-16, and Archon autosampler, Tekmar 2000, 3000, and 3100 and OI Analytical 4560 concentrators, HP5890 and 6890 GC systems with HP 5971, 5972, and 5973 MSD's. Also responsible for reducing and reporting data according to standard operating procedures and contractual requirements. Perform TCLP-ZHE extractions, routine troubleshooting and instrument maintenance, and the storage and disposal of VOA samples. Review GAS/BTEX analytical data generated for completeness and contractual requirements according to SW-846 methods.

Analyst III, Sample Management Office, *Columbia Analytical Service, Inc., Canoga Park, California*, 1996-1998. Duties primarily as listed below.

Analyst II, Sample Management Office, *Columbia Analytical Services Inc., Canoga Park, California*, 1995-1996. Primary responsibilities include logging samples and requested analyses, distribution of service request forms to each department, storage and disposal of samples, and shipment of samples to other laboratories. Logging jobs into the LIMS system.

Lab Technician, *Pace Inc., Camarillo, California,* 1995. Duties included extraction of cyanide and phenols via steam distillation. Determined amounts of cyanide, phenols, phosphorus, and nitrogen using Lachat Automated Analyzer. Determined amounts of oil and grease, total dissolved solids, total suspended solids, and bacteria in samples.

Laboratory Assistant, *Aerotek Lab Support, Gardena, California*, 1995. Cleaned and sterilized glassware in the protein chemistry department of Amgen Inc., Thousand Oaks, California.

Specimen Processor, *Olsten Staffing Services, Thousand Oaks, California*, 1994. Data entry of patient information and requested tests. Separated and labeled specimens for different departments at Physicians Clinical Laboratory, Newbury Park, California.

Education

BS, Biochemistry, *California Polytechnic State University at San Louis Obispo, San Louis Obispo,* California, 1995

RUSTICO "RUSTY" BRAVO

2004 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position	**CHEMIST**– 2004 to Present
Responsibilities	Analyzing indoor air, ambient air and source emission samples by GC/MS methods, standard preparation, perform maintenance on instruments when required, real time data reduction, participate in peer review process, and good practice of all QA/QC requirements. **Documentation of Demonstration of Capabilities is available for review.**
Experience	**Chemist,** *FGL Environmental, Santa Paula, CA,* 1995-2004. Primary operator of HP ICP/MS and Thermo ICP/MS; backup operator of TJA Trace ICP/AES and Leeman P5200; senior chemist of the Metals Department, supervising trace operator and sample prep technician; maintained and troubleshoot instrumentation and methodologies. **Chemist,** *Pace, Inc., Camarillo, CA,* 1992-1995. Primary operator of Varian AA and GFAA, and of Leeman PS200 Hg analyzer; backup operator of TJA Trace ICP/AES; sample prep of CARB and BIF trains.
Education	**B.S., Chemistry,** *University of Santo Tomas, Manila, Philippines,* 1986.

SIMON CAO

2007 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

CHEMIST– 2007 to Present

Responsibilities

Analyzing indoor air, ambient air and source emission samples by GC/MS methods, standard preparation, perform maintenance on instruments when required, real time data reduction, participate in peer review process, and good practice of all QA/QC requirements.

Documentation of Demonstration of Capabilities is available for review.

Experience

Chemist, *Columbia Analytical Services, Canoga Park, CA.* 2004-2006. Responsible for the analyses of base/acid/neutral (BNA) by EPA Method 8270C and low-level polyaromatic hydrocarbons (PAH) by EPA Method 8270C-SIM. Perform data reduction, data review, and reporting. In addition, also responsible for routine instrument maintenance and troubleshooting.

Inorganics Supervisor, *American Analytics, Chatsworth, CA. 2000-2004.* Supervised wet chemistry and metals departments; responsible for the daily operation of sample analyses and the quality of report generation. Methods in wet chemistry department included analytical techniques such as ion selective electrodes, colorimetric, photometric, and gravimetric. Metals analyses were performed on ICP, CVAA, and GFAA. Also responsible for instrument maintenance, troubleshooting, and the training of new chemists.

Analyst III, *Columbia Analytical Services, Canoga Park, CA. 1993-1999*. Responsible for the extraction of environmental samples, both aqueous and soil matrixes, for diesels, pesticides/PCB, BNA, and volatile analyses by GC and GC/MS. Performed diesel analysis by EPA Method 8015B and gasoline/BTEX analysis by EPA Methods 8015B/8021.

Education

BS, Pharmaceutical Science, *First Medical College of Shangai, Shanghai, China.* 1976.

UNCONTROLLED COPY

DAVID CASTILLO

2007 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position	**CHEMIST** – 2007 to Present
Responsibilities	Responsible for preparation and analysis of wet and general chemistry samples for turbidity, settleable solids, residue, ion selective electrode analyses (e.g., pH, nitrite, fluoride, and conductivity), hexavalent chromium, and other similar analyses. Additional responsibilities include standard preparation, instrument maintenance, and real time data reduction; participate in peer review process, and good practice of all QA/QC requirements. **Documentation of Demonstration of Capabilities is available for review.**
Experience	**Research Associate,** *University of Southern California, Los Angeles, CA.* 2004-2006. Responsible for tissue culturing mouse embryo fibroblast cells for cytotoxicity and genotoxicity assays. Ordered laboratory equipment, reagents and maintained equipment. Trained students in tissue culturing techniques. **Laboratory Ancillary Operations Technician,** *Los Robles Regional Medical Center, Thousand Oaks, CA.* 2003-2004. Responsible for data entry for laboratory patient demographics and test orders. Managed phone inquiry and facsimile responses to requests for laboratory service and reports. Performed pre-analytical processing of specimens sent to laboratory for testing.
Education	**M.S. Molecular Microbiology and Immunology,** University of Southern California, Los Angeles, CA, 2006 **B.S. Biochemistry,** California Lutheran University, Thousand Oaks, CA, 2004

LLESENIA CERCADO

2000 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position	**TECHNICIAN** – 2003 to Present
Responsibilities	Responsibilities include waste disposal, canister conditioning and preparation, fulfillment of media requests; shipping, occasionally receiving samples, and flow controller and critical orifice calibration and calibration checks. Additional responsibilities include coordination of canister maintenance and release and cleaning of canisters for field sampling, training within the department, sampling media inventory and pressure/vacuum gauge inventory and calibration checks between annual metrology calibrations.
Experience	**Technician,** *Columbia Analytical Services, Inc., Simi Valley, CA*, 2003-2006. Responsibilities include waste disposal, canister conditioning and preparation, fulfillment of media requests; shipping and occasionally receiving samples. Additional responsibilities include training within the department, of flow controller and critical orifice calibration and checks, sampling media inventory and pressure/vacuum gauge inventory and calibration checks between annual metrology calibrations. **Analyst II,** *Columbia Analytical Services, Inc., DBA Performance Analytical, Inc., Los Angeles, California*, 2000-2003. Responsibilities include preparation of samples using Soxhlet, shakeout and sonication extraction. Preparation of indoor air and industrial hygiene samples using solvent desorption. Gas Chromatographic screening of samples collected in Tedlar bags and summa canisters for volatile organic compounds
Education	**CERTIFICATE, Chemical Technology,** *Los Angeles Trade Technical College, Los Angeles, California,* 2000.

KU-JIH CHEN

1989 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position	**DIRECTOR OF TECHNOLOGY DEVELOPMENT** – 2000 to Present
Responsibilities	Responsible for the development and validation of new sampling and analysis methods, new technology and laboratory automation.
Experience	**Scientist VII,** *Columbia Analytical Services, Inc., DBA Performance Analytical, Inc., Los Angeles, California,* 1994-2000. Responsibilities included operating the Gas Chromatography and Sample Preparation Laboratories, developing methods (previously developed the Total Combustion Analyzer for the measurement of reactive organic gases in stationary source samples, and the Determination of Reduced Sulfur Compounds and fixed atmospheric gases in POTW emissions, refinery and landfill gases), and serving as the laboratory's primary Industrial Hygiene Chemist. **Principal Chemist,** *Performance Analytical, Inc., Canoga Park, California,* 1989-1994. Responsibilities listed above. **Extraction Laboratory Supervisor,** *C-E Environmental Inc., Camarillo, CA,* 1984-1989. Responsibilities included supervising chemists, associate chemists, and technicians, preparing SOP's, analytical standards, and spiking solutions, serving as Primary Extraction Chemist for the Love Canal Habitability Study, and previously responsible for instrumental analysis using GC, LC, GC/MS, and AA. **Research & Development Chemist,** *Paolyta Company, Taipei, Taiwan,* 1980-1984. **Research Chemist,** *Panlabs Taiwan Ltd., Taipei, Taiwan,* 1975-1980.
Education	**BS, Botany,** *National Chung-Hsing University, Taipei, Taiwan.*

MADELEINE DANGAZYAN

1999 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

CHEMIST, Semi-Volatiles Team Leader – 2002 to Present

Responsibilities

Team leader for the Semi-Volatile group responsibilities are but not limited to training of chemists, peer review of analytical data, mentoring of junior analysts, standard operating procedure review and streamlining of methods. Duties also require performance reviews and development of direct reports. Additional responsibilities are analyzing ambient air, source emissions, and industrial hygiene samples using GC and HPLC. Preparation and analysis of air samples taken on various sorbent tubes for semi-volatile organic compounds. Determination of Carbonyls, Phenols and Cresols in ambient air and source emission samples using HPLC. Routine and necessary instrument maintenance.

Documentation of Demonstration of Capabilities is available for review.

Experience

Chemist, *Columbia Analytical Services, Inc., Simi Valley, CA,* 1999-2002. Responsibilities included training of chemists, peer review of analytical data, mentoring of junior analysts, standard operating procedure review and streamlining of methods. Additional responsibilities are analyzing ambient air, source emissions, and industrial hygiene samples using GC and HPLC. Preparation and analysis of air samples taken on various sorbent tubes for semi-volatile organic compounds. Determination of Carbonyls, Phenols and Cresols in ambient air and source emission samples using HPLC. Routine and necessary instrument maintenance.

Analytical Chemist, *Air Products and Chemicals, Inc., Long Beach, California,* 1995-1999. Quality assurance analysis of EPA protocol gases utilizing GC, FTIR and NDIR. Preparation of personnel schedules, lead laboratory contact.

Undergraduate Research, *California State University at Northridge, Northridge, California,* 1993-1994. Assisted professor with improving and implementing student laboratory experiments to better utilize a GC/MS.

Education

BS, Chemistry, *California State University at Northridge, Northridge, California,* 1995.

ROBERT DE LA O

1990 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position	**SYSTEMS ANALYST** – 1995 to Present
Responsibilities	Responsible for generating reports, automating routine work and maintaining databases, electronic data archiving, e-mail functions. Also responsible for client spreadsheets and disk deliverables and computer maintenance/upgrades, generation and submission of client electronic data deliverables.
Experience	**Administrator III,** *Columbia Analytical Services, Inc., DBA Performance Analytical, Inc., Los Angeles, California,* 1990-1995. Responsible for logging samples in, generating reports and invoicing. Shipping and Receiving. **Assistant Manager,** *May Company, North Hollywood, California,* 1990. Responsibilities included: employee scheduling, inventory control and making sure items were well stocked and clearly priced. **Assistant Manager,** *Sears Roebuck and Company, North Hollywood, California,* 1985-1990. Supervised 10 Departments (approximately 50 employees). Responsibilities included: employee scheduling, hiring, customer service/complaints, and assisting with opening and closing the store daily.
Education	**COURSEWORK, Computer Science,** *Moorpark College, Moorpark, California,* 1999 to present **COURSEWORK, Business and Computer Science,** *Los Angeles Valley College, Van Nuys, California,* 1990-1998. **COURSEWORK, Business and Computer Science,** *California State University at Northridge, Northridge, California, 1987-1990.*

ROBIN GILL

1991 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

DATA VALIDATION COORDINATOR AND TEAM LEADER – 2002 to Present

Responsibilities

Team leader responsibilities are evaluation and approval of work shifts, vacation requests, training and mentoring new data validation team members, in addition to yearly performance reviews to evaluate job achievements. Data validation responsibilities are for data review and validation as well as data package compilation, job tracking, archiving and the production of laboratory reports. Interacts with project managers and Quality Assurance Program Manager to ensure that all reports fulfill client requirements as well as QA/QC needs. Also serves as a backup for case narrative generation and manages the turn around times so that reports are distributed to the clients in a timely manner.

Experience

Project Manager III, Quality Control Coordinator, *Columbia Analytical Services, Inc., DBA Performance Analytical, Inc., Los Angeles, California,* 1994-2002. Responsibilities listed above.

Project Manager III, Quality Control Coordinator, *Performance Analytical Services, Inc., Canoga Park, California,* 1991-1994. Primarily responsible for data review and validation as well as data package compilation. Also responsible for job tracking, archiving and the production of laboratory reports.

Data Group Supervisor, *ABB Environmental, Camarillo, California,* 1980-1991. Supervised five employees in the Data Group Department. Responsible for data review and validation, document control, data package compilation, job tracking and archiving, and the organization and prioritization of workload.

WADE H. HENTON

1994 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

CHEMIST, VOLATILE GAS CHROMATOGRAPHY TEAM LEADER – 2000 to Present

Responsibilities

Team leader for the Volatile Gas Chromatography group where responsibilities include but not limited to training of chemists, peer review of analytical data, mentoring of junior analysts, standard operating procedure review and streamlining of methods. Duties also require performance reviews and development of his direct reports.

Documentation of Demonstration of Capabilities is available for review.

Experience

Scientist V, *Columbia Analytical Services, Inc., DBA Performance Analytical, Inc., Los Angeles, California,* 1995-2000. Responsibilities include analyzing indoor and ambient air, source emission, and industrial hygiene samples by GC and GC/MS methods.

Scientist IV, *Columbia Analytical Services, Inc., DBA Performance Analytical, Inc., Los Angeles, California,* 1994-1995. Responsibilities listed above.

Analytical Chemist, *Coast to Coast Analytical Services, Camarillo, California,* 1992-1994. Responsibilities included analyzing samples using EPA methods 625, 525 and 1625 as well as developing new methods for GC/MS testing.

Analytical Chemist, *Coast to Coast Analytical Services, Goleta, California,* 1991-1992. Responsibilities included analyzing samples using EPA methods 624 and 524.2 by GC/MS. Used GC/MS methods to perform fuel fingerprinting.

Analytical Chemist, *Combustion Engineering Environmental, Inc., Camarillo, California*, 1986-1991. Responsibilities included method development for GC and HPLC. Analysis of samples using EPA methods 608, 615, 631, 632 and SW846. Other methods used include 8080, 8010, 8020, 8150 and 8030. Oversaw data integrity for the GC Laboratory instrument data network. Data review.

Chemist, *Fortin Industries, Sylmar, California,* 1986. Research and Development and Quality Assurance/Quality Control on polymer products and metal coatings using differential scanning calorimeters, scanning electron microscope, AA, GC, and HPLC.

Education

BS, Chemistry, *University of California at Santa Barbara, Goleta, California,* 1985.
COURSEWORK, Chemistry and General Education, *Ventura College, Ventura, California*, 1982-1983.
COURSEWORK, Chemistry and General Education, *Moorpark College, Moorpark, California*, 1981-1983.

KELLY M. HORIUCHI

2003 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

PROJECT MANAGER – 2005 to Present

Responsibilities

Responsibilities include interfacing with clients to provide technical project management and customer service, including project scheduling, tracking and consulting to determine appropriate sampling and analytical protocols. Coordinates with the laboratory and administration to ensure that analyses are properly executed and meets the client's needs.

Experience

Data Validation Coordinator, *Columbia Analytical Services, Inc., Simi Valley, CA,* 2003-2005**.** Responsibilities included validation of analytical results produced by the laboratory. Verification of client analytical requests, sample information, and reporting formats. Interacts with project managers and Quality Assurance Program Manager to ensure that all reports fulfill client requirements as well as QA/QC needs. Compiled quality control summary, and calibration data upon client request for data packages. Assist the Quality Assurance Program Manager with standard operating procedures, control charting, and audit preparation.

Database Analyst, *Cure Autism Now (Autism Genetic Resource Exchange), Los Angeles, California,* 2002-2003. Performed analysis of test date through data audits and queries, maintained extensive database, and coordinated data audits between Northern and Southern California locations. Additional duties included assisting in the creation of new databases, as needed, creation of SOP for phenotypic and genotypic data collecting, and process improvements for subject flow through the research project.

Scientist II, Data Validation Coordinator, *Columbia Analytical Services, Inc., DBA Performance Analytical, Inc., Simi Valley, California,* 2000-2002. Responsibilities included validation of all analytical results produced by the laboratory. Verification of client analyses, sample information, and reporting format. Compiled quality control summary, and calibration data upon client request for data packages. Assisted the Quality Assurance Program Manager with standard operating procedures, control charting, and audit preparation.

Administrative Assistant/Data Analyst, *Specialty Laboratories, Santa Monica, California,* 1999-2000. Performed retrieval, quality control, and organization of data. Compiled data for reporting of HIV, lead, urinalysis, kidney stones, and communicable diseases. Also communicated with the state DOH and clients regarding reporting requirements and demographic information.

Administrative Assistant, *Horvitz & Levy LLP, Encino, California,* 1991-1999. Report new cases to attorneys, check clients through conflict database, QC party information, maintain attorney calendars, and perform orientations of new attorneys.

Education

BA, Biology, *California State University at Northridge, Northridge, California,* 1998.

CHANEY HUMPHREY

2005 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

CHEMIST – 2005 to Present

Responsibilities

Analyzing indoor air, ambient air and source emission samples by GC/MS methods, standard preparation, perform maintenance on instruments when required, real time data reduction, participate in peer review process, and good practice of all QA/QC requirements.

Documentation of Demonstration of Capabilities is available for review.

Experience

Analyst I, *Columbia Analytical Service, Inc. Kelso, Washington,* 2004-2005. Performed a variety of analytical tests within the General Chemistry laboratory according to EPA Methodologies including Ion Chromatography, total sulfur, and solids. Saturday crew member responsible for performance of all short hold time methods including microbiology methodologies.

2002-2004. Temporary employee (summers) performing a variety of analytical tests including grain size, total organic carbon, total suspended solids, total dissolved solids, alkalinity, acidity, and chemical oxygen demand. Additionally, performed colorimetric methods including ortho-phosphorous, total-phosphorous, hexavalent chromium, and nitrite as nitrogen.

Toxicology Risk Assessment Procedure (ToxRap) Assistant, *Environmental Health Sciences Center, Oregon State University, 2001-2003.* Developed curriculum alignment for K-12 state benchmarks. Prepared workshop materials for K-12 grade teachers. Assisted in workshop presentations.

Education

BS, Biology, *Oregon State University, Corvallis, Oregon,* 2004

LONNIE KUKITA

2006 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

SAMPLE MANAGEMENT CUSTODIAN – 2006 to Present

Responsibilities

Primary responsibilities include logging in samples and requested analyses, coordination of local courier services, distribution of service request forms to each department, storage and disposal of samples, and shipment of samples to other laboratories. Responsible for evaluating sample receipt compliance against the appropriate method requirements and recording any deviations. Also, maintains calibration and log of thermometers, as well as recording temperatures of all refrigerators and freezers and coordination of local courier services.

Experience

Technician, Supervisor Sample Management Office, *Columbia Analytical Services, Inc., Canoga Park, CA*, 2001-2006. Primary responsibilities include logging in samples and requested analyses, coordination of local courier services, distribution of service request forms to each department, storage and disposal of samples, and shipment of samples to other laboratories. Also responsible for supervision of department personnel, back up for Project Chemists, and development and maintenance of departmental SOPs.

Vault Librarian/Driver, *Digital Images/Liberty Livewire, Burbank, California*, 2000-2001. Responsibilities included storing and retrieving film and video from vault, data entry, and delivery and pick up from studios and film lab. Preparing large shipment of film to studios.

Clerk/Driver, *American Scientific, Los Angeles, California*, 1999-2000. Responsibilities included pick up and delivery of samples from field sites and offices and preparing samples for shipment. Maintaining daily temperature log books, transferring samples from analyst refrigerators to storage. Ordering supplies for laboratory, preparing bottle orders for client. Field sampling using bailers devices.

Sample Control/Driver, *Del Mar Analytical, Van Nuys, California*, 1994-1999. Responsibilities included data entry of samples, pick up and delivery, maintenance of lab temperature book and sample disposal. Assisting analysts with tests by weighing samples and performing minor analysis. Changing gas cylinders for Chemists. Washing laboratory glassware and bioassay tanks.

Education

AA, Electronic Drafting Design, *Los Angeles Valley College, Los Angeles, California*, 1976.

REGAN LAU

2001 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position	**CHEMIST** – 2001 to Present
Responsibilities	Analysis of vapor phase and liquid samples for various volatile compounds, perform maintenance on instruments when required, real time data reduction, participate in peer review process, maintain working knowledge of all GC methods performed in laboratory, and good practice of all QA/QC requirements. **Documentation of Demonstration of Capabilities is available for review.**
Experience	**QC Analyst,** *Cancer Vax, Santa Monica, California*, 2001. Responsibilities included screening of material and manufactured products using cGMP and SOPs. **Research Associate I,** *Cedars-Sinai Medical Center, Los Angeles, California*, 1997-2000. Responsibilities included research on immunological function of mice with tumor. **Lab Assistant I,** *University of California at Los Angeles, Los Angeles, California*, 1997. Responsibilities included constructed DNA vector for possible use in gene therapy for cancer.
Education	**BS, Microbiology,** *University of California at Los Angeles, Los Angeles, California*, 1997.

LILIANA MARGHITOIU

2005 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

CHEMIST – 2005 to Present

Responsibilities

Analyzing indoor air, ambient air and source emission samples by GC/MS methods, standard preparation, perform maintenance on instruments when required, real time data reduction, participate in peer review process, and good practice of all QA/QC requirements.

Documentation of Demonstration of Capabilities is available for review.

Experience

Analytical Chemist, *Capco Analytical Services, Ventura, California*, 2004-2005. Responsible for qualitative and quantitative analyses of wastewater, drinking water, soil, and gas samples. Additionally, responsibilities included analysis of vapor phase, liquid and soil samples for various volatile compounds through GC and GC/MS (for 8020, 8015 EPA methods, sulfur and natural gas analysis). Performed analytical tests for water and soil using IC-Dionex (anions and per chlorate) and method development and implementation for IC and GC methods. Wrote and updated SOP's and participated in internal and external audit, review and validation of QC forms and books. Conducted training of other employees and reported and validated results. Performed maintenance on instruments and ordered supplies.

Loan and Insurance processor, *Countrywide, Simi Valley, California,* 2003-2004. Data entry, loan and insurance review and update.

Laboratory Assistant, *Esoterix Endocrinology, Calabasas, California*, 2002-2003. Responsible for reagent and media preparation, calibration and general maintenance of laboratory instruments, and documentation.

Chemistry and Physics Teacher, *High School, Timisoara, Romania*, 1997-1999. Teach Chemistry and Physics. Prepared students for High School final exam and University admission.

Education

BS, Chemistry and Physics, *West University, Timisoara, Romania, 1997*

KRISTIANA "KRISTY" MILLER

2006 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

CHEMIST – 2006 to Present

Responsibilities

Responsibilities include the preparation and analyses of soil, groundwater, and waste water samples for volatile organic compounds, utilizing Tekmar 2016, OI Analytical DPM-16, and Archon autosamplers, Tekmar 2000, 3000, and 3100 and OI Analytical 4560 concentrators, HP5890 and 6890 GC systems with HP 5971, 5972, and 5973 MSDs. Other responsibilities include standard preparation, performing maintenance on instruments when required, real time data reduction, participation in peer review process, and good practice of all QA/QC requirements.

Documentation of Demonstration of Capabilities is available for review.

Experience

Chemist, *Columbia Analytical Services, Inc., Canoga Park, CA,* 2004-2006. Analyze soil, groundwater, and waste water samples for volatile organic compounds. Utilize Tekmar 2016, OI Analytical DPM-16, and Archon autosamplers, Tekmar 2000, 3000, and 3100 and OI Analytical 4560 concentrators, HP5890 and 6890 GC systems with HP 5971, 5972, and 5973 MSDs. Perform routine maintenance on instrumentation. Prepare standards and samples for analysis. Report and review data.

Analyst I, *BC Laboratories, Bakersfield, CA.* 2004 Prep samples for analysis by GC/MS; run and analyze samples on GC/MS; process data using HP Chem Station; report data using Arev Lims system; change tanks, dump liquid waste, archive samples, and preserve encores.

Scientist I, *Columbia Analytical Services, Canoga Park, CA,* 2002-2004. Digest samples for analysis; set up TCLP and STLC extractions; help with mercury digestions and analysis; file ILSRs after digestion; help wet chem. When needed; and filter and preserve water samples when required.

Analyst II, *Columbia Analytical Services, Canoga Park, CA,* 2001-2002. Digest samples for flame, furnace, ICP and ICP analysis.

Education

BS, Biochemistry, *California State University, Northridge, CA,* 2004.

TAKASHI MIYAKE

2007 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

CHEMIST – 2007 to Present

Responsibilities

Responsibilities include analyzing ambient air, source emissions, and industrial hygiene samples using GC, GC/MS and HPLC. Preparation and analysis of air samples taken on various sorbent tubes for semi-volatile organic compounds. Determination of Carbonyls, Phenols and Cresols in ambient air and source emission samples using HPLC. Other responsibilities include standard preparation, performing maintenance on instruments when required, real time data reduction, participation in peer review process, and good practice of all QA/QC requirements.

Documentation of Demonstration of Capabilities is available for review.

Experience

Director of the Science Department and Science Teacher, *Los Angeles International School, Torrance, California.* 2003-2006. Responsible for making curriculum, planning the school events, teaching chemistry & biology (K-12) and supervising science teachers.

Researcher and Instructor, *Osaka Institute of Technology, Osaka, Japan* 2002-2003. Responsible for investigating antioxidative activities of charcoal made from woods in Wakayama Prefecture, Japan. Additionally, responsibilities included lecturing undergraduate Organic Chemistry and Organic Synthesis classes.

Manager of Research & Development Department and Quality Assurance Department, *YH Products Corporation*, Oxnard, California, 1998-2001. Responsible for development of analytical methods and product specifications, customer satisfaction detail reports and supervision of lab technicians.

Post Doctoral Researcher, *University of California at Davis, Davis, California* 1996-1998. Research included the investigation of toxic volatile carbonyl compounds in cigarette smoke, MTBE in gasoline, foods, beverages, oxidization of lipids in whole blood from human & various animals using Gas Chromatography. Also investigated the potential inhibition of the development of Atherosclerosis by a flavonoid isolated from young barley leaves *in-vitro*. Additionally responsible for the supervision of undergraduate and graduate students.

Education

Ph.D. Agricultural & Environmental Chemistry, *University of California at Davis, Davis, California*, 1996
MS, Applied Chemistry, *Osaka Institute of Technology, Osaka, Japan*, 1991
BS, Applied Chemistry, *Osaka Institute of Technology, Osaka, Japan*, 1988

K. LYNNE NELSON

2000 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

QUALITY ASSURANCE PROGRAM MANAGER – 2000 to Present

Responsibilities

Responsibilities include facilitate ethics and QA training, maintain all training documentation, perform QA orientation for new employees, review data (both hardcopy and electronic), perform internal QA audits and prepare written reports, review, approve, and control Standard Operating Procedures, maintain QA Manual, maintain QA records (including archived logbooks, archived certificates of analysis, nonconformity and corrective action reports, MDL studies results, SOP revision and distribution, statistical control limits, PE sample results), serve as document control officer, and PC for all PE sample analyses, prepare corrective action report for any unacceptable PE sample results, maintain laboratory's certifications and approvals, facilitator for external QA audits and prepare written response to deficiencies, prepare activity report to management.

Experience

Manager, Laboratory Quality Systems, *WorldwideTesting.com, Atlanta, Georgia,* 1999-2000. Responsibilities included determining laboratory qualifications, conducting laboratory audits and issuing reports, writing Standard Operating Procedures, building databases for online ordering system, interfaced with laboratories and clients to determine specific requirements.

Technical Account Representative, *SGS US Testing Company, Los Angeles, California,* 1995-1999. Responsibilities included internal auditing, coordinating test programs, and developing test programs for clients based on requirements, attended trade shows and technical meetings, initiated new sales through written and verbal communications.

Analytical Chemist, *BOC Gases, Research Triangle Park, North Carolina,* 1993-1995. Responsibilities included analyzing gases for impurities; headed corrective action teams dedicated to various aspects of the quality system, supervised and trained new employees, responsible for implementing and maintaining control charts.

Environmental Chemist, *Oak Ridge Research Institute, Oak Ridge, Tennessee,* 1991-1993. Responsibilities included organic extractions, analysis of waste for PCBs and radionuclides, worked independently on second shift performing routine and rush analyses.

Education

BS, Professional Biology, *University of North Alabama, Florence, Alabama,* 1991.
BS, Chemistry, *University of North Alabama, Florence, Alabama,* 1991.

Publications/ Presentations

The Value of Independent Laboratories, PCI Magazine, September 1997.

Affiliations

American Society for Quality (ASQ)
American Society for Testing and Materials (ASTM)

CHRISTOPHER J. PARNELL

1991 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

CHEMIST, VOLATILE GAS CHROMATOGRAPHY / MASS SPECTROMETRY TEAM LEADER – 2000 to Present

Responsibilities

Team leader for the Volatile Gas Chromatography Mass Spectrometry group responsibilities are but are not limited to training of chemists, peer review of analytical data, mentoring of junior analysts, standard operating procedure review and streamlining of methods. Duties also require performance reviews and development of his direct reports.

Documentation of Demonstration of Capabilities is available for review.

Experience

Scientist VI, *Columbia Analytical Services, Inc., DBA Performance Analytical, Inc., Los Angeles, California,* 1994-2002. Responsibilities include analyzing indoor air, ambient air and source emission samples by GC/MS methods, standards preparation, perform maintenance on instruments when required, real time data reduction, participation in peer review process, and good practice of all QA/QC requirements.

Scientist VI, *Performance Analytical, Inc, Canoga Park, California,* 1991-1994. Responsibilities listed above.

Air Toxics Laboratory Supervisor, *ABB Environmental Inc., Camarillo, California,* 1990-1991. Responsibilities included scheduling client analyses and developing methods for non-routine analyses, and operating the Air Toxics laboratory.

Analytical Chemist, *C-E Environmental Inc., EMSI, Camarillo, California,* 1987-1990. Responsibilities included overseeing the Pesticide/PCB analysis of samples under the EPA Contract Laboratory Program, and interfacing with the EPA and regional offices to respond to inquiries and performing GC analyses and extractions.

Chemist, *Damon Reference Laboratory, Newbury Park, California,* 1986-1987. Responsibilities included performing Enzyme-linked immunosorbent assays, Western-Blot assays, and Protein Electrophoresis.

Education

BS, Chemistry, *University of California at Santa Barbara, Santa Barbara, California,* 1986.

KAREN H. RYAN

2006 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

PROJECT MANAGER / VOLATILE ORGANICS (SOIL/WATER) TEAM LEADER – 2006 - Present

Responsibilities

Responsibilities include interfacing with clients to provide technical project management and customer service, including project scheduling, tracking and consulting to determine appropriate sampling and analytical protocols. Coordinates with the laboratory and administration to ensure that analyses are properly executed and meets the clients' needs.

Experience

Chemist, Semi-Volatile Organics, *Columbia Analytical Services, Inc., Canoga Park, CA,* 1999-2006. Responsible for analytical services to comply with State and Federal regulatory requirements. Performs and coordinates workload and train personnel as necessary. Participates in method development and certification, as well as method troubleshooting and instrument maintenance.

Research and Development Laboratory Supervisor, *Applied Silicone Corporation, Ventura, California,* 1997-1999. Supervised all work within the department, following ISO 9001 guidelines. Developed silicone chemical formulations. Maintained laboratory notebooks in accordance with GLP and GMP guidelines. Performed project coordination using LSR systems for molding device applications, handling client contacts/consultations, troubleshooting staff technical inquiries and design specifications. Organized and scheduled molding time to ensure prompt product delivery. Certified as an ISO 9000 Internal Auditor.

GC Chemist and GC/MS Chemist, *Fruit Growers Laboratory Inc., Santa Paula, California,* 1996-1997. Scheduled and performed sample analysis by established EPA methods using Gas Chromatography and Gas Chromatography/Mass Spectrometry. Performed TOC sample analysis. Managed instrumentation and department expenditures.

GC Chemist, *Pace Inc., Camarillo, California,* 1991-1995. Scheduled and performed sample analysis using various GC methods. Approved and monitored test results and turn-around times. Managed equipment and expenditures within the department. Revised and maintained all standard operating procedures and method detection limits.

Extraction Chemist, *Coast to Coast Analytical Services, Camarillo, California,* 1991. Scheduled and performed sample extraction using various EPA methods. Prepared working spike standards within the department. Calibrated equipment in the laboratory.

Education

BS, Chemistry, *California Lutheran University, Thousand Oaks, California,* 1991.
AA, Liberal Arts, *Oxnard College, Oxnard, California,* 1987.

MICHELLE H. SAKAMOTO

2000 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

DATA VALIDATION COORDINATOR – 2005 to Present

Responsibilities

Responsibilities included validation of analytical results produced by the laboratory. Verification of client analytical requests, sample information, and reporting formats. Interacts with project managers and Quality Assurance Program Manager to ensure that all reports fulfill client requirements as well as QA/QC needs. Compiled quality control summary, and calibration data upon client request for data packages.

Experience

Chemist, *Columbia Analytical Services, Inc., Simi Valley, CA,* 2002-2005. Analyzing indoor air, ambient air and source emission samples by GC/MS methods, standard preparation, perform maintenance on instruments when required, real time data reduction, participate in peer review process, and good practice of all QA/QC requirements.

Data Validation Coordinator, *Columbia Analytical Services, Inc. DBA Performance Analytical, Inc. Los Angeles, California,* 2002. Responsibilities included validation of all analytical results produced by the laboratory. Verification of client analytical request, sample information, and reporting formats. Compiled quality control summary and calibration data upon client request for data packages.

Analytical Chemist, *Columbia Analytical Services, Inc. DBA Performance Analytical, Inc. Los Angeles, California,* 2000-2002. Responsibilities included analysis of vapor phase and liquid samples for various volatile compounds, perform maintenance on instruments when required, real time data reduction, participate in peer review process, maintain working knowledge of all GC methods performed in laboratory, and good practice of all QA/QC requirements

Technical Support Specialist, *Quidel Corporation, San Diego, California,* 2000. Provided technical support of diagnostic products to medical professionals, sales representative, and laypersons via the telephone. Additional duties included documentation of complaints and follow up with customers.

Office Manager/Receptionist, *Manex Visual Effects, Culver City, California,* 1999-2000. Responsible for operation of the switchboard, greeting clients, purchase order requests, and timecard data entry.

Laboratory Technician, *Prince William County Service Authority, Woodbridge, Virginia,* 1996-1999. Responsible for qualitative and quantitative analyses of wastewater and drinking water samples. Also responsible for reagent and media preparation, calibration and general maintenance of laboratory instruments, and documentation and data entry of results.

Associate Process Group Chemist II, *Quidel Corporation, San Diego, California,* 1994-1995. Separated, purified, and conjugated proteins; performed product release analysis; assay performance; and buffer and reagent formulation.

Education

BA, Biology, *Point Loma Nazarene University, San Diego, California,* 1992

SHREEJANA "SHREE" SINGH

2005 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

SYSTEMS ANALYST – 2005 to Present

Responsibilities

Electronic data deliverable (EDD) generation, review and reporting in accordance with both in-house and client specifications. Validation of laboratory and client valid values for input into Corporate valid value list for reports and EDDs. Coordination of EDD generation setup and compliance utilizing the laboratory EDD generation software with Corporate IT. Assisting with Laboratory Information Management Systems (LIMS) setup for EDD production and reporting.

Experience

Manager/Account Executive, *Imax Bancard Network, LLC, Valencia, California, 2004-2005*. Responsibilities included testing of Max software system, created organizational and work flowchart in Visio, tested online application, assist assigned agents with all their inquiries, assist merchants, underwrite new accounts, run and analyze credit reports, board accounts to First Data, send profile request for Nashville and Cardnet, board accounts on Vital, prepare stage only file sheet for deployment, help merchants obtain Amex and Discover processing, review TMF report, MES maintenance- DDA Change, DBA Change, prepare merchant kits for new merchants, Telemarketing lead data management in Excel, etc.

Report Production, *Columbia Analytical Services, Inc. Simi Valley, California. 2004-Temporary Assignment.* Responsibilities included data entry into Excel, created charts and prepared reports.

System Administrator, *Countrywide, Calabasas, California, 2004*. Responsibilities included download SQL reports in AS400-General Ledger System, Audited Active/Inactive Cost Centers and prepared reports, Granted Hyperion Access to employees, Created Monthly Maintenance Calendar, Downloaded and refreshed Treasury Bank accounts, Assisted Department Manager with Special Projects, Prepared/Maintained Excel Database of Cost Centers Created Organizational Chart for Corporate Accounting.

Purchaser, *Countrywide, West Hills, California, 2004.* Responsibilities included, reviewed and entered Closed Loan Packages to the System, suspended Account for incomplete packages.

Internet Specialist, *Cardservice International, Agoura Hills, California, 1994-1999*, responsibilities included Educated Sales Agents and merchants regarding e-commerce solutions, coordinated gateway integration of major clients with Technical Support and Programming, provided weekly reports to the Senior Management regarding Payment Gateway, coordinated multiple departments on resolution of technical and logistical issues, met with various vendors, prepared monthly sales and profitability reports, downloaded all new accounts and prepared spreadsheet for VP-Internet Commerce Group, prepared commission statement for agents, sales and accounting department, assisted merchants with new applications and procedures, reviewed new/existing merchant accounts for profitability and adjusted rates and fees, prepared daily company sales and revenue reports, reviewed and recommended existing and new department procedures for better efficiency, trained new employees, ran SQL report for various departments through NOAH system, prepared commission statement for agents and sales department, maintained and managed high volume accounts, audited new merchant accounts for accuracy on rates, fees, and setup, audited and prepared report listing all merchants using the 1-800# according to the agent, prepared and provided daily department reports, assisted Department Manager with special projects, provided administrative support to the department staff, handled all incoming merchant inquiries from merchants, reprogrammed existing point of sale terminals to dial out local access numbers.

Education

BS, Information Systems, Option: Business, *California State University, Northridge, CA,* 2003.

UNCONTROLLED COPY

SADIA TERRANOVA

2007 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

CHEMIST – 2007 to Present

Responsibilities

Analyzing indoor air, ambient air and source emission samples by GC/MS methods, standard preparation, perform maintenance on instruments when required, real time data reduction, participate in peer review process, and good practice of all QA/QC requirements.

Documentation of Demonstration of Capabilities is available for review.

Experience

Environmental Research Analyst, *SGS UK, Liverpool, England,* 2006-2006. Performed a variety of analytical tests using EPA protocols using GC/MS/MS, Provided new method research and development, method validation, record keeping and maintained the laboratory inventory.

Material Analyst / Supervisor, *ColorMatrix, Liverpool, England,* 2005-2006. Performed moisture analysis and other analyses using Minolta, Viscometer and Paar. Performed site sampling and record keeping, method validation and research & development.

QC Chemical Analyst, *Ineos Silicas, Warrington, England,* 2004-2005. Performed moisture analysis and other analyses using Minolta, Viscometer and Paar. Performed site sampling and record keeping, method validation and research & development.

Material & QC Analyst & Project Development, *LG Phillips - Displays, Southport, England,* 2002-2003. Performed analyses of metal oxides using XRF, TGA, tensile tester, electrical & magnetic instruments, project planning and coordinating, method validation, and thermal analyses.

QA Analyst / Technician, *Astra Zeneca, Macclesfield, England,* 2002-2002. Quality control of drugs under GMP and GLP practices.

Material Experimental Analyst / Process Technician, *Nortel Networks, Paignton, England,* 2000-2002. Quality control of Opto-electronic resins using GC/MS, DSC, FTIR, viscometer, and titration. Testing of in-house resins, surface analysis including SEM, EDX, and contact angles. Failure analyses using metallurgy techniques and optical microscopy, x-ray analysis, sectioning and tensile testing. Analysis of new products for on line process improvement, ensured continued operation of production equipment, environmental sampling and compliance with health and safety regulations.

Laboratory Technician, *James Watt College, Greenock, England,* 1998-2000. Independent analysis of various experiments to validate and improve on practical methods, assisted student in the use of HPLC, demonstrated and supervised the use of various analytical equipment and maintained comprehensive records of experimental work, tested and calibrated equipment and performed any necessary maintenance.

Education

Bsc(Hons), Chemistry, *Manchester Metropolitan University, Manchester, England,* 2004

Departmental Diploma, Pure and Applied Chemistry, *Strathclyde University, Glasgow, Scotland,* 1993.

HnD, Chemistry, Information Technology, Instrumentation, *Caldonian University, Glasgow, Scotland,* 1992.

MICHAEL TUDAY

1988 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

DIRECTOR OF RESEARCH AND DEVELOPMENT /PROJECT MANAGER – 2002 to Present

Responsibilities

Responsibilities include identifying new markets, determining laboratory feasibility, providing guidance in business development, marketing, and overseeing method development. Review of contract proposals, pricing and intuitive review of analytical data prior to it being released to the client. Also involved in writing and implementing training sessions and acts as a project manager when necessary. Project Manager responsibilities include interfacing with clients to provide technical project management and customer service, including project scheduling, tracking and consulting to determine appropriate sampling and analytical protocols. Coordinates with the laboratory and administration to ensure that analyses are properly executed and meets the clients' needs.

Experience

Laboratory Director, *Columbia Analytical Services, Inc., DBA Performance Analytical, Inc., Los Angeles, California,* 1994-2002. Responsibilities include managing technical operations, employee development and business operations (financial and marketing). Overseeing the Quality Assurance activities and reviewing analytical data for final report approval. Advising clients of appropriate sampling and analytical protocols related to air testing data interpretation. Participating in the development and validation of new sampling and analysis protocols. Serving as an expert witness in legal cases requiring testimony. Lecturing for educational courses and association meetings.

Laboratory Director/Owner, *Performance Analytical, Inc, Canoga Park, California,* 1988-1994. Duties primarily as listed above.

Laboratory Technical Manager, *C-E Environmental Inc., EMSI, Camarillo, California,* 1984-1988. Responsibilities included Program management of EPA Contract Laboratory Program and Special Analytical Services Contracts. Project Management for several large multidisciplinary projects, including the Love Canal Habitability Study. Initiated the development of the Air Toxics Analysis Laboratory. Served as Technical Marketing Coordinator for Laboratory Services (cost proposals and technical plans). Previously responsible for the supervision of the Gas Chromatography/Mass Spectrometry Laboratory.

GC/MS Laboratory Supervisor, *International Technology Corporation, Cerritos, California,* 1981-1984. Responsibilities included: Supervision of ten chemists in a large commercial laboratory. Projects included EPA Contract Laboratory Program analyses, EPA EMSL-Cinn drinking water method development and analysis contracts, Battelle and Radian interlaboratory method validation studies, hazardous waste characterization, analytical support for Remedial Investigations/Feasibility Studies, groundwater and wastewater effluent monitoring, commercial product deformulation and industrial hygiene analysis.

Chemist, Chromatography Laboratory, *O'Brien & Gere Engineers, Inc., Syracuse, New York,* 1980-1981. Responsibilities included: Performance of trace organics analysis of environmental samples for pesticides/PCBs, chlorophenoxyacid herbicides, and volatile organic compounds by gas chromatography.

Education

BS, Chemistry, *State University of New York, Oswego, New York,* 1980.
SHORT COURCES IN: Chemical Ionization GC/MS, INCOS Operation, and MS Interpretation, *Finnigan Institute, Cincinnati, Ohio.*

Affiliations

Air & Waste Management Association
Southern California Environmental Chemists Society
American Industrial Hygiene Association

INDIAN TYLER

2007 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position	**BUSINESS DEVELOPMENT** – 2007 to Present
Responsibilities	Helps lead the sales, marketing and new business development efforts for the Simi Valley, California location. Responsible for new client development, communication of client requirements and acting as a liaison between the client and the laboratory to ensure ongoing improvement of client service.
Experience	**Director of Marketing and Sales,** *Todd International Distribution, Laurel, MD,* 2005-2006. Managed and organized sales team and marketing representatives. Developed sale and marketing strategies to increase revenue and profit. Trained sales and marketing staff and implemented innovative sales protocols. Oversaw sales forecasting and created and maintained budgets for the organization. **Health and Science Teacher,** *The Catholic High School, Baltimore, MD,* 2002-2003. Conducted health and physical science classes at the high school level. Developed lesson plans and class curriculums for individual classes. Provided detailed instruction and assigned students with projects and coursework and promoted the acceleration of their learning aptitude.
Education	**BS, Biology,** *Morgan State University, Baltimore, MD,* 2000. **MS, Public Health**, *Morgan State University, Baltimore, MD,* 2002.

ZHENG WANG

2004 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

CHEMIST– 2004 to Present

Responsibilities

Analysis of vapor phase and liquid samples for various volatile compounds, perform maintenance on instruments when required, real time data reduction, participate in peer review process, maintain working knowledge of all GC methods performed in laboratory, and good practice of all QA/QC requirements.

Documentation of Demonstration of Capabilities is available for review.

Experience

Chemist, *Atmospheric Analysis and Consulting, Inc., Ventura, CA,* 2003. Responsible for the analytical method development and validation of testing raw materials, environmental pollutants and the documentation of quality control standards and analytical results. Overview all laboratory equipment. Perform and revise testing methodologies when necessary. Apply EPA, ASTM, SCAQMD, and SW 846 methods to analyze volatile organic compounds.

Senior Research Associate, *China National Petroleum Corporation, Renqiu, Hebei, China,* 1988-2000. Developed and validated analytical methods for the analysis of geological samples and conducted organic geochemistry evaluation using HPLC, GC/MS, UV, IR, fluorescent detection and column chromatography. Performed separation and quantitative analysis of crude oil and bitumen A, including saturate and aromatic compounds, non-hydrocarbon and asphaltenes by using HPLC and column chromatography. Evaluated and calculated organic matter abundance. Performed analysis of the saturate (C8-C35), headspace gas (c1-C5), and aromatic by using GC and GC/MS. Parameters of evaluating geochemistry were calculated from GC spectrum. Performed identification and analysis of biomarkers in saturate compounds by GC/MS. Parameters of gas and oil migration were calculated from mass spectrum. Documented and wrote analytical protocols and reports. Maintained the analytical instruments include GC, GC/MS, HPLC, UV, IR, etc. Managed the development and growth of technicians.

Education

MS, Organic Chemistry, *New Mexico Highland University, Las Vegas, New Mexico,* 2002.

BS, Analytical Chemistry, *Ningxia University, Yinchuan, Ningxia, China*. 1988

Affiliations

American Chemical Society; Chinese Petroleum Society

UNCONTROLLED COPY

ROGER WONG

2006 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position	**CHEMIST** – 2006 to Present
Responsibilities	Responsible for preparation and analysis of wet and general chemistry samples for turbidity, settleable solids, residue, ion selective electrode analyses (e.g., pH, nitrite, fluoride, and conductivity), hexavalent chromium, and other similar analyses. Additional responsibilities include standard preparation, instrument maintenance, and real time data reduction; participate in peer review process, and good practice of all QA/QC requirements. **Documentation of Demonstration of Capabilities is available for review.**
Experience	**Chemist**, *Columbia Analytical Services, Inc*., Canoga Park, CA 2003-2006 - Responsible for performing and reporting the assigned tasks by following standard operating procedures. Perform metal digestions for analyses by inductive coupled plasma (ICP), inductive coupled plasma – mass spectrometer (ICP-MS), and graphite furnace atomic absorption (GFAA). Prepared samples for TCLP and STLC extraction. In addition to metals prep, also perform general chemistry analyses, including flash point, chemical oxygen demand (COD), paint filter test, and other ion selective electrode analyses (e.g., pH, nitrite, fluoride, and conductivity).
Education	**BS, Biology,** *UCLA, Los Angeles, CA. December 2003.*

JOHN YOKOYAMA

1997 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

LABORATORY MANAGER – 2002 to Present

Responsibilities

Responsibilities include managing technical operations, employee development and business operations (financial and marketing). Additionally responsible for ensuring that quality control functions are carried out as planned and to guarantee the production of high quality data. The Laboratory Operations Manager is also required to coordinate laboratory work shifts, perform work reviews, schedule programs such as method detection limit studies and training, review corrective action reports, and coordinate sample analysis scheduling with respect to holding times and client requirements. Additionally works with the Project Managers on scheduling conflicting client projects and the Quality Assurance Program Manager on certain quality issues as they directly relate to the laboratory.

Experience

Scientist VI, *Columbia Analytical Services, Inc., DBA Performance Analytical, Inc., Los Angeles, California,* 1997-2002. Responsibilities include, but is not limited to, sample analysis of various constituents using GC, GCMS, and HPLC methodologies. Sample and standard preparation for air and traditional analyses, method development, training of personnel, semi-volatile performance evaluation samples, instrument maintenance, regulating and maximizing sample flow through the semi-volatile area, ordering of a large majority of lab supplies, and when necessary acting as a Project Chemist/Client Services.

GC/MS Supervisor, *West Coast Analytical Service, Santa Fe Springs, California,* 1996-1997. Oversight of GC/MS workflow. Maintenance of GC/MS instruments and some method development. Duties also included review of analytes, reports, and analysis of semi-volatile GC/MS samples.

Organics Manager, *PACE Incorporated, Camarillo, California,* 1994-1996. Oversaw organics group's workload with each group's supervisor. Involved with budget decisions, including instrument purchase and personnel. Also reviewed reports and analyzed volatile GC/MS samples as necessary.

GC/MS Supervisor, *Thermal Analytical, Monrovia, California,* 1992-1994. In charge of GC/MS groups, responsibly which included review of reports, personnel, method development, routine instrument maintenance, and analysis of semi-volatile samples.

GC/MS Chemist, *IT Corporation, Cerritos, California,* 1986-1992. Analysis of volatile and semi-volatile samples of various matrices. Developed methods, reviewed some reports and performed routine maintenance on instruments.

Education

BS, Biological Sciences/Marine Toxicology, *University of California at Los Angeles, Los Angeles, California,* 1982.

MANUAL "MANNY" ZAMORA

2005 TO PRESENT

Columbia Analytical Services, Inc., 2655 Park Center Drive, Suite A, Simi Valley, CA 93065 (805)-526-7161

Current Position

SAMPLE MANAGEMENT CUSTODIAN – 2005 to Present

Responsibilities

Primary responsibilities include logging in samples and requested analyses, coordination of local courier services, distribution of service request forms to each department, storage and disposal of samples, and shipment of samples to other laboratories. Responsible for evaluating sample receipt compliance against the appropriate method requirements and recording any deviations. Also, maintains calibration and log of thermometers, as well as recording temperatures of all refrigerators and freezers and coordination of local courier services.

Experience

Sample Management Technician – *Columbia Analytical Services, Inc., Canoga Park, CA,* 2002-2005. Responsible for the receipt of groundwater and soil samples into the lab. Maintained proper documentation of sample receipt by following chain-of-custody (COC) procedures. Checked the number of samples received against the COC to account for all the samples. Logged samples into the laboratory; labeled samples; checked pH of preserved samples; and input tests required for each sample into the computerized Laboratory Information Management System (LIMS). Performed courier services (e.g., transported samples or bottle orders between clients and laboratory), field services (e.g., taking field samples for the clients), and bottle order preparation (e.g., adding preservation into bottles and containers for delivery to clients for sampling).

Facilities Assistant – Mailroom, *Xirom, Inc., a division or INTEL, Thousand Oaks, California,* 1998-2002. Responsible for pickup, sorting, and delivery of company mail from the Post Office; administration of computerized shipping system for corporate shipping; assist with daily maintenance of company buildings; stock/purchase office supplies and snacks/drinks for the Company snack machines.

Stockroom Administrator, *American Network Systems, Simi Valley, California,* 1997-1998. Responsible for operation of the warehouse, including receipt/inspection of incoming materials and shipment of product worldwide. Administrative duties included production of export documents required for international shipments; creation of work orders, transfers, new order entry, and monthly inventory report transactions.

Material Handler II - Shipping, *Xirom, Inc., a division or INTEL, Thousand Oaks, California,* 1994-1997. Responsible for daily inventory reports and daily RMA and Sales Order logs. Responsible for all internal material transfers, including freight calculation.

Receiving Clerk, *Hewlett Packard, Eesof Inc., Westlake Village, California,* 1992-1994. Responsible for receipt documentation, and distribution of all deliveries. Coordinated inspection of fabricated materials with Quality Assurance.

Education

COURSEWORK, Business Administration, *Moorpark Community College, Moorpark, California,* 1982-1985.

APPENDIX B

MAJOR EQUIPMENT

Equipment Description	Service	Location
Gas Chromatographs		
GC01: Hewlett-Packard 5890 with FID/TCD Detectors *Fixed Gas Analyzer/Total Combustion Aanlyzer (TCA)*	LM	VOA-GC
GC02: Hewlett-Packard 5890A with PID/PID Detector	LM	VOA-GC
GC03: Hewlett-Packard 5890 PID/FID Detectors *Hewlett-Packard 7673 Autosampler*	LM	SVOA
GC05: Hewlett-Packard 5890 Series II with Sievers SCD Detector *Tekmar LSC 2000 Purge and Trap Concentrator*	LM	VOA-GC
GC06: Hewlett-Packard 6890 with ECD/ECD Detectors *Hewlett-Packard 6890 Autosampler*	LM	SVOA
GC07: Hewlett-Packard 6890 with FID/NPD Detectors *Hewlett-Packard 6890 Autosampler*	LM	VOA-GC
GC08: Hewlett-Packard 5890 Series II with TCD Detector	LM	VOA-GC
GC09: Hewlett-Packard 5890 Series II with FID/NPD Detectors	LM	VOA-GC
GC10: Hewlett-Packard 5890A with FID/TCD Detectors	LM	VOA-GC
GC11: Hewlett-Packard 5890 Series II with FID Detector	LM	VOA-GC
GC12: Hewlett-Packard 5890 Series II with FID Detector *Hewlett-Packard 7673 Autosampler*	LM	SVOA
GC13: Agilent 6890A with Sievers SCD Detector	LM	VOA-GC
GC14: Agilent 6890N with NPD/FID Detectors *Agilent 7683B Autosampler*	LM	SVOA
GC15: Agilent 6890N with NPD/FID Detectors *Agilent 7683 Autosampler*	LM	VOA-GC
GC16: Agilent 6890N with PFPD/FID Detectors *OI Detector Controller; Sievers Dual Plasma Controller*	LM	VOA-GC
GC17: Hewlett-Packard 5890 PID/FID Detectors *Precision Sampling PTA-30 Autosampler* *Tekmar LSC 2000 Purge and Trap Concentrators*	LM	VOA GC/MS (S/W)
GC18: Hewlett-Packard 5890 Series II with OI PID/FID Detectors *DPM-16 Autosampler* *OI 4560 Purge and Trap Concentrator*	LM	NOT IN SERVICE
GC19: Hewlett-Packard 5890 FID Detector *Hewlett-Packard 7673A Autosampler*	LM	NOT IN SERVICE
GC/MS Systems		
MS01: Hewlett-Packard 5890 Series II/5971A MSD *Hewlett-Packard 7673 Autosampler*	LM	SVOA
MS02: Hewlett-Packard 5890 Series II/5972 MSD *Tekmar AUTOCAN Autosampler*	LM	VOA GC/MS
MS03: Hewlett-Packard 6890A/5973 MSD *Tekmar AUTOCAN Autosampler*	LM	VOA GC/MS
MS04: Hewlett-Packard 5890 Series II/5970 MSD *Hewlett-Packard 7673 Autosampler*	LM	SVOA
MS05: Agilent 6890+/5973N MSD *Perkin Elmer TurboMatrix ATD-50 Thermal Desorber*	LM	VOA GC/MS
MS06: Hewlett-Packard 5890 Series II/5970 MSD	LM	VOA GC/MS
Tekmar AUTOCAN Autosampler		
MS07: Hewlett-Packard 6890A/ Agilent 5973N MSD	LM	VOA GC/MS
Tekmar AUTOCAN Autosampler		

Equipment Description	Service	Location
GC/MS Systems		
MS08: Agilent 6890N/5973inert MSD *Tekmar AUTOCAN Autosampler*	LM	VOA GC/MS
MS09: Agilent 6890N/5973*inert* MSD *Tekmar AUTOCAN Autosampler*	LM	VOA GC/MS
MS10: Hewlett-Packard 6890A/5973 MSD *OI 4560 Sample Concentrator* *OI 4551-A Autosampler*	LM	VOA GC/MS (S/W)
MS11: Hewlett-Packard 5890 Series II/5972A MSD *Varian Archon Autosampler* *Tekmar 3100 Concentrator*	LM	VOA GC/MS (S/W)
MS12: Hewlett-Packard 5890 Series II/5971 MSD *OI DPM-16 Auto Sampler* *OI 4560 Sample Concentrator*	LM	VOA GC/MS (S/W)
MS13: Agilent 6890N/5975B*inert* MSD *Tekmar AUTOCAN Autosampler*	LM	VOA GC/MS
MS14: Hewlett-Packard 5890 Series II/5971 MSD *OI Analytical 4551-A Auto Sampler* *OI Analytical Eclipse 4660 Sample Concentrator*	LM	VOA GC/MS (S/W)
MS15: Hewlett-Packard 5890 Series II/5972 MSD *Hewlett-Packard 7673 Autosampler*	LM	SVOA
MS16: Agilent 6890N/5975C*inert* MSD *Tekmar AUTOCAN Autosampler*	LM	VOA GC/MS
LC01: Waters Liquid Chromatograph Module I Plus/UV_Vis 360	LM	SVOA
LC02: Hewlett-Packard 1050	LM	SVOA
Spectrophotometers		
SPM01: Spectronic Instrument 20+ from SC	LM	GENCHEM
Conductivity Meters		
CM01: Thermo Orion Model 162A	LM	GENCHEM
Turbidimeters		
TM01: Hach Turbidimeter 2100	LM	GENCHEM
pH and Specific Ion Meters		
pH01: Thermo Orion 920 Selective Ion Meter	LM	GENCHEM
pH02: Orion 720A	LM	GENCHEM
Ion Chromatograph		
IC01: Dionex DX-100 with Self-regenerating suppressor *VI20 Univeral Interface* *AS40 Autosampler*	LM	GENCHEM
IC02: Metrohm with *Lambda 1010* *830 IC Interface, 830 IC Liquid Handling Units* *818 IC Pump, 820 IC Separator Center*	LM	GENCHEM
Miscellaneous Equipment		
US Filter Water Purification System	SC	

LM – Laboratory Maintained
VOA – Volatile Organic Analysis
GENCHEM – General Chemistry
IH – Industrial Hygiene
SC – Service Contract
S/W – Soils and Waters
SVOA – Semi-Volatile Organic Analysis

SAMPLE MANAGEMENT AND DISPOSAL

Air sampling containers / flow controllers

- Six-liter Summa passivated stainless steel canisters (1900)
- Six-liter Silco passivated stainless steel canisters (15)
- Three-liter Silco passivated stainless steel canisters (70)
- Meriter 2.4-liter passivated stainless steel canisters (35)
- One-liter Summa passivated stainless steel canisters (500)
- 400-millilter mini passivated stainless steel canisters (21)
- Low volume flow controllers for time integrated sampling (500)
- Mini-canister flow controllers for time integrated sampling (12)

Automated Summa canister conditioning units

- Ten-position, microprocessor controlled conditioners with heater controller, vacuum gauge, humidified nitrogen fill capability and large capacity vacuum pump (2)
- Fourteen-position, microprocessor controlled conditioners with heater controller, vacuum gauge, humidified nitrogen fill capability and large capacity vacuum pump (1)
- Twenty-position, microprocessor controlled conditioners with heater controller, vacuum gauge, humidified nitrogen fill capability and large-capacity vacuum pump (1)
- Sixteen-position, microprocessor controlled conditioner with heater controller, vacuum gauge, humidified nitrogen fill capability and large-capacity vacuum pump (1)

APPENDIX C

METHOD REFERENCES AND STANDARD OPERATING PROCEDURES

Method References[1]
ASTM D 1946, “Standard Practice for Analysis of Reformed Gas by Gas Chromatography.”
ASTM D 3588, “Standard Practice for Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels.”
ASTM D 5075, “Nicotine and 3-Ethenylpyridine in Indoor Air.”
ASTM D 5504, “Standard Test Method for Determination of Sulfur Compounds in Natural Gas and Gaseous Fuels by Gas Chromatography and Chemiluminescence.” ; SCAQMD Method 307, “Determination of Sulfur in a Gaseous Matrix.”
CARB Method 410A, “Determination of Benzene from Stationary Sources at Low Concentrations.”
CARB Method 410B, “Determination of Benzene from Stationary Sources at High Concentrations.”
CARB Method 422, “Determination of Volatile Organic Compounds in Emissions from Stationary Sources.”
EPA 110.2, “Colorimetric-Platinum-Cobalt.”
EPA 120.1, “Conductance (Specific Conductance, umhos at 25°C)
EPA 150.1, “pH (Electrometric)
EPA 160.2, “Residue, Non-filterable (Gravimetric, Dried at 103-105°C)
EPA 160.3, “Solids, Total”
EPA 160.5, “Settleable Matter (Volumetric, Imhoff Cone)”
EPA 180.1, “Turbidity (Nephelometric)”
EPA 218.6, “Determination of Dissolved Hexavalent Chromium in Drinking Water, Groundwater, and Industrial Wastewater Effluents by Ion Chromatography”
EPA 300.0, “Determination of Inorganic Anions by Ion Chromatography”
EPA 354.1, “Nitrogen, Nitrite (Spectrophotometric)”
EPA 624, “Purgeables”
EPA Compendium Method TO-3, “Method for the Determination of Volatile Organic Compounds in Ambient Air Using Preconcentration Techniques and Gas Chromatography with Flame Ionization and Electron Capture Detection.”
EPA Compendium Method TO-4A, “Determination of Pesticides and Polychlorinated Biphenyls in Ambient Air Using High Volume Polyurethane Foam (PUF) Sampling Followed by Gas Chromatographic/Multi-Detector Detection (GC/MD).”
EPA Compendium Method TO-5, “Method for the Determination of Aldehydes and Ketones in Ambient Air Using High Performance Liquid Chromatography (HPLC).”
EPA Compendium Method TO-8, “Method for the Determination of Phenol and Methylphenols (Cresols) in Ambient Air Using High Performance Liquid Chromatography (HPLC).”
EPA Compendium Method TO-10A, “Determination of Pesticides and Polychlorinated Biphenyls in Ambient Air Using Low Volume Polyurethane Foam (PUF) Sampling Followed by Gas Chromatographic/Multi-Detector Detection (GC/MD).”
EPA Compendium Method TO-11A, “Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC) [Active Sampling Methodology].”
EPA Compendium Method TO-13A, “Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in Ambient Air Using Gas Chromatography/Mass Spectrometry (GC/MS).”

Method References – Continued[1]
EPA Compendium Method TO-14A, "Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using Specially Prepared Canisters with Subsequent Analysis by Gas Chromatography."
EPA Compendium Method TO-15, "Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)."
EPA Compendium Method TO-17, "Determination of Volatile Organic Compounds in Ambient Air Using Active Sampling Onto Sorbent Tubes."
EPA Method 25C, "Determination of Nonmethane Organic Compounds (NMOC) in Landfill Gases."
EPA Method 3C, "Determination of Carbon Dioxide, Methane, Nitrogen, and Oxygen from Stationary Sources."
Massachusetts Department of Environmental Protection (MADEP), "Method for the Determination of Air-Phase Petroleum Hydrocarbons (APH)", Public Comment Draft 1.0
NCASI Method DI/HAPS-99.01, "Selected HAPS in Condensates by GC/FID."
NCASI Method DI/MEOH-94.03, "Methanol in Process Liquids by GC-FID."
NCASI Method IM/CAN/WP-99.02, "Impinger/Canister Source Sampling Method for Selected HAPS and Other Compounds at Wood Products Facilities."
NIOSH 1005, "Methylene Chloride."
NIOSH 1300, "Ketones I."
NIOSH 1301, "Ketones II."
NIOSH 1400, "Alcohols I."
NIOSH 1401, "Alcohols II."
NIOSH 1402, "Alcohols III."
NIOSH 1403, "Alcohols IV."
NIOSH 1450, "Esters I".
NIOSH 1457, "Ethyl Acetate".
NIOSH 1500, "Hydrocarbons, 36-126C BP."
NIOSH 1501, "Aromatic Hydrocarbons."
NIOSH 1550, "Hydrocarbons."
NIOSH 2000, "Methanol."
NIOSH 2538, "Acetaldehyde by GC."
NIOSH 2549, "Volatile Organic Compounds (Screening)."
NIOSH 5515, "Polynuclear Aromatic Hydrocarbons by GC."
OSHA 07, "Organic Vapors."
[2]SM 2120B, "Color by Visual Comparison Method"
[2]SM 2510B, "Conductivity"
[2]SM 2520B, "Salinity"
[2]SM 2540B, "Total Solids"
[2]SM 2540D, "Total Suspended Solids Dried at 103-105°C"
[2]SM 2540F, "Settleable Solids"
[2]SM 2540G, "Total, Fixed, and Volatile Solids in Solid and Semi-Solid Samples"

Method References – Continued[1]
[2]SM3500-Cr D, "Colorimetric Method"
[2]SM 4500-H B, "pH, Electrometric"
SW-846 METHOD 8015B, "Nonhalogenated Organics Using GC/FID"
SW-846 METHOD 8015D, "Nonhalogenated Organics Using GC/FID"
SW-846 METHOD 3060A, "Alkaline Digestion for Hexavalent Chromium"
SW-846 METHOD 5030B, "Purge and Trap for Aqueous Samples"
SW-846 METHOD 5030C, "Purge and Trap for Aqueous Samples"
SW-846 METHOD 5035A, "Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soils and Waste Samples"
SW-846 METHOD 5035, "Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soils and Waste Samples"
SW-846 METHOD 7196A, "Chromium, Hexavalent (Colorimetric)"
SW-846 METHOD 7199, :"Determination of Hexavalent Chromium in Drinking Water, Groundwater and Industrial Wastewater Effluents by Ion Chromatography"
SW-846 METHOD 8021B, "Aromatic and Halogenated Volatiles by Gas Chromatography using Photoionization and/or Electrolytic Conductivity Detectors"
SW-846 Method 8260B, "Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)."
SW-846 Method 8315A, "Determination of Carbonyl Compounds by High Performance Liquid Chromatography (HPLC)."
SW-846 METHOD 9040, "pH"
SW-846 METHOD 9040B, "pH Electrometric Measurement"
SW-846 METHOD 9040C, "pH Electrometric Measurement"
SW-846 METHOD 9045, "Corrosivity, pH"
SW-846 METHOD 9045C, "Soil and Waste pH"
SW-846 METHOD 9045D, "Soil and Waste pH"
SW-846 METHOD 9050A, "Specific Conductance"
SW-846 METHOD 9056, "Determination of Inorganic Anions by Ion Chromatography"
In-House Methods
"Dissolved Gas Analysis in Aqueous Samples Using a GC Headspace Equilibration Technique."
"Determination of Volatile Amines in Ambient Air."
"Determination of Carboxylic Acids in Air."
"Analysis of Sulfur Compounds in Liquid Samples by Gas Chromatography with Sulfur Chemiluminescence Detection."

[1] *The list of referenced methods consists of both routine and non-routine performed methods. In addition, a number of the methods are performed with modification and are reported accordingly. Additionally, other methods may be performed, referenced and reported as long as the minimum requirements of the method and the Quality Assurance Manual are followed.*

[2] *The Standard Methods are in accordance with and as specified in the 19th or 20th editions; the correct version performed is in accordance with applicable accreditations and as stated in the corresponding standard operating procedures.*

LABORATORY STANDARD OPERATING PROCEDURES & MANUALS	
SOP CODE	**TITLE**
ADM-AUDIT	Conducting Internal Laboratory Audits
ADM-BATCH	Sample Batches
ADM-CMPLT	Dealing With Complaints
ADM-COC	Chain Of Custody For Sample Transfer Between Laboratories
ADM-CONFIRM	Confirmation Of Organic Analytes Id And Quantitation
ADM-CTMN	Checking New Lots Of Chemical For Contamination
ADM-CTRL_LIM	Control Limits
ADM-DATA_INT	Ensuring Data Integrity
ADM-DATA_REV	Data Review and Reporting
ADM-DATANTRY	Making Entries Into Logbooks And Onto Benchsheets
ADM-DOC_CTRL	Document Control
ADM-E_DATA	Preparation Of Electronic Data For Organic Analyses For Electronic-Data Auditing
ADM-SupEQ	Calibration and Use of Laboratory Support Equipment
SMO-FSHT	Foreign Soils Handling and Treatment
ADM-CONSUM	Handling Consumable Materials
ADM-E_DATAUDIT	Electronic-Data Auditing
ADM-INT	Manual Integration Of Chromatographic Peaks
ADM-MDL	Determination Of Method Detection Limits And Limits Of Detection
MED-Media_Req	Media Request Fullfilment
ADM-MGMTRVW	Managerial Review Of The Laboratory's Quality System
ADM-NCAR	Nonconformity And Corrective Action Documentation
ADM-PMgmt	Project Management And Business Development
ADM-PTS	Proficiency Testing Sample Analysis
ADM-PUR	Purchasing Through CAS Purchasing Agent In Kelso
ADM-SftwreQA	Software And Data Quality Assurance
ADM-SIGFIG	Significant Figures
ADM-LabSAT	Laboratory Storage, Analysis And Tracking
ADM-SOP	Preparation Of Standard Operating Procedures
ADM-DTAPES	Electronic Data Tape Backup, Archiving & Restoration
ADM-SUBLAB	Qualification Of Subcontract Laboratories Outside Of CAS Network

LABORATORY STANDARD OPERATING PROCEDURES & MANUALS	
SOP CODE	**TITLE**
ADM-TRANDOC	Documentation Of Training
ADM-UNCERT	Estimation Of Uncertainty Of Measurements
DSP-WASTE	Waste Disposal
GEN-GLAS	Glassware Cleaning
NA	Software Quality Assurance Plan
SMO_CanCert	Cleaning And Certification Of Summa Canisters & Other Specially Prepared Canisters
SMO-Can-Press	Evaluation And Pressurization Of Specially Prepared Stainless Steel Canisters
SMO-Flow_Cntrl	Flow Controllers And Critical Orifices
SMO-SMPL_REC	Sample Receiving, Acceptance And Log-In
GCP-TO4A	Sample Extraction and Preparation of Pesticide and PCB Samples According to EPA Compendium Methods TO-4A and TO-10A
MSP-13A	Sample and Media Preparation per EPA Compendium Method TO-13A
SVG-Amines	Determination of Volatile Amines in Ambient Air Using GC/NPD
SVG-TO4A	Determination of Pesticides and Polychlorinated Biphenyls (PCBs) in Ambient Air by GC/ECD per EPA Compendium Methods TO-4 and TO-10A
SVM-11A	Determination of Formaldehyde and Other Carbonyl Compounds in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC) EPA Compendium Method T0-11A
SVM-13A	Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in Ambient Air Using Gas Chromatography/Mass Spectrometry (GC/MS)
SVM-M8315A	Determination of Carbonyl Compounds in Solid and Liquid Samples by High Performance Liquid Chromatography (HPLC) per Modified EPA Method 8315A
SVM-NCASI_MeOH	Determination of Methanol, Acetaldehyde, MEK and Propionaldehyde in Pulp and Paper Process Liquids by GC/FID
SVM-CACIDS	Determination of Carboxylic Acids in Ambient Air Using GC/MS
SVM-OSHA_07	Determination of Organic Vapors Using GC/FID in Accordance with OSHA Method 07
VOA-BTU	Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels in Accordance with ASTM D 3588
VOA-CARB410M	Analysis of Benzene and Other Aromatic Hydrocarbons by Gas Chromatography with Photoionization Detection by Modified CARB 410

LABORATORY STANDARD OPERATING PROCEDURES & MANUALS	
SOP CODE	**TITLE**
VOA-CARB422	Analysis of Halogenated Volatile Organic Compounds in Emissions from Stationary Sources using GC/ECD in Accordance with a Modification of CARB Method 422
VOA-DISGAS	Dissolved Gas Analysis in Aqueous Samples Using a GC Headspace Equilibration Technique
VOA-EPA25C	Determination of Total Gaseous Nonmethane Organic (TGNMO) Emissions as Carbon in Landfill Gases in Accordance with EPA Method 25C
VOA-EPA25CM	Determination of Methane, Carbon Monoxide, Carbon Dioxide, and Total Gaseous Nonmethane Organic (TGNMO) Emissions as Carbon in Landfill Gases According to Modified EPA Method 25C
VOA-EPA3C	Determination of Hydrogen, Carbon Monoxide, Carbon Dioxide, Nitrogen, Methane, and Oxygen using Gas Chromatography with Thermal Conductivity Detection (TCD) in Accordance with EPA Method 3C or ASTM D 1946
VOA-HE	Analysis of Helium using Gas Chromatography with Thermal Conductivity Detection (TCD)
VOA-MAPH	Determination of Air-Phase Petroleum HC by GC/MS
VOA-NCASI	Impinger/Canister Source Sampling Method for Selected HAPS and Other Compounds at Wood Product Facilities
VOA-S307M_SCD	Analysis of Sulfur Compounds in a Gaseous Matrix by Gas Chromatography with Sulfur Chemiluminescence Detection per ASTM D 5504 and Modified SCAQMD Method 307
VOA-SH20_SCD	Analysis of Sulfur Compounds in Liquid Samples by Gas Chromatography with Sulfur Chemiluminescence Detection
VOA-TO15	Determination of Volatile Organic Compounds in Air Samples Collected in Specially Prepared Canisters and Gas Collection Bags and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)
VOA-TO17	Determination of VOCs in Ambient Air Using Active or Passive Sampling Onto Sorbent Tubes
VOA-TO3C1C6	Analysis of C1-C6+ using Gas Chromatography with Flame Ionization Detection (FID) in Accordance with a Modification of EPA Compendium Method TO-3
VOA-TPHG_TO3	Analysis of Total Petroleum Hydrocarbons as Gasoline in Air by Gas Chromatography with Flame Ionization Detection
VOA-TO3MeOH	Analysis of Various Compounds using Gas Chromatography with Flame Ionization Detection (FID) in Accordance with a Modification of EPA Compendium Method TO-3

LABORATORY STANDARD OPERATING PROCEDURES & MANUALS	
SOP CODE	**TITLE**
VOC-8260B	Volatile Organic Compounds (VOCs) by Gas Chromatography/Mass Spectrometry (GC/MS)
Appendix (VOC-8260B)	VOC-8260B, APPENDIX - The Analysis of Gasoline Range Organics (GRO)
VOC-EPA624	Analysis of Volatile Organic Compounds (VOCs) by Gas Chromatography/Mass Spectrometry (GC/MS)
VOH-8015B	Total Petroleum Hydrocarbons (TPH) as Gasoline
WET-COLOR	Color (Colorimetric, Platinum-Cobalt)
WET-COND	Conductivity, Resistivity and Salinity
WET-SOLIDS	Total Solids and Total Suspended Solids
WET-pHL	pH Electrometric Measurement for Liquids by Ion Selective Electrodes
WET-pHS	pH Electrometric Measurement for Solids by Ion Selective Electrodes
WET-NO2	Nitrite: Colorimetric
WET-TURB	Determination of Turbidity
WET-Anions_IC	Determination of Inorganic Anions by Ion Chromatography
WET-HexCr_IC	Hexavalent Chromium by Ion Chromatography
WET-Cr6L	Hexavalent Chromium: Colorimetric, Liquids
WET-Cr6S	Hexavalent Chromium: Colorimetric, Solids
WET-SS	Settleable Solids

APPENDIX D

DATA QUALIFIERS

Flag[1]	Data Qualifiers - Definition	Uncertain: Identity / Concentration
#	Analyte was detected above the method reporting limit prior to normalization.	No/no
B	Analyte found in the method blank	No/yes
BC	Results reported are not blank corrected. *(AIHA analyses only)*	No/yes
BH	The back portion of the sampling tube yielded higher results than the front.	No/yes
BT	Indicates possible breakthrough – result for back section ≥10% of result from front section of tube.	No/yes
C	Possible/Probable contamination	No/yes
C1	Confirmed by GC/MS.	No/no
D	Duplicate precision not within the specified limits.	No action taken by data user on the data alone.
DE	Results reported are corrected for desorption efficiency.	No/yes
E	Estimated; result based on response which exceeded the instrument calibration range.	No/yes
EH	Sample extracted outside of extraction hold time.	No/no
F	Analyte was found in the field blank.	No/yes
G	Quantitated using fuel calibration, but pattern does not match current gasoline standard.	Yes/yes
H	Sample analyzed outside of holding time.	No/yes
I	Internal standard not within the specified limits.	No/yes
J or F	[1]The analyte was positively identified below the method reporting limit; the associated numerical value is considered estimated. [2]The analyte was positively identified below the method reporting limit prior to utilizing the dilution factor; the associated numerical value is considered estimated.	No/yes
L	Laboratory control sample recovery outside the specified limits; results may be biased (high/low).	No/yes
M	Matrix interference; results may be biased (high/low).	No/yes (possible)
M	Matrix interference due to coelution with a non-target compound (TO-15 only);	No/yes (possible)
NA	Not applicable.	No/no
ND or U	[1]Compound was analyzed for, but not detected above the **laboratory detection limit**. *(if "J" flagging)* [2]Compound was analyzed for, but not detected above the **laboratory reporting limit**.	No/no
NF	Compound was searched for, but not found. *(for specified TICs)*	No/no
NQ	Result qualitatively confirmed but not able to quantify.	No/yes
P	Possible/Probable interference and/or analyte whose concentration has a greater than 25% difference for detected concentrations between the GC primary and confirmation columns.	No/yes
W	Result quantified but corresponding peak was detected outside of generated retention time window.	Yes/no
RH	Sample received outside of holding time.	No/yes
S	Surrogate recovery not within specified limits.	No/yes
T	Analyte is a tentatively identified compound, result is estimated.	No/yes
V	The continuing calibration verification standard was outside (biased high/low) the specified limits for this compound.	No/yes

<u>Note</u>: Where specified by project requirements or laboratory circumstances dictate, these may be altered or additional ones utilized. All qualifiers must be completely and unambiguously defined.

APPENDIX E

CERTIFICATIONS

The American Industrial Hygiene Association

CELEBRATING 30 Thirty Years of AIHA Accrediting Labs
SOUND DATA SMART DECISIONS
1974 – 2004

acknowledges that

Columbia Analytical Services, Inc.

2665 Park Center Drive, Suite A, Simi Valley, CA 93065-6200
Laboratory ID: 101661

has fulfilled the requirements of the AIHA Laboratory Quality Assurance Programs (LQAP), thereby, conforming to the ISO/IEC 17025:1999 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories*. The above named laboratory, along with all premises from which key activities are performed, as listed above, have been accredited by AIHA in the following:

ACCREDITATION PROGRAMS

✓	**INDUSTRIAL HYGIENE**	Accreditation Expires: 05/01/2008
☐	**ENVIRONMENTAL LEAD**	Accreditation Expires:
☐	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires:
☐	**FOOD**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation**. Continued accreditation is contingent upon successful on-going compliance with LQAP requirements. This certificate is not valid without the attached **Scope of Accreditation**.

David Kahane

David Kahane, CIH
Chairperson, Analytical Accreditation Board

Frank M. Renshaw

Frank M. Renshaw, PhD, CIH, CSP
President, AIHA

Date Re-Issued: 11/28/2006

LABORATORY QUALITY ASSURANCE PROGRAMS
SOUND DATA SMART DECISIONS

AIHA
Your Essential Connection: Advancing Occupational and Environmental Health and Safety Globally
2700 Prosperity Ave., Suite 250, Fairfax, VA 22031 U.S.A.
(703) 849-8888; Fax (703) 207-3561; www.aiha.org

AIHA Laboratory Quality Assurance Programs
SCOPE OF ACCREDITATION

Columbia Analytical Services, Inc.
2665 Park Center Drive, Suite A, Simi Valley, CA 93065-6200

Laboratory ID: 101661
Date Re-Issued:11/28/2006

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or revocation. A complete listing of currently accredited Industrial Hygiene laboratories is available on the AIHA website at:
http://www.aiha.org/Content/LQAP/accred/AccreditedLabs.htm

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 09/01/1994

IHLAP Category	Field of Testing (FoT)	Method	Method Description (*for internal methods only*)
Core Program Testing	Gas Chromatography	NIOSH 1450	
		NIOSH 1457	
		NIOSH 1500	
		NIOSH 1501	
		NIOSH 1550	
		OSHA 07	

The laboratory participates in the following AIHA* or AIHA-approved proficiency testing programs:

- ☐ Metals*
- ☐ Silica*
- ☐ Asbestos*
- ☐ Bulk Asbestos*
- ☐ Beryllium*
- ☑ Organic Solvents*
- ☑ Diffusive Sampler (3M)*
- ☐ Diffusive Sampler (SKC)*
- ☐ Diffusive Sampler (AT)*
- ☐ WASP[1] (Formaldehyde)
- ☐ WASP[1] (Thermal Desorption Tubes)
- ☐ Pharmaceutical Round Robin
- ☐ Compressed/Breathing Air Round Robin
- ☐ NVLAP (determined at the time of site assessment)

[1] Workplace Analytical Scheme for Proficiency

Effective: February 28, 2006
Scope_IHLAP_R3
Author: Kris Heinbaugh
Page 1 of 1

Arizona Department of Health Services

ENVIRONMENTAL LABORATORY LICENSE

Issued to:

Laboratory Director: John Yokoyama
Owner/Representative: John Yokoyama

Columbia Analytical Services, Inc.
AZ0694

is in compliance with Environmental Laboratory's applicable standards for the State of Arizona and maintains on file a List of Parameters for which the laboratory is certified to perform analysis.

PERIOD OF LICENSURE FROM: 06/28/2007 TO: 06/27/2008

Steven D. Baker, Chief
Office of Laboratory Services
Bureau of State Laboratory Services

AZ License: AZ0694
Lab Director: Mr. John Yokoyama

Lab Name: Columbia Analytical Services, Inc.
Phone: (805) 526-7161
Fax: (805) 526-7270

Program AIR

Parameter	EPA Method	Billing Code	Cert Date
Volatile Organic Compounds	METHOD TO-15	AIR17	06/28/06

Total Licensed Parameters in this Program: 1

Program HW

Parameter	EPA Method	Billing Code	Cert Date
Bromide	EPA 9056	NIIIA1	06/28/06
Chloride	EPA 9056	NIIIA1	06/28/06
Chromium, Hexavalent	EPA 7196A	MTL4	06/28/06
Chromium, Hexavalent	EPA 7199	MTL4	06/28/06
Closed System Purge And Trap Extract. Vocs	EPA 5035A	PREP2	12/05/06
Corrosivity Ph Determination	EPA 9040C	HAZ1	12/05/06
Fluoride	EPA 9056	NIIIA1	06/28/06
Hydrogen Ion (Ph)	EPA 9045D	NIA6	12/05/06
Nitrate	EPA 9056	NIIIA1	06/28/06
Nitrite	EPA 9056	NIIIA1	06/28/06
Nonhalogenated Organics Using Gc/Fid	EPA 8015D	VOC4	12/05/06
Ortho-Phosphate	EPA 9056	NIIIA1	06/28/06
Purge And Trap For Aqueous Samples	EPA 5030C	PREP2	12/05/06
Specific Conductance	EPA 9050A	NIA7	06/28/06
Sulfate	EPA 9056	NIIIA1	06/28/06
Vocs By Gc/Ms	EPA 8260B	VOC8	06/28/06

Total Licensed Parameters in this Program: 16

Program WW

Parameter	EPA Method	Billing Code	Cert Date
Bromide	EPA 300.0	NIIIA1	06/28/06
Chloride	EPA 300.0	NIIIA1	06/28/06
Chromium, Hexavalent	SM 3500-CR D	MTL4	06/28/06
Color	SM 2120B	NIA4	12/05/06
Fluoride	EPA 300.0	NIIIA1	06/28/06
Hydrogen Ion (Ph)	SM 4500-H B	NIA6	02/20/07
Nitrate	EPA 300.0	NIIIA1	06/28/06
Nitrite (As N)	EPA 300.0	NIIIA1	06/28/06
Nitrite (As N)	EPA 354.1	NIIB4	06/28/06
Orthophosphate	EPA 300.0	NIIIA1	06/28/06
Purgeables	EPA 624	VOC8	06/28/06
Residue Nonfilterable	SM 2540D	NIIA5	12/05/06
Residue Total	SM 2540B	NIIA4	12/05/06
Residue, Settleable Solids	SM 2540F	NIIA6	06/28/06

AZ License: AZ0694 **Lab Name: Columbia Analytical Services, Inc.**

Program WW

Parameter	EPA Method	Billing Code	Cert Date
Specific Conductance	EPA 120.1	NIA7	06/28/06
Sulfate	EPA 300.0	NIIIA1	06/28/06
Turbidity	EPA 180.1	NIA9	06/28/06

Total Licensed Parameters in this Program: 17

Instruments	Quantity	Date
GAS CHROMATOGRAPH/MASS SPECTROMETER	8	05/19/06
GAS CHROMATOGRAPH	2	05/19/06
ION CHROMATOGRAPH	2	11/27/06

Softwares
ENVIROQUANT - GCMS
HP CHEMSTATION - GC
ENVIROQUANT - GC
CHEMSTATION - GC/MS
METROHM - IC
STEALTH - GC
STEALTH GC/MS

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

NELAP - RECOGNIZED

ACCREDITATION

Is hereby granted to

COLUMBIA ANALYTICAL SERVICES, INC.

2655 PARK CENTER DRIVE, SUITE A

SIMI VALLEY, CA 93065

Scope of accreditation is limited to the
"NELAP Fields of Accreditation"
which accompanies this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **02115CA**

Expiration Date: **12/31/2007**

Effective Date: **12/31/2006**

Richmond, California
subject to forfeiture or revocation

George C. Kulasingam, Ph.D.
Program Chief
Environmental Laboratory Accreditation Program

CALIFORNIA DEPARTMENT OF HEALTH SERVICES

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM - NELAP RECOGNIZED

Fields of Accreditation

COLUMBIA ANALYTICAL SERVICES, INC. **Lab Phone** (805) 526-7161

2655 PARK CENTER DRIVE, SUITE A
SIMI VALLEY, CA 93065

Certificate No: 02115CA **Renew Date: 12/31/2007** **INTERIM**

108 - Inorganic Chemistry of Wastewater			
108.016	001	EPA 110.2	Color
108.020	001	EPA 120.1	Conductivity
108.050	001	EPA 150.1	pH
108.070	001	EPA 160.2	Residue, Non-filterable
108.080	001	EPA 160.3	Residue, Total
108.100	001	EPA 160.5	Residue, Settleable
108.110	001	EPA 180.1	Turbidity
108.120	001	EPA 300.0	Bromide
108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	005	EPA 300.0	Nitrite
108.120	006	EPA 300.0	Nitrate-nitrite, Total
108.120	007	EPA 300.0	Phosphate, Ortho
108.120	008	EPA 300.0	Sulfate
108.240	001	EPA 354.1	Nitrite
109 - Toxic Chemical Elements of Wastewater			
109.104	001	EPA 218.6	Chromium (VI)
109.811	001	SM3500-Cr D	Chromium (VI)
110 - Volatile Organic Chemistry of Wastewater			
110.040	001	EPA 624	Benzene
110.040	002	EPA 624	Bromodichloromethane
110.040	003	EPA 624	Bromoform
110.040	004	EPA 624	Bromomethane
110.040	005	EPA 624	Carbon Tetrachloride
110.040	006	EPA 624	Chlorobenzene
110.040	007	EPA 624	Chloroethane
110.040	008	EPA 624	2-Chloroethyl Vinyl Ether
110.040	009	EPA 624	Chloroform
110.040	010	EPA 624	Chloromethane
110.040	011	EPA 624	Dibromochloromethane
110.040	012	EPA 624	1,2-Dichlorobenzene
110.040	013	EPA 624	1,3-Dichlorobenzene

As of 01/17/2007, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

110.040	014	EPA 624	1,4-Dichlorobenzene
110.040	015	EPA 624	1,1-Dichloroethane
110.040	016	EPA 624	1,2-Dichloroethane
110.040	017	EPA 624	1,1-Dichloroethene
110.040	018	EPA 624	trans-1,2-Dichloroethene
110.040	019	EPA 624	1,2-Dichloropropane
110.040	020	EPA 624	cis-1,3-Dichloropropene
110.040	021	EPA 624	trans-1,3-Dichloropropene
110.040	022	EPA 624	Ethylbenzene
110.040	023	EPA 624	Methylene Chloride
110.040	024	EPA 624	1,1,2,2-Tetrachloroethane
110.040	025	EPA 624	Tetrachloroethene
110.040	026	EPA 624	Toluene
110.040	027	EPA 624	1,1,1-Trichloroethane
110.040	028	EPA 624	1,1,2-Trichloroethane
110.040	029	EPA 624	Trichloroethene
110.040	030	EPA 624	Trichlorofluoromethane
110.040	031	EPA 624	Vinyl Chloride
114 - Inorganic Chemistry of Hazardous Waste			
114.103	001	EPA 7196A	Chromium (VI)
114.106	001	EPA 7199	Chromium (VI)
114.240	001	EPA 9040B	Corrosivity - pH Determination
114.241	001	EPA 9045C	Corrosivity - pH Determination
114.250	001	EPA 9056	Fluoride
116 - Volatile Organic Chemistry of Hazardous Waste			
116.020	001	EPA 8015B	Acetone
116.020	006	EPA 8015B	n-Butyl Alcohol
116.020	009	EPA 8015B	Ethanol
116.020	011	EPA 8015B	Ethylene Glycol
116.020	014	EPA 8015B	Isopropyl Alcohol
116.020	015	EPA 8015B	Methanol
116.030	001	EPA 8015B	Gasoline-range Organics
116.080	001	EPA 8260B	Acetone
116.080	002	EPA 8260B	Acetonitrile
116.080	003	EPA 8260B	Acrolein
116.080	004	EPA 8260B	Acrylonitrile
116.080	005	EPA 8260B	Allyl Alcohol
116.080	007	EPA 8260B	Benzene
116.080	010	EPA 8260B	Bromochloromethane
116.080	011	EPA 8260B	Bromodichloromethane
116.080	012	EPA 8260B	Bromoform

As of 01/17/2007, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

116.080	013	EPA 8260B	Bromomethane
116.080	015	EPA 8260B	Carbon Disulfide
116.080	016	EPA 8260B	Carbon Tetrachloride
116.080	018	EPA 8260B	Chlorobenzene
116.080	019	EPA 8260B	Chloroethane
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether
116.080	021	EPA 8260B	Chloroform
116.080	022	EPA 8260B	Chloromethane
116.080	023	EPA 8260B	Chloroprene
116.080	026	EPA 8260B	Dibromochloromethane
116.080	027	EPA 8260B	Dibromochloropropane
116.080	028	EPA 8260B	1,2-Dibromoethane
116.080	030	EPA 8260B	Dibromomethane
116.080	031	EPA 8260B	1,2-Dichlorobenzene
116.080	032	EPA 8260B	1,3-Dichlorobenzene
116.080	033	EPA 8260B	1,4-Dichlorobenzene
116.080	034	EPA 8260B	cis-1,4-Dichloro-2-butene
116.080	035	EPA 8260B	trans-1,4-Dichloro-2-butene
116.080	036	EPA 8260B	Dichlorodifluoromethane
116.080	037	EPA 8260B	1,1-Dichloroethane
116.080	038	EPA 8260B	1,2-Dichloroethane
116.080	039	EPA 8260B	1,1-Dichloroethene
116.080	040	EPA 8260B	trans-1,2-Dichloroethene
116.080	041	EPA 8260B	cis-1,2-Dichloroethene
116.080	042	EPA 8260B	1,2-Dichloropropane
116.080	043	EPA 8260B	1,3-Dichloropropane
116.080	044	EPA 8260B	2,2-Dichloropropane
116.080	045	EPA 8260B	1,1-Dichloropropene
116.080	046	EPA 8260B	cis-1,3-Dichloropropene
116.080	047	EPA 8260B	trans-1,3-Dichloropropene
116.080	050	EPA 8260B	1,4-Dioxane
116.080	052	EPA 8260B	Ethyl Acetate
116.080	053	EPA 8260B	Ethylbenzene
116.080	055	EPA 8260B	Ethyl Methacrylate
116.080	056	EPA 8260B	Hexachlorobutadiene
116.080	058	EPA 8260B	2-Hexanone (MBK)
116.080	059	EPA 8260B	Iodomethane
116.080	060	EPA 8260B	Isobutyl Alcohol
116.080	062	EPA 8260B	Methacrylonitrile
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)
116.080	065	EPA 8260B	Methylene Chloride

As of 01/17/2007, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

116.080	066	EPA 8260B	Methyl Ethyl Ketone
116.080	067	EPA 8260B	Methyl Methacrylate
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)
116.080	069	EPA 8260B	Naphthalene
116.080	078	EPA 8260B	Propionitrile
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane
116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane
116.080	083	EPA 8260B	Tetrachloroethene
116.080	084	EPA 8260B	Toluene
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene
116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	088	EPA 8260B	1,1,1-Trichloroethane
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane
116.080	092	EPA 8260B	1,2,3-Trichloropropane
116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total
116.080	096	EPA 8260B	tert-Amyl Methyl Ether (TAME)
116.080	097	EPA 8260B	tert-Butyl Alcohol (TBA)
116.080	098	EPA 8260B	Ethyl tert-butyl Ether (ETBE)
116.080	099	EPA 8260B	Bromobenzene
116.080	100	EPA 8260B	n-Butylbenzene
116.080	101	EPA 8260B	sec-Butylbenzene
116.080	102	EPA 8260B	tert-Butylbenzene
116.080	103	EPA 8260B	2-Chlorotoluene
116.080	104	EPA 8260B	4-Chlorotoluene
116.080	105	EPA 8260B	Isopropylbenzene
116.080	106	EPA 8260B	N-propylbenzene
116.080	107	EPA 8260B	Styrene
116.080	108	EPA 8260B	1,2,4-Trimethylbenzene
116.080	109	EPA 8260B	1,3,5-Trimethylbenzene
116.100	001	LUFT GC/MS	Total Petroleum Hydrocarbons - Gasoline
116.100	010	LUFT GC/MS	BTEX and MTBE
116.110	001	LUFT	Total Petroleum Hydrocarbons - Gasoline
120 - Physical Properties of Hazardous Waste			
120.070	001	EPA 9040B	Corrosivity - pH Determination
120.080	001	EPA 9045C	Corrosivity - pH Determination

As of 01/17/2007, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

FLORIDA DEPARTMENT OF
HEALTH

State of Florida
Department of Health, Bureau of Laboratories
This is to certify that

E871020
COLUMBIA ANALYTICAL SERVICES, INC. - SIMI VALLEY
2655 PARK CENTER DRIVE, SUITE A
SIMI VALLEY, CA 91360

has complied with Florida Administrative Code 64E-1,
for the examination of Environmental samples in the following categories

AIR AND EMISSIONS - VOLATILE ORGANICS

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

EFFECTIVE July 01, 2007 THROUGH June 30, 2008

Max Salfinger, M.D.
Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1697, 7/04
NON-TRANSFERABLE E871020-01-7/1/2007
Supersedes all previously issued certificates

Charlie Crist
Governor

FLORIDA DEPARTMENT OF HEALTH

Ana M. Viamonte Ros, M.D., M.P.H.
Secretary of Health

Laboratory Scope of Accreditation

Attachment to Certificate #: E871020-01, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E871020 **EPA Lab Code: CA01527** **(805) 526-7161**

E871020
Columbia Analytical Services, Inc. - Simi Valley
2655 Park Center Drive, Suite A
Simi Valley, CA 91360

Matrix: Air and Emissions

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1-Trichloroethane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,1,2,2-Tetrachloroethane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,1,2-Trichloro-1,2,2-trifluoroethane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,1,2-Trichloroethane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,1-Dichloroethane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,1-Dichloroethylene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,2,4-Trichlorobenzene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,2,4-Trimethylbenzene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,2-Dichloro-1,1,2,2-tetrafluoroethane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,2-Dichlorobenzene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,2-Dichloroethane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,2-Dichloropropane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,3,5-Trimethylbenzene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,3-Butadiene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,3-Dichlorobenzene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,4-Dichlorobenzene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
1,4-Dioxane (1,4-Diethyleneoxide)	EPA TO-15	Volatile Organics	NELAP	6/11/2007
2,2,4-Trimethylpentane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
2-Butanone (Methyl ethyl ketone, MEK)	EPA TO-15	Volatile Organics	NELAP	6/11/2007
4-Methyl-2-pentanone (MIBK)	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Allyl chloride (3-Chloropropene)	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Benzene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Bromoform	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Carbon disulfide	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Carbon tetrachloride	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Chlorobenzene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Chloroethane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Chloroform	EPA TO-15	Volatile Organics	NELAP	6/11/2007
cis-1,2-Dichloroethylene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
cis-1,3-Dichloropropene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Dichlorodifluoromethane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Ethylbenzene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Hexachlorobutadiene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Methyl bromide (Bromomethane)	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Methyl chloride (Chloromethane)	EPA TO-15	Volatile Organics	NELAP	6/11/2007

Clients and Customers are urged to verify the laboratory's current certification status with the Environmental Laboratory Certification Program. **Issue Date: 7/1/2007** **Expiration Date: 6/30/2008**

Charlie Crist
Governor

FLORIDA DEPARTMENT OF HEALTH

Ana M. Viamonte Ros, M.D., M.P.H.
Secretary of Health

Laboratory Scope of Accreditation

Attachment to Certificate #: E871020-01, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E871020 **EPA Lab Code: CA01527** **(805) 526-7161**

E871020
Columbia Analytical Services, Inc. - Simi Valley
2655 Park Center Drive, Suite A
Simi Valley, CA 91360

Matrix: Air and Emissions

Analyte	Method/Tech	Category	Certification Type	Effective Date
Methyl isobutyl ketone (Hexone)	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Methyl methacrylate	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Methyl tert-butyl ether (MTBE)	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Methylene chloride	EPA TO-15	Volatile Organics	NELAP	6/11/2007
n-Heptane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
n-Hexane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Styrene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Tetrachloroethylene (Perchloroethylene)	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Toluene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
trans-1,2-Dichloroethylene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
trans-1,3-Dichloropropylene	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Trichloroethene (Trichloroethylene)	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Trichlorofluoromethane	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Vinyl acetate	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Vinyl chloride	EPA TO-15	Volatile Organics	NELAP	6/11/2007
Xylene (total)	EPA TO-15	Volatile Organics	NELAP	6/11/2007

Clients and Customers are urged to verify the laboratory's current certification status with the Environmental Laboratory Certification Program. **Issue Date: 7/1/2007** **Expiration Date: 6/30/2008**

State of New Jersey
Department of Environmental Protection
Certifies That

Columbia Analytical Services, Inc.

Laboratory Certification ID #: CA009

having duly met the requirements of the
Regulations Governing The Certification Of
Laboratories And Environmental Measurements N.J.A.C. 7:18 et. seq.
and
having been found compliant with the standard approved by the
National Environmental Laboratory Accreditation Conference
is hereby approved as a
Nationally Accredited Environmental Laboratory
to perform the analyses as indicated on the Annual Certified Parameter List
which must accompany this certificate to be valid

Expiration Date June 30, 2008

Joseph F. Aiello, Chief
Office of Quality Assurance

NJDEP is a NELAP Recognized Accrediting Authority

THIS CERTIFICATE IS TO BE CONSPICUOUSLY DISPLAYED AT THE LABORATORY WITH THE ANNUAL CERTIFIED PARAMETER LIST IN A LOCATION ON THE PREMISES VISIBLE TO THE PUBLIC

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 07/01/2007 until 06/30/2008

Laboratory Name: COLUMBIA ANALYTICAL SERVICES INC Laboratory Number: CA009 Activity ID: NLC070001
2655 PARK CTR DR
STE A
SIMI VALLEY, CA 93065

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Dropped	No	NJ	CAP03.00180	AE	GC/MS, Canisters	[EPA TO-15]	Acetaldehyde
Certified	Yes	NJ	CAP03.00184	AE	GC/MS, Canisters	[EPA TO-15]	Acetone
Applied	No	NJ	CAP03.00185	AE	GC/MS, Canisters	[EPA TO-15]	Acetonitrile
Dropped	No	NJ	CAP03.00190	AE	GC/MS, Canisters	[EPA TO-15]	Acetophenone
Certified	Yes	NJ	CAP03.00195	AE	GC/MS, Canisters	[EPA TO-15]	Acrolein
Dropped	No	NJ	CAP03.00200	AE	GC/MS, Canisters	[EPA TO-15]	Acrylamide
Dropped	No	NJ	CAP03.00205	AE	GC/MS, Canisters	[EPA TO-15]	Acrylic acid
Applied	No	NJ	CAP03.00210	AE	GC/MS, Canisters	[EPA TO-15]	Acrylonitrile
Certified	Yes	NJ	CAP03.00215	AE	GC/MS, Canisters	[EPA TO-15]	Allyl chloride
Certified	Yes	NJ	CAP03.00225	AE	GC/MS, Canisters	[EPA TO-15]	Benzene
Applied	No	NJ	CAP03.00230	AE	GC/MS, Canisters	[EPA TO-15]	Benzyl chloride
Dropped	No	NJ	CAP03.00235	AE	GC/MS, Canisters	[EPA TO-15]	Propiolactone (beta-)
Dropped	No	NJ	CAP03.00240	AE	GC/MS, Canisters	[EPA TO-15]	Bis (2-chloroethyl) ether
Dropped	No	NJ	CAP03.00245	AE	GC/MS, Canisters	[EPA TO-15]	Bis (chloromethyl) ether
Certified	Yes	NJ	CAP03.00250	AE	GC/MS, Canisters	[EPA TO-15]	Bromodichloromethane
Certified	Yes	NJ	CAP03.00255	AE	GC/MS, Canisters	[EPA TO-15]	Bromoform
Certified	Yes	NJ	CAP03.00260	AE	GC/MS, Canisters	[EPA TO-15]	Bromomethane
Certified	Yes	NJ	CAP03.00265	AE	GC/MS, Canisters	[EPA TO-15]	Butadiene (1,3-)
Certified	Yes	NJ	CAP03.00270	AE	GC/MS, Canisters	[EPA TO-15]	Carbon disulfide
Certified	Yes	NJ	CAP03.00275	AE	GC/MS, Canisters	[EPA TO-15]	Carbon tetrachloride
Dropped	No	NJ	CAP03.00280	AE	GC/MS, Canisters	[EPA TO-15]	Carbon oxysulfide (Carbonyl sulfide)
Dropped	No	NJ	CAP03.00285	AE	GC/MS, Canisters	[EPA TO-15]	Catechol
Dropped	No	NJ	CAP03.00295	AE	GC/MS, Canisters	[EPA TO-15]	Chloroacetic acid
Certified	Yes	NJ	CAP03.00300	AE	GC/MS, Canisters	[EPA TO-15]	Chlorobenzene
Certified	Yes	NJ	CAP03.00305	AE	GC/MS, Canisters	[EPA TO-15]	Chloroethane
Certified	Yes	NJ	CAP03.00310	AE	GC/MS, Canisters	[EPA TO-15]	Chloroform
Certified	Yes	NJ	CAP03.00315	AE	GC/MS, Canisters	[EPA TO-15]	Chloromethane
Dropped	No	NJ	CAP03.00320	AE	GC/MS, Canisters	[EPA TO-15]	Chloromethyl methyl ether
Dropped	No	NJ	CAP03.00325	AE	GC/MS, Canisters	[EPA TO-15]	Chlorotoluene (2-)
Dropped	No	NJ	CAP03.00330	AE	GC/MS, Canisters	[EPA TO-15]	Cresols/Cresylic acid
Certified	Yes	NJ	CAP03.00335	AE	GC/MS, Canisters	[EPA TO-15]	Cyclohexane

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 07/01/2007 until 06/30/2008

Laboratory Name: COLUMBIA ANALYTICAL SERVICES INC Laboratory Number: CA009 Activity ID: NLC070001
2655 PARK CTR DR
STE A
SIMI VALLEY, CA 93065

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00342	AE	GC/MS, Canisters	[EPA TO-15]	Dibromochloromethane
Applied	No	NJ	CAP03.00345	AE	GC/MS, Canisters	[EPA TO-15]	Dibromo-3-chloropropane (1,2-)
Certified	Yes	NJ	CAP03.00350	AE	GC/MS, Canisters	[EPA TO-15]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	CAP03.00355	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	CAP03.00360	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	CAP03.00365	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	CAP03.00368	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorodifluoromethane
Certified	Yes	NJ	CAP03.00370	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethane (1,1-)
Certified	Yes	NJ	CAP03.00375	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethane (1,2-)
Certified	Yes	NJ	CAP03.00380	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (1,1-)
Certified	Yes	NJ	CAP03.00384	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	CAP03.00385	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (trans-1,2-)
Dropped	No	NJ	CAP03.00390	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorofluoromethane
Certified	Yes	NJ	CAP03.00395	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropane (1,2-)
Certified	Yes	NJ	CAP03.00400	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	CAP03.00401	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	CAP03.00405	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorotetrafluoroethane (1,2-)
Dropped	No	NJ	CAP03.00410	AE	GC/MS, Canisters	[EPA TO-15]	Diethyl sulfate
Dropped	No	NJ	CAP03.00415	AE	GC/MS, Canisters	[EPA TO-15]	Dimethyl sulfate
Dropped	No	NJ	CAP03.00425	AE	GC/MS, Canisters	[EPA TO-15]	Dimethylcarbamoyl chloride
Dropped	No	NJ	CAP03.00430	AE	GC/MS, Canisters	[EPA TO-15]	Dimethyl formamide (N, N-)
Certified	Yes	NJ	CAP03.00440	AE	GC/MS, Canisters	[EPA TO-15]	Dioxane (1,4-)
Dropped	No	NJ	CAP03.00445	AE	GC/MS, Canisters	[EPA TO-15]	Epichlorohydrin
Dropped	No	NJ	CAP03.00450	AE	GC/MS, Canisters	[EPA TO-15]	Epoxybutane (1,2-)
Applied	No	NJ	CAP03.00452	AE	GC/MS, Canisters	[EPA TO-15]	Ethyl acetate
Dropped	No	NJ	CAP03.00455	AE	GC/MS, Canisters	[EPA TO-15]	Ethyl acrylate
Dropped	No	NJ	CAP03.00460	AE	GC/MS, Canisters	[EPA TO-15]	Ethyl carbamate (Urethane)
Certified	Yes	NJ	CAP03.00465	AE	GC/MS, Canisters	[EPA TO-15]	Ethylbenzene
Dropped	No	NJ	CAP03.00470	AE	GC/MS, Canisters	[EPA TO-15]	Ethylene Oxide
Certified	Yes	NJ	CAP03.00480	AE	GC/MS, Canisters	[EPA TO-15]	Ethyltoluene (4-)
Dropped	No	NJ	CAP03.00485	AE	GC/MS, Canisters	[EPA TO-15]	Formaldehyde
Certified	Yes	NJ	CAP03.00490	AE	GC/MS, Canisters	[EPA TO-15]	Hexachlorobutadiene (1,3-)

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 07/01/2007 until 06/30/2008

Laboratory Name: COLUMBIA ANALYTICAL SERVICES INC Laboratory Number: CA009 Activity ID: NLC070001
2655 PARK CTR DR
STE A
SIMI VALLEY, CA 93065

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00498	AE	GC/MS, Canisters	[EPA TO-15]	Hexanone (2-)
Dropped	No	NJ	CAP03.00500	AE	GC/MS, Canisters	[EPA TO-15]	Heptane (n-)
Dropped	No	NJ	CAP03.00505	AE	GC/MS, Canisters	[EPA TO-15]	Hexane (n-)
Dropped	No	NJ	CAP03.00510	AE	GC/MS, Canisters	[EPA TO-15]	Isophorone
Applied	No	NJ	CAP03.00511	AE	GC/MS, Canisters	[EPA TO-15]	Isopropanol
Applied	No	NJ	CAP03.00515	AE	GC/MS, Canisters	[EPA TO-15]	Isopropylbenzene
Dropped	No	NJ	CAP03.00520	AE	GC/MS, Canisters	[EPA TO-15]	Methyl alcohol (Methanol)
Certified	Yes	NJ	CAP03.00525	AE	GC/MS, Canisters	[EPA TO-15]	Methyl ethyl ketone
Certified	Yes	NJ	CAP03.00535	AE	GC/MS, Canisters	[EPA TO-15]	Methyl isobutyl ketone
Dropped	No	NJ	CAP03.00540	AE	GC/MS, Canisters	[EPA TO-15]	Methyl isocyanate
Certified	Yes	NJ	CAP03.00545	AE	GC/MS, Canisters	[EPA TO-15]	Methyl methacrylate
Certified	Yes	NJ	CAP03.00550	AE	GC/MS, Canisters	[EPA TO-15]	Methyl tert-butyl ether
Certified	Yes	NJ	CAP03.00555	AE	GC/MS, Canisters	[EPA TO-15]	Methylene chloride (Dichloromethane)
Dropped	No	NJ	CAP03.00565	AE	GC/MS, Canisters	[EPA TO-15]	Methylphenol (2-)
Dropped	No	NJ	CAP03.00570	AE	GC/MS, Canisters	[EPA TO-15]	Nitrobenzene
Dropped	No	NJ	CAP03.00575	AE	GC/MS, Canisters	[EPA TO-15]	Nitropropane (2-)
Dropped	No	NJ	CAP03.00580	AE	GC/MS, Canisters	[EPA TO-15]	N-Nitrosodimethylamine
Dropped	No	NJ	CAP03.00585	AE	GC/MS, Canisters	[EPA TO-15]	N-Nitrosomorpholine
Dropped	No	NJ	CAP03.00590	AE	GC/MS, Canisters	[EPA TO-15]	N-Nitroso-N-methylurea
Dropped	No	NJ	CAP03.00595	AE	GC/MS, Canisters	[EPA TO-15]	Phenol
Dropped	No	NJ	CAP03.00600	AE	GC/MS, Canisters	[EPA TO-15]	Phosgene
Dropped	No	NJ	CAP03.00605	AE	GC/MS, Canisters	[EPA TO-15]	Propionaldehyde
Applied	No	NJ	CAP03.00612	AE	GC/MS, Canisters	[EPA TO-15]	Propylene
Dropped	No	NJ	CAP03.00615	AE	GC/MS, Canisters	[EPA TO-15]	Propylene oxide
Dropped	No	NJ	CAP03.00620	AE	GC/MS, Canisters	[EPA TO-15]	Propane sultone (1,3-)
Certified	Yes	NJ	CAP03.00625	AE	GC/MS, Canisters	[EPA TO-15]	Styrene
Dropped	No	NJ	CAP03.00630	AE	GC/MS, Canisters	[EPA TO-15]	Styrene oxide
Certified	Yes	NJ	CAP03.00635	AE	GC/MS, Canisters	[EPA TO-15]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	CAP03.00640	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	CAP03.00645	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	CAP03.00650	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylpentane (2,2,4-)
Applied	No	NJ	CAP03.00652	AE	GC/MS, Canisters	[EPA TO-15]	Tert-butyl alcohol

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 07/01/2007 until 06/30/2008

Laboratory Name: COLUMBIA ANALYTICAL SERVICES INC Laboratory Number: CA009 Activity ID: NLC070001
2655 PARK CTR DR
STE A
SIMI VALLEY, CA 93065

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00655	AE	GC/MS, Canisters	[EPA TO-15]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	CAP03.00660	AE	GC/MS, Canisters	[EPA TO-15]	Tetrachloroethene
Applied	No	NJ	CAP03.00662	AE	GC/MS, Canisters	[EPA TO-15]	Tetrahydrofuran
Certified	Yes	NJ	CAP03.00665	AE	GC/MS, Canisters	[EPA TO-15]	Toluene
Certified	Yes	NJ	CAP03.00670	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	CAP03.00675	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	CAP03.00680	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethene
Certified	Yes	NJ	CAP03.00684	AE	GC/MS, Canisters	[EPA TO-15]	Trichlorofluoromethane
Certified	Yes	NJ	CAP03.00685	AE	GC/MS, Canisters	[EPA TO-15]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Dropped	No	NJ	CAP03.00695	AE	GC/MS, Canisters	[EPA TO-15]	Trifluoromethane
Certified	Yes	NJ	CAP03.00700	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl acetate
Dropped	No	NJ	CAP03.00705	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl bromide
Certified	Yes	NJ	CAP03.00710	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl chloride
Certified	Yes	NJ	CAP03.00715	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (m-)
Certified	Yes	NJ	CAP03.00720	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (o-)
Certified	Yes	NJ	CAP03.00725	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (p-)
Certified	Yes	NJ	CAP03.00730	AE	GC/MS, Canisters	[EPA TO-15]	Xylenes (total)

Joseph F. Aiello, Chief

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER
RICHARD F. DAINES, M.D.

Expires 12:01 AM April 01, 2008
Issued April 01, 2007

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. MICHAEL TUDAY
COLUMBIA ANALYTICAL SERVICES INC. -SIMI VALLEY
2655 PARK CENTER DR, SUITE A
SIMI VALLEY, CA 93065

NY Lab Id No: 11221
EPA Lab Code: CA00404

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category ENVIRONMENTAL ANALYSES AIR AND EMISSIONS
All approved analytes are listed below:

Acrylates	
Acrylonitrile	EPA TO-15
Methyl methacrylate	EPA TO-15
Chlorinated Hydrocarbons	
1,2,4-Trichlorobenzene	EPA TO-15
Hexachlorobutadiene	EPA TO-15
Purgeable Aromatics	
1,2,4-Trimethylbenzene	EPA TO-15
1,2-Dichlorobenzene	EPA TO-15
1,3,5-Trimethylbenzene	EPA TO-15
1,3-Dichlorobenzene	EPA TO-15
1,4-Dichlorobenzene	EPA TO-15
Benzene	EPA TO-15
Chlorobenzene	EPA TO-15
Ethyl benzene	EPA TO-15
Styrene	EPA TO-15
Toluene	EPA TO-15
Total Xylenes	EPA TO-15
Purgeable Halocarbons	
1,1,1-Trichloroethane	EPA TO-15
1,1,2,2-Tetrachloroethane	EPA TO-15
1,1,2-Trichloroethane	EPA TO-15

Purgeable Halocarbons	
1,1,2-Trifluoro-1,2,2-Trichloroethane	EPA TO-15
1,1-Dichloroethane	EPA TO-15
1,1-Dichloroethene	EPA TO-15
1,2-Dichloro-1,1,2,2-tetrafluoroethane	EPA TO-15
1,2-Dichloroethane	EPA TO-15
1,2-Dichloropropane	EPA TO-15
Bromodichloromethane	EPA TO-15
Bromoform	EPA TO-15
Bromomethane	EPA TO-15
Carbon tetrachloride	EPA TO-15
Chloroethane	EPA TO-15
Chloroform	EPA TO-15
Chloromethane	EPA TO-15
cis-1,2-Dichloroethene	EPA TO-15
cis-1,3-Dichloropropene	EPA TO-15
Dichlorodifluoromethane	EPA TO-15
Methylene chloride	EPA TO-15
Tetrachloroethene	EPA TO-15
trans-1,2-Dichloroethene	EPA TO-15
trans-1,3-Dichloropropene	EPA TO-15
Trichloroethene	EPA TO-15
Trichlorofluoromethane	EPA TO-15
Vinyl chloride	EPA TO-15

Serial No.: 32757

Property of the New York State Department of Health. Valid only at the address shown. Must be conspicuously posted. Valid certificates have a raised seal. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify laboratory's accreditation status.

Page 1 of 2

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER
RICHARD F. DAINES, M.D.

Expires 12:01 AM April 01, 2008
Issued April 01, 2007

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. MICHAEL TUDAY
COLUMBIA ANALYTICAL SERVICES INC. -SIMI VALLEY
2655 PARK CENTER DR, SUITE A
SIMI VALLEY, CA 93065

NY Lab Id No: 11221
EPA Lab Code: CA00404

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category ENVIRONMENTAL ANALYSES AIR AND EMISSIONS
All approved analytes are listed below:

Volatile Organics

1,3-Butadiene	EPA TO-15
1,4-Dioxane	EPA TO-15
2-Butanone (Methylethyl ketone)	EPA TO-15
Acetone	EPA TO-15
Carbon Disulfide	EPA TO-15
Hexane	EPA TO-15
Methyl tert-butyl ether	EPA TO-15
Vinyl acetate	EPA TO-15

Serial No.: 32757

Property of the New York State Department of Health. Valid only at the address shown. Must be conspicuously posted. Valid certificates have a raised seal. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify laboratory's accreditation status.

Page 2 of 2

OREGON

ENVIRONMENTAL LABORATORY
ACCREDITATION PROGRAM

NELAP Recognized

Columbia Analytical Services, Inc.

CA200007

2655 Park Center Drive, Suite A
Simi Valley, CA 93065

IS GRANTED APPROVAL BY ORELAP UNDER THE 2003 NELAC STANDARDS, TO PERFORM ANALYSES ON ENVIRONMENTAL SAMPLES IN MATRICES AS LISTED BELOW:

Air	Drinking Water	Non Potable Water	Solids and Chem. Waste	Tissue
Chemistry				

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTIC TECHNIQUES, AND FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN OREGON.

Irene E. Ronning

Irene E. Ronning, Ph.D.
ORELAP Administrator
1717 SW 10th
Portland, OR 97201

ISSUE DATE: 5/13/2007
EXPIRATION DATE: 5/12/2008
Certificate No: CA200007-004

Oregon

Environmental Laboratory Accreditation Program

Public Health Laboratory
1717 SW 10th Avenue
Portland, OR 97201
(503) 229-5505
FAX (503) 229-5682
TTY (503) 731-4031

NELAP Recognized

Department of Agriculture, Laboratory Division
Department of Environmental Quality, Laboratory Division
Department of Human Services, Public Health Laboratory

ORELAP Fields of Accreditation

ORELAPID: CA200007
EPACode: CA00404

Columbia Analytical Services, Inc.

Certificate: CA200007-004

2655 Park Center Drive, Suite A
Simi Valley, CA, 93065

Issue Date: 5/13/2007 ***Expiration Date:*** 5/12/2008

As of 5/13/2007 this list supercedes all previous lists for this certificate number.
Cusotmers: Please verify the current accreditation standing with ORELAP.

MATRIX: Air

Reference	*Code*	*Description*
EPA TO-15	**120**	**VOCs collected in Canisters by GC/MS**

Analyte Code	*Analyte*
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane
4655	1,2-Dichloropropane
9396	1,2-Epoxybutane
5215	1,3,5-Trimethylbenzene
9318	1,3-Butadiene
4615	1,3-Dichlorobenzene
9576	1,3-Propane sultone
4620	1,4-Dichlorobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
5220	2,2',4-Trimethylpentane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4535	2-Chlorotoluene
4860	2-Hexanone
6400	2-Methylphenol (o-Cresol)
5020	2-Nitropropane
158	4-Ethyltoluene
4300	Acetaldehyde
4315	Acetone
5510	Acetophenone
4325	Acrolein (Propenal)
4330	Acrylamide
4335	Acrylic acid
4355	Allyl chloride (3-Chloropropene)
4375	Benzene
5075	beta-Propiolactone

Columbia Analytical Services, Inc.
2655 Park Center Drive, Suite A
Simi Valley, CA, 93065

Issue Date: 5/13/2007 ***Expiration Date:*** 5/12/2008

As of 5/13/2007 this list supercedes all previous lists for this certificate number.
Cusotmers: Please verify the current accreditation standing with ORELAP.

5765	bis(2-Chloroethyl)ether
4515	bis(Chloromethyl)ether
4395	Bromodichloromethane
4400	Bromoform
4950	Bromomethane (Methyl bromide)
4450	Carbon disulfide
4455	Carbon tetrachloride
7215	Carbonyl sulfide
7235	Catechol
9336	Chloroacetic acid
4475	Chlorobenzene
4485	Chloroethane
4505	Chloroform
105	Chloromethane
4520	Chloromethyl methyl ether
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
7325	Cresol/Cresylic acid (mixed isomers)
4555	Cyclohexane
4575	Dibromochloromethane
4625	Dichlorodifluoromethane
154	Dichlorofluoromethane
4650	Dichloromethane (DCM, Methylene chloride)
6080	Diethyl sulfate
7480	Dimethyl carbamoyl chloride
7485	Dimethyl sulfate
4745	Epichlorohydrin (1-Chloro-2,3-epoxypropane)
4760	Ethyl acrylate
6250	Ethyl carbamate (Urethane)
4765	Ethylbenzene
4795	Ethylene oxide
4815	Formaldehyde
3815	Freon-114 (Dichlorotetrafluoroethane)
166	Heptane
4835	Hexachlorobutadiene
4850	Hexane
6320	Isophorone
4930	Methanol
4985	Methyl isobutyl ketone (MIBK)
9498	Methyl isocyanate
4990	Methyl methacrylate
5000	Methyl tert-butyl ether (MTBE)
5245	m-Xylene
5010	n,n-dimethyl formamide
5015	Nitrobenzene
6530	n-Nitrosodimethylamine
6555	n-Nitrosomorpholine
6520	n-Nitroso-n-methylurea
5250	o-Xylene
6625	Phenol
7995	Phosgene

ORELAP Fields of Accreditation

ORELAPID: CA200007
EPACode: CA00404

Certificate: CA200007-004

Columbia Analytical Services, Inc.

2655 Park Center Drive, Suite A
Simi Valley, CA, 93065

Issue Date: 5/13/2007 ***Expiration Date:*** 5/12/2008

As of 5/13/2007 this list supercedes all previous lists for this certificate number.
Cusotmers: Please verify the current accreditation standing with ORELAP.

9573	Propanal (Propionaldehyde)
9579	Propylene oxide
5255	p-Xylene
5100	Styrene
9594	Styrene oxide
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dicloroethylene
4685	trans-1,3-Dichloropropylene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane
256	Trifluoromethane
5225	Vinyl acetate
5230	Vinyl bromide
5235	Vinyl chloride
5260	Xylene (total)

DEPARTMENT OF THE NAVY

NAVAL FACILITIES ENGINEERING SERVICE CENTER
1100 23RD AVE
PORT HUENEME CA 93043-4370

IN REPLY REFER TO:

NFESC 413
February 8, 2007

Ms. Lynne Nelson
Quality Assurance Program Manager
Columbia Analytical Services – Simi Valley
2655 Park Center Drive, Suite A
Simi Valley, CA 93065

Dear Ms. Nelson,

This correspondence addresses the status of Columbia Analytical Services of Simi Valley, California in the Navy Environmental Restoration (ER) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

Your laboratory is accepted to perform sample analysis for the methods listed in Table 1. The period of acceptance expires September 20, 2008. This acceptance does not guarantee the delivery of any analytical samples. Acceptance is facility specific and can not be transferred to an affiliated or subcontract laboratory.

The Navy's review included a review of the laboratory's QA manual, selected standard operating procedures (SOPs) and SOP master list, list of major analytical instrumentation, performance test (PT) results and onsite audit documentation1.

The Navy reserves the right to conduct additional laboratory assessments or to suspend or revoke acceptance status for any or all of the listed parameters if deemed necessary.

Table 1

METHOD	PARAMETER	MATRIX
EPA Method TO-15	Volatile Organic Compounds (GC/MS)	Air

Acceptance for use for parameters not identified on the table will be determined by Navy project personnel. The laboratory should notify NFESC if there are parameters not presented on Table 1 that the laboratory expects to run on a routine basis in support of Navy environmental

[1] State of Arizona, Department of Health Services conducted an onsite assessment September 19-20, 2006.

NFESC 413
February 7, 2007

restoration projects. In these circumstances the laboratory's capability to run the tests will be reviewed and the table will be modified accordingly.

Questions concerning the information provided should be directed to the NFESC ER QA Program coordinator, Ms. Patricia Moreno at (805) 982-1659, or via email at pati.moreno@navy.mil.

Sincerely,

for Robert J. Kratzke
Supervisor, Consultation/Information
Management Branch

EMSL Analytical, Inc.

San Leandro, CA

EMSL Analytical, Inc.

LABORATORY
QUALITY ASSURANCE
MANUAL

REVISION 10 – December 2008

Note: This is an uncontrolled copy and has been printed for client distribution purposes only. Only the title page differs from the laboratory copy. This manual's title page does not include:

- *Laboratory Location*
- *Signature of Lab Manager*
- *Signature of QA Manager*
- *President Name*
- *Internal audit schedule*
- *List of Modules included*

TABLE OF CONTENTS

General and Administrative

1.0 QUALITY ASSURANCE PROGRAM

1.1 Scope

EMSL Analytical, Inc.'s commitment to providing quality services to our customers is embodied in EMSL's corporate policy on quality assurance (QA). The objectives of the EMSL quality assurance program are to ensure the following:

- Quality, accuracy and integrity of analytical results.
- Conformance with all analytical methodologies.
- Conformance with corporate mandated QA/QC requirements.
- Delivery of the highest quality of professional services and technical excellence to our customers.
- Fulfillment of the requirements of the American Industrial Hygiene Association (AIHA), the National Voluntary Laboratory Accreditation Program (NVLAP), The NELAC Institute (TNI) and/or state and local accrediting authorities.

To achieve these goals, this Quality Assurance Manual (QAM) directs the implementation and maintenance of the quality assurance program, describes responsibilities and duties of personnel, and addresses the elements of the quality assurance system. This QAM covers analytical services offered in the EMSL laboratories, which include asbestos, lead, environmental microbiology, industrial hygiene organics, inorganics and radon. The specific policies, procedures and requirements for each of these service areas are addressed in individual modules. These modules are organized as follows:

Module	Program Description
A	Asbestos
B	Environmental Lead
C	Environmental Microbiology
D	IH Organics
E	IH Inorganics
F	Radon

This manual is administered by the corporate Quality Assurance Department. Only those modules that apply to a specific laboratory are provided to that laboratory. Laboratories shall comply with the requirements detailed in this manual and the additional program requirements specified in Modules A - F. This manual is to be kept accessible to all employees. Employees are responsible for being familiar with, and adhering to its contents.

This manual is the property of EMSL and may not be used for any other purposes other than those related to EMSL work. Under no circumstances, will this manual be removed from the laboratory facility nor will any of its contents be disclosed to any outside entity unless prior approval has been granted by EMSL corporate management. Requests for copies of this manual must be made to the EMSL quality assurance manager.

1.1.1 Manual Revision History

The QAM will be reviewed annually for continued suitability. The revisions made to the QAM are recorded in a Revision History which follows each section of the QAM. A 'Notice from the

Quality Assurance Department' may also be provided with the QAM at distribution summarizing the additions and changes to the QAM.

1.2 Quality Policy Statement

EMSL is committed to providing a high standard of service and producing dependable, accurate and technically defensible test results in order to best serve our customers. Our experienced and qualified technical personnel are committed to providing data of the highest quality achievable.

The senior management of EMSL Analytical, Inc. is committed to adopting the quality standards utilized by the various accrediting authorities – namely, NVLAP, AIHA, state authorities and The NELAC Institute. The major goal (and focus) of the laboratory and its personnel will be toward constant improvement in the quality management system which has been designed with the purpose of ensuring consistent operations leading to quality data.

The senior management staff of EMSL acknowledges and accepts the responsibility for the overall quality of the data produced by the laboratory and makes a commitment toward constant improvement of the final product. In doing so, management provides the laboratory manager and the Quality Assurance Department with full authority to accomplish this end. Management is committed to providing all of the resources necessary to provide high quality analytical data.

All personnel concerned with testing within the laboratory must familiarize themselves with the quality documentation and implement the policies and procedures addressed in this manual.

This statement is issued under the authority of company President, Peter Frasca, Ph.D.

1.3 Program Objectives

The program described in this manual is designed to help plan and institute company policies and quality objectives throughout the laboratory facilities. This program is intended to provide procedures and policies, which provide:

- Development of company quality control programs
- Good laboratory technique that ensures a contamination-free environment
- Constant oversight of laboratory quality performance
- Establishment of training requirements
- Job descriptions of each employee delineating responsibilities
- Development and maintenance of internal quality audit program
- Use of appropriate analytical technology including review of current literature to capture recent applicable developments
- Proper documentation and quality review of analytical data
- A comfortable work atmosphere away from undue productivity pressures
- Maintenance of accreditation programs
- Assurance that national coherency is maintained through standardization of policies and procedures
- Control and maintenance of round robin programs
- Control of documents
- Respect for customer confidentiality

Quality policies and procedures are integrated into our daily work, and are constantly reviewed by national, regional and laboratory management and by the Quality Assurance (QA) Department.

The program is managed and maintained by the corporate QA Department.

1.3.1 Commitment to ISO Standards

Starting with corporate management and extending to regional and local laboratory management, EMSL is committed to ensuring that the standards documented in the ISO 17025 are upheld in all aspects of the company affairs. These standards cover:

- Organization of management system
- Management system - definition, establishment and maintenance
- Document control
- Review of requests for work (contracts, etc.)
- Subcontracting services/interlaboratory exchange of samples
- Purchasing supplies
- Service to the customer
- Complaints
- Control of non-conforming work
- Corrective and preventative action
- Control of records
- Internal audits
- Management reviews
- Personnel qualifications
- Method validation
- Traceability
- Assuring quality
- Reporting results

By way of authority, it is corporate management whom implements, maintains and monitors compliance.

1.4 Changes to the Quality Management System

The quality management system is designed to ensure the integrity of the system is maintained in the event any changes take place. Procedures include:

- Contingency plans
- Assignment of the same responsibility by multiple personnel (back ups)
- Assignment of deputies or designated second person

1.5 Departures from Quality Assurance Policies

Any departure from the procedures and policies as stated in this document must under go a review by the Quality Assurance Department and corporate management prior to approval and effect. This will include, at a minimum:

- Reason for deviation from policy and/or procedure
- Applicability of alternative policy and/or procedure
- Availability of resources
- For deviations of analytical procedures, assurance that data is reported with appropriate references and disclaimer on final reports affected by a policy and/or procedure change (if applicable).

A record of the review of the alternative procedure or policy is maintained as part of the project files.

No departures from the policies and procedures, as written in this document, are permitted without

acceptance by the QA manager or corporate management.

1.6 Quality Management System Review

The QA manager will review the quality management system at least annually. It will also be reviewed any time a problem arises that indicates a possible program flaw. In such an instance, the QA manager will discuss the problem with corporate regional and laboratory management and analytical staff to ensure needed input from all levels within the laboratory.

1.7 Normative References

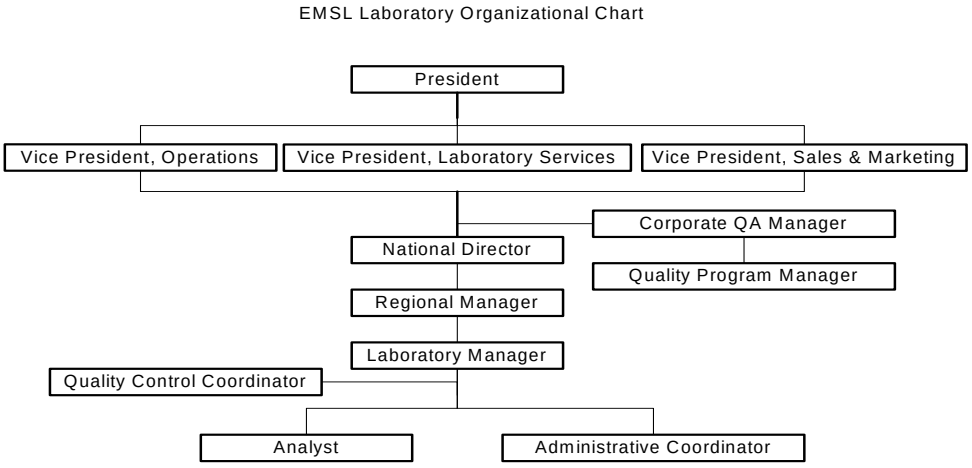
The EMSL Analytical management system complies with the requirements of the following references as well as those of several other State and local accrediting agencies:

- ISO/IEC 17025:2005
- 2003 NELAC Standards
- AIHA Accreditation Policies (May 2008)
- NIST Handbook 150, 150-3 and 150-13 (2006 Edition)
- NYS Department of Health ELAP Certification Manual (March 2008)

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. References to "NELAC" were replaced with "The NELAC Institute" or "TNI" throughout. Added requirement that QAM is to be reviewed annually. The "Notice" referenced in 1.1.1 has been made optional. Quality Policy Statement updated by adding more stress on service to the customer, defining purpose of quality system and incorporating the previous amendment in last paragraph. Updated program objective regarding coherency to clarify that this is accomplished through standardization of policy and procedure. Added Section 1.7.

2.0 ORGANIZATION, RESPONSIBILITY AND TRAINING



2.1 Scope

The following section describes the company organization and the responsibilities of laboratory personnel. Technical training requirements for personnel are also covered here. Specialized training for each analytical service is found in the modules. This section also discusses EMSL's ethics and data integrity policies.

2.2 Corporate Organization

The corporate headquarters of EMSL Analytical operates out of the Westmont N.J. office location. The corporate headquarters oversee the laboratory operations located there, as well as the branch laboratory locations. Organizational charts for each laboratory are maintained by the corporate QA department. Copies of these charts are stored at each EMSL laboratory. Corporate headquarters are responsible for the management of the company activities. These include:

- Fiscal management
- Personnel management
- Human resources
- Information technology (IT)
- Credit and collections
- Accounting (including billings)
- Sales
- Customer service
- Contracts review
- Business development
- Quality assurance/quality control management systems
- Legal counsel
- Purchasing

The corporate laboratory and the branch laboratories perform the company's analytical services. They report to the corporate headquarters on quality control, productivity, staffing and marketing issues.

2.2.1 EMSL Analytical and LA Testing

Pursuant to the terms of an out-of-court settlement, EMSL Analytical, Inc. operates as "LA Testing," a duly registered Fictitious Business Name, within a 5 county area in southern California. For simplicity, this manual refers to the EMSL name only. The policies and procedures documented in this manual apply to all facilities including those doing business as LA Testing.

2.2.2 Products Division

EMSL Analytical, Inc. also operates a Products Division which supplies environmental sampling equipment. No key personnel in this division have involvement or influence on the testing activities of our laboratories and, therefore, present no conflict of interest.

2.3 Laboratory Job Responsibilities/Descriptions

2.3.1 Scope

This section describes the positions and responsibilities of the technical personnel in a basic laboratory operation of EMSL. It does not include specialized assignments or positions that may have been instituted for specific projects or special laboratory needs. It is possible that more than one of these job responsibilities is shared among one person. For example, an analyst may also be assigned administrative support duties.

Minimum education and experience requirements are listed for each position. Specific requirements for education, training and skills for method specific requirements are listed in each of the individual program modules.

2.3.2 Administrative Coordinator

The administrative coordinator reports to the laboratory manager.

The minimum education and experience requirement is on the job training.

The position is a support position to the entire laboratory including the analysts. The responsibilities include but are not limited to those listed below:

2.3.2.1 Sample Receipt Responsibilities*:*

- Reviews paperwork for all incoming samples to ensure completeness and correctness.
- Inspects samples to ensure sample integrity is retained and that packaging is not compromised.
- Logs in all samples in a timely manner based on turn around time.
- Ensures all samples are placed in the proper storage area to await analysis.
- Delivers incoming samples to the laboratory.
- Informs the laboratory manager or analyst of any special priorities regarding the samples and informs them if there are any concerns noted regarding sample integrity.

The administrative coordinator shall also be aware of sample origin as it impacts regulatory requirements. The administrative coordinator follows all sample tracking protocols in handling samples, in particular, completing and verifying chain-of-custody forms.

Ensures that proper numbering is used and transcribed correctly into the Laboratory Information Management System (LIMS) and onto all applicable forms. The administrative coordinator also ensures compliance with all relevant quality standards (e.g., ISO 17025, NELAC, NIST) as

related to job responsibilities.

2.3.2.2 Data Entry Responsibilities:

- Generates analytical reports.
- Enters data produced by the analysts into the computer system for production of the final, customer ready report.
- Generates reports in the priority in which the laboratory manager assigns them.
- Ensures that the final report is prepared within the required time frames and that the results are reported to the customer in a timely matter.
- Reviews the information in the report and check the data for any obvious errors.
- Checks both technical and non-technical information, such as sample location, volume and sample I.D. numbers for possible transcription errors.
- Reports any observations of erroneous or unusual data or apparent errors to the laboratory manager.
- Ensures compliance with all relevant quality standards (e.g., ISO 17025, NELAC) as related to job responsibilities

The administrative coordinator contributes to the EMSL quality objectives by ensuring that they act as a professional interface with laboratory customers. Administrative coordinators ensure that samples are received with the appropriate paperwork and that data is transcribed accurately and in a manner which prevents questions about the integrity of laboratory data. They also ensure that they record all non-conforming work, non-conformities, opportunities for improvement and customer complaints and report these to the attention of those personnel authorized to handle these situations.

2.3.3 Analyst

All analysts report directly to the laboratory manager.

Minimum education and experience requirements:

- In house training documented by the EMSL qualifications checklist.
- Participation in ongoing training programs (in-house workshops, laboratory meetings, etc.)

The analyst is responsible for performing calibrations of equipment, assigned analysis, and recording of all analytical data according to established procedures. The analyst must use good analytical technique and he/she must provide analytical results suitable for issuing a customer report.

The analyst manages all work assigned. He/she completes all paperwork in accordance with established laboratory procedures. The analyst reviews all paperwork for correctness and completeness and ensures that work progresses in a timely and productive manner.

The analyst is responsible for performing all required analysis on QC samples as directed by the QC coordinator or laboratory manager. The analyst is required to notify the laboratory manager or QC coordinator of any occurrence that could affect the validity of an analytical result.

He/she must ensure compliance with all relevant quality standards (e.g., ISO 17025, NELAC) as related to job responsibilities.

The analyst contributes to the EMSL quality objectives by ensuring that they have read and understood all EMSL policies and procedures relevant to their job tasks and follows all SOPs in order to ensure consistent and accurate analyses. The analyst ensures that all required QC functions of their job are performed in a timely manner including calibration of equipment and analysis of QC samples at the required frequency. Analysts also ensure that they record all non-conforming work, non-conformities, possible opportunities for improvement and customer complaints and report these to the attention to those personnel authorized to handle these situations. Analysts contribute to the overall quality of the EMSL final results by ensuring they avoid any actions which may call into question the integrity of their work.

2.3.4 Quality Manager (QM)

The QM works under the direction of the laboratory manager (or regional manager /national director if the QM is the laboratory manager) with periodic interaction with the quality assurance manager.

Minimum education and experience requirements:

- Knowledge of analytical methodologies
- Basic understanding of EMSL QA/QC program (including statistical analysis)
- Participation in ongoing training programs (in-house workshops, laboratory meetings, etc.)

The QM is responsible for ensuring that all QA/QC procedures are performed at the required frequencies. He/she collects and maintains all QC data for reporting to the laboratory manager.

He/she oversees the QA/QC program and is responsible for the laboratory's compliance with all standard policies as guided by the corporate quality assurance manager. An analyst or laboratory manager may also function as the QM.

The QM ensures that all QA/QC is being performed by the analyst and is responsible for reporting any non-compliance issues to the laboratory manager or, if necessary, directly to the corporate QA manager. The QM performs periodic reviews of final data reports. These reviews are documented and placed in the project file. Any errors or discrepancies are corrected and documented on a corrective action form.

The QM ensures that the laboratory maintains compliance with the policies and procedures documented in this manual and the requirements documented in all relevant quality (e.g., ISO 17025, NELAC) standards.

The laboratory quality manager contributes to the EMSL quality objectives by ensuring that all quality system requirements are being followed in the laboratory. The laboratory quality manager oversees the implementation of the system in their laboratory, and ensures it is consistently followed by those employed in the laboratory in such a manner that the laboratory remains a coherent part of EMSL and is not operating on its own set of policies and procedures. They oversee the quality reports being submitted to ensure that they are generated on-time and that any problems reported have been handled and resolved maintaining the accuracy of laboratory data.

2.3.5 Laboratory Manager

The laboratory manager reports to the regional manager. In the circumstance where no regional manager is assigned to the laboratory, the laboratory manager reports to the national director.

Minimum education and experience requirement is 1 year of related analytical experience.

The laboratory manager makes technical decisions for the laboratory such as:

- Assuring all requirements for laboratory equipment and supplies are met
- Resolution of analytical problems
- Development and implementation of training programs for analysts

The laboratory manager is responsible for overall administration of laboratory operations. He/she ensures that company policies are understood by all personnel, that adequate supervision is provided to the staff, ensures that work-scheduling procedures adequately address customer needs, and is responsible for ensuring all customer complaints are resolved. He/she also approves all employee reviews and promotions and provides regional or corporate management with information regarding laboratory budgeting issues (e.g., purchase of equipment and supplies, expenses for out-of-house training, staffing requirements). The laboratory manager is responsible for designating qualified personnel (deputy) to assume specific, temporary management responsibilities in the event of absence. The deputy is identified on the laboratory organization chart. The laboratory manager is also responsible for ensuring a comfortable working atmosphere, free from excessive pressures (including unreasonable productivity rates), for all their laboratory employees. The laboratory manager must ensure that the policies and procedures of this quality management system are communicated to the laboratory staff.

The laboratory manager is responsible for the data reported by the laboratory. The laboratory manager reviews and approves the final customer reports. The laboratory manager ultimately holds the responsibility for the release of the final report. This responsibility includes the verification of the sample results which, include:

- Verification of sample number
- Correctness of sample result
- Check for typographical errors
- Completeness of chain of custody

It is the full responsibility of the laboratory manager/designee to ensure that the final report is accurate and complete. The laboratory manager may assign designated personnel to perform the task of final review and approval following the EMSL SOP for Final Report Approval for Electronic Signature.

The laboratory manager ensures that QA standards are established, understood and administered. He/she is ultimately responsible for ensuring that the QA program is conscientiously implemented. He/she reviews the QA program with the regional manager or national director to ensure completeness and effectiveness, and supports the QA manager/ regional manager in carrying out the program by use of authority. The laboratory manager is responsible for submitting all QC data reports on a monthly basis to the regional or QA manager as directed.

The laboratory manager contributes to the EMSL quality objectives by ensuring that the laboratory maintains compliance with the policies and procedures documented in this manual and the requirements documented in relevant quality standards (e.g., ISO 17025, NELAC). The lab manager also oversees employee qualifications ensuring they are properly qualified and trained prior to conducting analysis. The lab manager is ultimately the person at the laboratory responsible for all data reported from the laboratory and ensuring that data is accurate and error-free. The lab manager ensures that all non-conforming work, non-conformities, and complaints are resolved in a timely manner leading to continual improvement at the laboratory.

2.3.6 Regional Manager

The regional manager reports directly to the national director.

Minimum education and experience requirements:

- 2 years related analytical experience
- 1 year management experience

The regional manager assumes responsibility for the overall performance of two or more laboratory locations. He/she controls all analytical programs, reporting processes, general management and is accountable for the overall operational and financial well being of the laboratories under authority.

The regional manager reports directly to the national director and initiates and controls all operational policies in the areas of administrative, technical and fiscal matters. The regional manager may also function as a laboratory manager.

The regional manager works closely with the QA manager in developing and maintaining the QA program. He/she consults directly with the QA manager regarding of the effectiveness, and applicability of the program, recommends needed changes, if any and reports any problems with the program design. The regional manager is responsible for ensuring full annual technical QA/QC audits are performed at each of their laboratories.

The regional manager ensures that the laboratory maintains compliance with the policies and procedures documented in this manual and the requirements documented in relevant quality standards (e.g., ISO 17025, NELAC).

The regional manager contributes to EMSL quality objectives by assisting laboratories in their implementation of the quality system, improving consistency across their laboratories. The input they provide the QA manager assists in the continual improvement of the quality system.

2.3.7 National Director

The national director reports to the EMSL vice presidents.

Minimum educational/experience requirements:

- AS degree in related science
- 3 years related analytical experience
- 2 years management experience

The national director is responsible for all aspects of the specific analytical services division assigned including: fiscal performance of the division, the operation of the branch laboratories, development and compliance with corporate mandated quality control and quality assurance procedures and policies and laboratory accreditation's.

The director is responsible for designing reporting policies, the management of quality control data and the development of all technical standard operating procedures.

The director also ensures that the laboratory maintains compliance with the policies and procedures documented in this manual and requirements documented in relevant quality standards (e.g., ISO 17025, NELAC).

National Directors contribute directly to the quality objectives of EMSL by developing and overseeing the quality control programs for their departments with the QA department. In

addition, their expertise ensures that only the most appropriate methods are adopted and utilized ensuring quality data for our customers. By assisting the QA department and branch laboratories to resolve customer complaints and major technical deficiencies, they ensure that customer needs are being met.

2.3.8 Quality Control Coordinator (Corporate)

The corporate quality control coordinator reports to the EMSL quality assurance manager.

Minimum educational/experience requirements:

- 2 years related analytical experience

The corporate quality control coordinator (QCC) reports to and works under the direction of the corporate quality assurance manager. The corporate QCC is responsible for providing technical support to the Quality Assurance Department, which includes:

- Participation in the development, implementation and maintenance of QA/QC policies and procedures
- Guidance to the laboratory operations on quality issues
- The monitoring and assurance of compliance with the QA plan
- Establishing and maintaining standardization throughout EMSL locations
- Performs and/or tracks internal audits and related follow up to non-conformities
- Develops and maintains national round robin programs

The corporate QCC is responsible for ensuring compliance with the requirements of the quality control program. The corporate QCC performs the review of the monthly quality control reports which includes:

- Compliance with QC analysis frequency and on time report submittals
- Ensure QC data is within acceptance criteria
- Review and ensure all corrective actions stated in response to internal audit findings are completed
- Ensure calibration measurements are within standards
- Report to management on laboratories QC performance

The corporate QCC is responsible for maintaining the program and standard operating procedures used for QC data and TEM calibrations.

The corporate QCC provides reports of performance (frequency of report submittals and review of quality of reports) to the QA manager, regional managers, national directors and vice presidents.

The corporate QCC ensures that the laboratory maintains compliance with the policies and procedures documented in this manual and the requirements documented in relevant quality standards (e.g., ISO 17025, NELAC).

The corporate QCC contributes to the quality objectives by tracking whether quality control programs are being implemented at branch laboratories through the review of monthly and quarterly reports. This review of quality reports ensure that QC is being properly documented and reviewed thus improving the quality of data from all laboratories, and allowing corporate management to act when areas of concern are identified. The corporate QCC's participation in the annual management reviews includes feedback on individual lab performance and advice on areas for improvement.

2.3.9 Quality Programs Manager (Corporate)

The corporate quality programs manager reports to the corporate quality assurance manager.

Minimum educational/experience requirements:

- 2 years related experience with Quality Management Systems
- 1 year management experience

The quality programs manager works with the corporate QA manager to develop EMSL policies and procedures, and ensuring that these comply with accreditation requirements. The quality programs manager also assists in the management of laboratory accreditations.

The quality program manager assists the corporate QAM in communication with accrediting authorities, researching requirements and determining required accreditations for work being performed by EMSL. In addition, he/she is responsible for improving efficiencies in the management system identifying areas of improvement in the quality system to ensure compliance with relevant quality standards (e.g., ISO 17025, NELAC, NIST) and improved laboratory performance.

The quality program manager may perform internal audits of EMSL branch laboratories and attend assessments performed by outside accrediting agencies and assist in responding to assessment findings.

The quality programs manager contributes directly to the EMSL quality objectives through the development of general quality system policies and procedures that are implemented in branch laboratories ensuring consistent operations that meet accreditation requirements and through the training of EMSL staff in these procedures.

2.3.10 Quality Assurance Manager (Corporate)

The corporate quality assurance (QA) manager reports to the EMSL vice presidents.

Minimum educational/experience requirements:

- 2 years related analytical experience
- 1 year management experience
- Course work on quality programs

The corporate QA manager establishes, implements, and maintains the entire QA program as described in this manual. He/she develops statistical protocols for data reduction and acceptance criteria. He/she defines requirements for submitting QC samples, controls results reporting policies, sets standards for analytical performance and issues protocols for yearly on-site audits for the branch laboratories.

The corporate QA manager is responsible for maintaining the QA manual and all standard operating procedures (SOPs). He/she conducts and/or establishes policies for QA audits, and sets standards for laboratory practices. He/she confers with the national directors, regional managers and/or the laboratory managers on QA policies and supports the laboratory manager and quality control manager in the daily maintenance of the QC program. The QA manager oversees laboratory accreditation's including initial applications, maintenance of proficiency testing programs and responses to non-conformities identified during on site audits.

The QA manager participates in the annual management review. The QA manager also ensures

that the laboratory maintains compliance with the requirements documented in the ISO 17025 and NELAC standards.

The corporate QA manager assists top management in defining the EMSL quality objectives. As head of the quality unit, the corporate QA manager ultimately has oversight of the entire quality program of EMSL and ensures the management systems meet the quality objectives.

2.3.11 Vice President, Laboratory Services

The vice president is responsible for the overall quality performance of the entire company, including the initiation, development and maintenance of the quality management system. The vice president advises the president on quality program management issues and has the ultimate authority to ensure the integrity of the management system is maintained at all times (including when changes are made) and initiate actions to prevent or minimize departures from the quality management system.

The vice president ensures appropriate communication processes are established for implementation and effectiveness of the quality management system. He/she participates in the management review process and commits to continually improve the effectiveness of this system.

The vice president makes all decisions related to the status of laboratory certifications and accreditations.

The vice president contributes to the objectives of the also ensures that the company maintains compliance with the policies and procedures documented in this manual and the requirements documented in relevant quality standards (e.g., ISO 17025, NELAC).

As part of top laboratory management, the Vice President of Laboratory Services assists in setting the quality objectives of EMSL. In addition, the Vice President ensures that these quality objectives are adequately communicated and understood by laboratory staff and ensures that they remain aware of the effectiveness of the EMSL quality system. The vice president also contributes by ensuring they are committed to the development, implementation and continual improvement of the laboratory quality system. As part of top management, the vice president shall ensure that the integrity of the management system is maintained at all times.

2.3.12 President

The president focuses and directs the path of the company and assumes complete responsibility for the success of the quality management system.

He provides the authority and approves the resources necessary to maintain compliance with the quality assurance program policies documented in this manual and applicable accreditation standards.

The president, as part of top laboratory management, assists in setting the quality objectives of EMSL, and issues the Quality Policy under which the company operates. The President contributes to the quality objectives by ensuring adequate resources to establish, maintain and improve the quality system of the laboratory and by clearly communicating the company's commitment to its Quality Policy and quality system policies and procedures.

2.4 Roles of the Administrative Support Group

This section describes the basic role of the corporate administrative support groups in the laboratory

organization. Administrative support consists of:

- Information technology
- Human resources
- Corporate counsel
- Accounting
- Credit/collection
- Sales and marketing
- Corporate customer service
- Purchasing

The departments of the support group are located in the corporate headquarters. The managers of each department report to the vice president(s). Each department has defined roles which provide the laboratories with the support needed to maintain the business. Laboratory managers have direct access to all employees of the individual departments in the administrative support group.

2.4.1 Information Technology (IT)

The IT department is responsible for all computer and technology services at EMSL including, but not limited to servers, PCs, telecommunications, storage, security, web services, software licensing, repair, maintenance, support and custom enhancement of EMSL's LIMS system (Sample Master XP), LabConnect (report distribution engine) and all company databases. Requests for assistance are forwarded to IT through an e-mail help request system.

2.4.2 Human Resources

All human resource responsibilities are handled by EMSL's Human Resources department. Responsibilities include, but are not limited to, employee recruitment and hiring, personnel record keeping, employee benefits and career development as well as providing advice to laboratory management on topics such as employee discipline, conflicts of interest, and discrimination and harassment prevention.

2.4.3 Corporate Counsel

EMSL maintains an in-house corporate counsel. Corporate counsel advises EMSL corporate management on all legal issues related to the business of EMSL.

2.4.4 Accounting

The Accounting department has the fiduciary responsibility of ensuring the accuracy and timeliness of all accounting processes and financial reporting. This includes invoicing to customers, processing and payment of vendor bills, cash management, reconciliation of accounts, satisfying financial reporting obligations to internal and external entities. The department ensures that accounting transactions are recorded, flow through the general ledger and are properly summarized to produce financial statements for management in accordance with Generally Accepted Accounting Principals (GAAP).

2.4.5 Credit/Collections

This is a sub-department of Accounting. The responsibility of this department is to act on the outstanding accounts receivable sub-ledger, which lists out customers and their outstanding invoices. Contacts are made in an effort to ensure all outstanding debt is collected in a timely fashion. They deposit daily cash receipts and apply client payments to their accounts. They also review accounts in consideration for outside collection assistance.

2.4.6 Sales and Marketing

The Sales and Marketing department develops new business for EMSL laboratories through advertising, marketing and contacting potential customers. Each sales employee is assigned

customers for whom they are responsible for negotiating contract terms. Marketing is responsible for the development of all marketing materials including fliers, advertising and informational materials that are distributed via the web and through the laboratories, as well as in-person through EMSL's participation in conferences and exhibitions.

2.4.7 Corporate Customer Service

The Corporate Customer Service team assists Marketing, Sales, and EMSL Laboratories nationwide. Their current duties include but are not limited to: Answering incoming calls to the customer service extension, assisting customers who are seeking information on capabilities and technical questions, researching invoice discrepancies, finding and sending reports, assisting with LABConnect user issues, setting up LABConnect accounts, placing supply orders and assisting with pricing inquiries.

2.4.8 Purchasing

The EMSL Purchasing department is responsible for arranging for the procurement of supplies and services for the entire EMSL organization. Responsibilities include obtaining and reviewing suppliers for business critical supplies and services, reviewing and approving service orders submitted by branch laboratories, and tracking performance of suppliers and service providers by being the main point of contact for complaints and supply/service problems.

2.5 Training

2.5.1 Scope

This section describes the corporate procedures and policies of the EMSL training program. Additional requirements for training for each analytical methodology, if any, are discussed in the program modules.

All analysts must complete the EMSL training program in order to perform analysis independently and receive a completed Demonstration of Capability certificate.

Because the amount of training needed will vary based on the education, past experience and skills of the trainee, the times described in this section and the program specific modules are considered minimums. Laboratory managers are responsible for ensuring that appropriate training is provided to every analyst and that they are completely competent, qualified and signed off to perform analysis.

2.5.2 Types of Training

2.5.2.1 "In-House" Course

These are organized EMSL courses designed for a classroom setting (they can be scheduled in workshop type modules) with syllabus and course materials. These courses contain recommended contact hours. A certificate is issued which documents attendance.

Formal in-house courses are developed and implemented under the direction of corporate management. The trainer must follow the requirements of the EMSL training program and ensure that all topics are covered according to the workshop outline or qualifications training checklist. The assignment of a trainer can be performed by the laboratory manager, regional manager, national director, QA manager, vice president or president. Competency will be determined based on knowledge, experience and demonstrated technical competence. The trainer must have a thorough and comprehensive understanding of the topics involved.

2.5.2.2 "On the Job" Technical Skills Training

This is training provided at the hands on level. The amount of training time needed will vary for each method and for each trainee. If the training involves analytical procedures, the trainer must have completed all the requirements of an analyst and have at least 1 year of experience. Non-analytical procedures may be trained by any experienced EMSL employee with a thorough and comprehensive understanding of the topics involved

2.5.2.3 "Out of House" Formal Training Courses

Under some circumstances, EMSL will provide staff members with formal, outside training. The certificate of training is maintained in the employee folder along with course outline. Courses will be selected based on applicability to job responsibilities. The qualifications of the course provider and instructor shall be reviewed prior to course approval. Contact hours vary based on the course.

2.5.3 Initial Training and Authorization of Analysts

2.5.3.1 Training Checklist

Analysts must satisfy theoretical and practical knowledge requirements in order to be authorized to independently analyze samples. Each EMSL program area utilizes a set of training checklist to document these requirements and track an analyst's training. The EMSL training checklists are available on the E-link site and are referenced in the program specific modules.

The training checklist documents all aspects of the analyst's training from their understanding of the theory behind applicable concepts to their ability to capably perform analysis of each method on which they are being trained. Specific requirements for each analysis are detailed in the QAM Modules and the training checklists.

As training of an analyst proceeds, the trainer and trainee sign and initial each item on the checklist as they are completed. There are a number of ways that a new analyst can satisfy the requirements presented in the training checklist.

The date the checklist is signed is the date on which the new analyst demonstrated understanding or ability satisfying the requirement. This demonstration may be completed in a number of ways.

- The analyst may receive training on the topic from a qualified trainer (an analyst that has at least one year of experience and a completed DOC for the method being trained) and subsequent to the training demonstrates their understanding and/or ability. Once the trainer is satisfied that the analyst has met the requirement, the trainer shall initial and date the training checklist for that requirement.
- Based on previous experience and training, a qualified trainer (as defined above) or the laboratory manager, may verify that knowledge or skills are already present through interviews and observed technique and once satisfied that the analyst has met the requirement of the checklist may initial and date the training checklist for that requirement without further training.

Note: Previous EMSL training policies allowed for a "qualifications statement" from the national director in lieu of a training checklist. This option is hereby eliminated. Beginning with Revision 10 of the QAM, all analysts must have each checklist item verified by laboratory manager or trainer and initialed on the

checklist. "Qualification statements" issued prior to the removal of this option (Dec 2008) will still be considered valid and should remain a part of the analyst's training records.

Once all requirements of the training checklist have been completed and marked on the checklist by the analyst and trainer, the laboratory manager signs off on the training checklist stating that the training of the analyst has been completed.

2.5.3.2 Demonstration of Capability Certificate

Following completion of the training checklist, the signed checklist is sent to the corporate Quality Assurance Department. As of Revision 10, of the QA Manual – Section 2, formal Demonstration of Capability certificates are issued through the Quality Assurance Department.

EMSL utilizes a DOC certificate which is based on the sample provided in Appendix C of Section 5 of the 2003 NELAC Standard. The form allows for the recording of all analyses for which demonstration has been completed for a particular analyst.

The certificate is prepared by the QA department and signed by the corporate QA manager against the information provided by the laboratory manager on the training checklist and supporting documentation for each matrix and method for which the analyst is authorized to perform analysis. Each analyses type is listed along with the date upon which Demonstration of Competency was completed. The date of the QA manager signature signifies the date upon which the information contained on the form was updated and the form reissued by the QA department.

The DOC certificate is then sent to the laboratory manager who signs the form thus authorizing the analyst to perform work for those methods listed on the DOC certificate. (Note: When the analyst being authorized is the laboratory manager, the DOC certificate shall be signed by either the regional manager or national director.) The date of laboratory manager signature signifies the date upon which the laboratory manager confirms the information listed on the DOC certificate.

The DOC certificate shall be revised whenever an analyst completes a new demonstration of capability or when their capability to perform the analysis is revoked. In such cases, the supporting material shall be sent to the QA department along with the most recent version of the DOC certificate. Once updated, the QA department will re-sign and send to the laboratory manager for re-affirmation of the information contained on the form. Thus the dates of the signature always correspond to the date that the certificate is issued and the information contained therein confirmed, and not necessarily the date upon which specific demonstrations were completed.

Prior to Revision 10, Demonstration of Competency certificates were generated by each individual laboratory and issued by the laboratory manager. These certificates may still be in place in laboratories and will be considered to meet the requirements above if issued prior to the publication date of Revision 10. Any revision to these certificates as a result of changes to the scope of the Demonstration of Competency shall be issued through the QA department as required above.

2.5.3.2.1 Exception to Certification Form:

Where a method has been used in the laboratory since July 1999, and there have been no significant changes in instrumentation type, personnel or method, evidence of ongoing performance (see below) will be acceptable. The Laboratory Manager

must have a record on file to demonstrate that an initial DOC is not required.

2.5.3.3 Authorization to Perform Analysis

Analysts must receive formal authorization to perform analysis. This is performed with the signature of the laboratory manager, regional manager or national director and corporate QA manager on the Demonstration of Capability certificate.

2.5.4 Ongoing Training and Continued Demonstration of Capability

2.5.4.1 Ongoing Training

Ongoing training of our staff is a very important piece of analytical quality. It provides an opportunity to sharpen skills and keep all employees up to date with the current procedures, techniques, regulations, etc.

Laboratory managers are to ensure that ongoing training is provided to all employees on a consistent basis. The opportunity for ongoing training occurs in many different forms. The following list suggests a number of different types of ongoing training:

- Laboratory staff meetings - these can cover a variety of technical topics. There is no organized agenda and interaction between all attendees is encouraged (much like an open forum). Examples of topics could include technical subjects/analytical method updates, customer service issues, health and safety, etc. This training must be documented.
- Laboratory audits – the staff can consult with the auditor (of both internal and external audits) and ask questions to be advised on many topics.
- Workshops provided by professional organizations, regulatory agencies or instrument/equipment vendors. Prior to approval of a workshop, the national director or QA department will review the credentials of the workshop provider and/or trainer to ensure competency in the area to be covered. If a certificate is not provided by the outside trainer, such as in a workshop, an open use training form is completed for each described topic covered during the training. A copy of this training record is maintained in the laboratory files.

2.5.4.2 Ongoing Demonstration of Capability

Continuous demonstration of capability by each analyst is achieved through the QC reanalysis of samples by the same analyst (intra-analyst), different analyst (inter-analyst), inter-laboratory analysis, the analysis of standard reference samples/LCS's and performance in proficiency testing programs. This is performed at a minimum of every six months and is documented with:

- copies of reports of individual analysts performance in proficiency testing programs (stored in employee training files)
- copies of reports of individual analysts performance in round robin programs (stored in employee training files)
- analytical quality control reports (QC results, standards analysis, etc.) generated during the course of analysis. *Note: This data is normally stored with the laboratory quality control data vs. in the individual analyst's files.*

Whenever possible, inter-analyst QC should be performed by analysts that have completed their training and for whom certifications of demonstration have been completed.

2.5.4.3 Recertification Statements

Every 12 months (or 6 months for AIHA accredited methods), the laboratory manager

shall sign a Recertification Statement for each analyst to document continued authorization to perform analysis. If the laboratory manager is also authorized to perform analysis, the national director shall review and sign the Continuing Certification Statement for the laboratory manager. The Recertification statement will be attached to the original DOC certificate in the analyst folder.

2.5.5 Measurement of the Effectiveness of the Training Program

The effectiveness of our training program is evaluated using a number of identifiers. These include:

- Analysts performance in the quality control program (inter/intra analyst, analysis of standards, blanks)
- Performance in proficiency testing programs
- Evaluation of data generated in round robin programs
- Analysis of blind QC samples
- Performance at internal and external onsite site audits

The evaluation of any of these identifiers may identify the need for additional training or modifications to the training program. Some examples of findings that may indicate training needs include:

- Poor performance in the quality control program
- Outliers reported in proficiency testing programs or round robin programs
- Findings noted during internal and external audits
- Feedback from laboratory staff self-identifying training needs
- Trends in non-conformities reported in the laboratory

2.6 Authorizations Log

Laboratory managers are responsible for maintaining an authorizations log which compiles all authorizations into one document for quick reference. The log lists lab personnel and critical tasks on one chart along with dates of authorization and the laboratory manager's initials authorizing personnel to perform these tasks. The log contains both technical tasks (preparation and analysis of samples) as well as any non-technical tasks which are critical to the operations of the laboratory (e.g., ordering supplies, discussing reports with customers, logging in samples). Laboratory managers are authorized and responsible to grant the authorizations for non-technical tasks not covered by the Demonstration of Competency policies above.

The Authorizations Log spreadsheet and its "Instructions" tab, is available on E-link.

2.7 Ethics and Data Integrity Procedures

This section describes one of the key elements of this quality assurance program. A proper ethics and data integrity program establishes the principals which ensure the well being of the company and all of its staff members. It presents the company values on honesty, integrity, excellence and trust.

2.7.1 Ethics Policy

As a condition of hire, every employee is required to sign an acknowledgement of the Corporate Ethics Policy. The policy, along with the signature is to be maintained in the personnel files. This policy is as follows:

EMSL Analytical, Inc
Corporate Ethics Statement

In order to comply with The NELAC Institute and ISO 17025 standards and to provide the highest level of proper, honest, reliable, legal and ethical service to EMSL Analytical, Inc.'s customers, EMSL requires that each employee comply with the following Corporate Ethics Statement ("Ethics Statement"). This Ethics Statement mandates that each EMSL employee perform their jobs honestly, properly, ethically, and legally and that each EMSL employee perform their assigned responsibilities with the utmost regard for the standards set forth in this Ethics Statement and in the EMSL Employee Handbook. Under no circumstances will any EMSL employee act dishonestly, unreliably, unethically, or unprofessionally while engaged in employment with EMSL. Without limiting what EMSL may consider acts that violate this Ethics Statement, examples of prohibited acts follow:

1) Fabrication of data of any kind, including but not limited to,
- Reporting data for samples not analyzed
- Quality control or customer results
- Training records
- Calibration measurements
- Maintenance records

2) Intentional misuse of company resources, including but not limited to:
- Changing documents without proper authorization or embezzling documentation (Manuals, Standard Operating Procedures, company generated forms)
- Performing unauthorized services for personal use or for use by an EMSL competitor or for any other non-EMSL purpose or use
- Misuse of office resources (phone, fax, internet etc.) for any non-EMSL purpose or use

3) Back-dating data

4) Misrepresenting or fabricating performance (e.g., sample volume, billing, etc.)

5) Misrepresenting qualifications (e.g., experience, academic training, etc.)

6) Disclosing information in contravention to, or in disregard of, customer confidentiality agreements

EMSL prohibits these and any other act that violates the Ethics Statement or the EMSL Employee Handbook. The officers, managers and employees of EMSL will not condone, tolerate, encourage or ignore: any unprofessional, illegal or unethical actions that are directed towards or impact a person's work at EMSL, EMSL customers or potential customers, or a person's co-workers; or any act that violates the Ethics Statement or the Employee Handbook. In addition, no officers, managers or employees of EMSL shall be offered, given or accept any encouragement, monetary or otherwise, to perform acts which violate the Ethics Statement or the Employee Handbook.

The management of EMSL strives to ensure laboratory employees (especially analysts) are not exposed to undue pressures such as:

- Impossible time constraints (turnaround times)
- Customer influences that may effect analysis
- Pricing/marketing issues
- Productivity rates*

If employees feel that they are exposed to any undue pressure, the situation should be brought to the attention of that staff member's immediate supervisor. If the supervisor is unable or unwilling to resolve the issue, or if the source of pressure originates with the supervisor and the staff member feels they can not bring it to their attention, the situation may be reported to the lab manager or corporate management for review.

NOTE: The corporate management of EMSL must monitor analyst's productivity rates as a normal course of business. Reasonable rates of analysis are used as guidelines to help determine analysts' ability. At no time are analysts given productivity goals that are unreasonable.

Employees are required to report to managers located at EMSL branch offices, EMSL Corporate Officers/Managers or human resources department located in Westmont, New Jersey all acts by EMSL employees, managers or officers that may violate this Ethics Statement. The failure to report such actions may subject that person(s) to the punishments set forth below and in the Employee Handbook. Reporting unprofessional and/or unethical behavior will not negatively impact employment and will not jeopardize the employment status of any EMSL employee.

If an unfortunate event occurs where a customer or fellow employee asks a staff member to perform in an unethical manner, the situation will be brought to the attention of that staff member's immediate manager. If the cause of pressure comes from the immediate manager, the situation may be brought to the next level manager for resolution. At all times, an ethics issue may be brought to the human resources department or other corporate management by any staff member.

If a violation or potential violation of this Ethics Statement has been reported, it will be investigated by the Laboratory Manager and/or by corporate management. Depending on the findings of that investigation, any violation of the Ethics Statement may subject the offending employee to disciplinary or corrective action as outlined in this Ethics Statement or the Employee Manual. Following investigation, if it is determined that a violation has occurred, EMSL, in its sole discretion, may determine appropriate disciplinary or corrective action as outlined in the Ethics Statement or Employee Handbook, which may include:

- Verbal warning
- Written warning
- Termination of employment

In addition to the above, EMSL reserves all rights to take appropriate legal action when it deems necessary. Employees must also be aware that breeches of personal and legal data integrity may lead to civil liability/criminal prosecution and fines/punishment.

2.7.2 Data Integrity

The data integrity policy is a piece of the ethics policy relating to fabrication of data and misrepresentation of results. EMSL complies with the NELAC standard requirements addressing data integrity procedures as described below.

Training: The training policy and procedures are described in the "Ethics and Data Integrity Training" section of this Manual.

Signed data integrity documentation: The ethics statement is signed by each employee as a condition of employment. In addition, a Quality Assurance Manual compliance disclosure form is executed by each employee (see "Compliance Disclosure" at end of the QAM). This compliance disclosure states that: "In executing this Compliance Disclosure, I attest and confirm that I have read and understand the entire contents of this document" (i.e., this manual).

Periodic monitoring of compliance with the data integrity and documentation policies is performed through:

- Review of monthly quality control reports: Reports are submitted to the Quality Assurance Department for review. This review includes a check on integrity such as misrepresentation of data, falsification of results, etc. Reports of review are completed and made part of the annual management review report.
- Monitoring of proficiency testing performance: Scores of PT samples are summarized in a report and reviewed by the QA manager, the national director and vice president.
- Investigations initiated by a customer compliant: see section of this Manual – "Procedures for Dealing with Non-conformities and Corrective Actions."
- Internal audits.
- Periodic submittal of blind samples by the QA Department.

2.7.3 Ethics and Data Integrity Training

One of the objectives of the quality assurance program is to ensure the staff of EMSL is provided training in the aspects of ethics and data integrity as they pertain to corporate policy. The goals of this training program are:

- To understand the responsibility to provide true and accurate information
- The understanding of the consequences of unethical conduct
- Provide direction to employees
- Define right and wrong (as it is job related)
- The understanding of the impact of our actions

Training will be provided in the form of required readings, staff meetings and corporate issued newsletters. Corporate management and the laboratory manager are responsible for ensuring that this training is provided to the staff and that records are maintained documenting the training.

2.8 Training & Personnel Files

Personnel and training files shall be maintained for all technical employees. Personnel files shall contain all general documentation associated with the employee. Training files shall include all files associated with the initial and ongoing training of the employee.

A completed personnel file must contain at a minimum:

- Job Description (signed)
- Resume/CV
- Signed Ethics Acknowledgment
- Diplomas for degreed employees (transcripts may also be included)
- Copies of any registrations/certifications held by analyst

A completed training file must contain at a minimum:

- Training checklists for all analyses for which the analyst is qualified
- Demonstration of Competency certificate (DOC) showing all analyses for which the analyst is authorized
- Raw data supporting initial DOC for all analyses*
- Summaries of data reviewed to demonstrate ongoing capability*
- Misc. training records (certificates from classes taken and in-house training sheets)
- For Asbestos: NIOSH 582 training certificates
- For Lead: 4 independent runs for each matrix

- Results of performance on proficiency testing samples/round robin samples.

***Note:** Copies of raw data shall be included in all personnel folders supporting the initial demonstration of competency for the analyst. For some instrumental IH and chemistry analysis this may be impractical due to the volume of documentation from the instrument. As a result, these may be summarized in the training folder with reference made to where the original data can be found. Copies of the original raw data shall be maintained for the length of employment and for five (5) years after the end of employment. For ongoing demonstration of competency, summaries of data reviewed with references to the original data are sufficient in the training folders.

Files are to be maintained and updated by the laboratory manager.

2.9 Relevance of Personnel Activities and Communication by Management

Management communicates to the staff the importance of their role in customer needs, regulatory requirements and involvement to the achievement of the objectives of the management system through this QA Manual, newsletters, management meetings and teleconferences and periodic phone conversations.

Communication between staff and management is also performed on a regular basis through scheduled regional conference calls, periodic phone conversations with the EMSL national director, quality assurance manager and vice presidents.

Correspondence is also performed through the monthly quality control reports (for asbestos, microbiology and lead), the quarterly quality control reports and the annual management review.

Management ensures that employees are aware of their role in the achievement of the objectives of the quality management system by requiring employees to sign acknowledgment of understanding of this QA Manual.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Revised language of Section 2.2.1 to clarify relationship of LA Testing . All references to “Quality Control Coordinator” in Section 2.3.4 changed to “Quality Manager” to better define the position and match accrediting body terminology, references to “QC” in responsibilities updated to “QA/QC”. New Section 2.3.9 added, subsequent section numbers updated. Sections 2.4.1-8 added. Section 2.5 restructured and reorganized. • 2.5.2 becomes 2.5.2.1 and second paragraph added incorporating info previously found in 2.5.7. • 2.5.3 becomes 2.5.2.2 and clarifies qualifications of trainer previously found in 2.5.7. • 2.5.4 becomes 2.5.2.3 and adds sentence on selection and approval of courses. • New Sections 2.5.3 and 2.5.4 absorb previous sections 2.5.6, 2.6

		and 2.5.5, 2.6 respectively. Sections expanded to better explain training and demonstration of competency (DOC) requirements and procedures. DOC certificates are now to be issued by corporate QA Dept and recertification statements are to be used instead of re-issuing the DOC certificate itself. • 2.5.8 becomes 2.5.5 and examples of effectiveness evaluation findings that may trigger additional training are included. New Section 2.6 included which requires use of an authorizations log. Sections 2.7.1.1 and 2.8 moved into Ethics Policy itself as found in Section 2.7.1. Also added procedures for reporting undue pressure, and ability to report any ethics issues to the human resources department.= Section 2.8 title and content updated to refer to personnel & training files, and provide minimum contents for these files.

3.0 STANDARD OPERATING PROCEDURES

3.1 Scope

Instructions or procedures for the activities affecting the quality of our analytical services shall be developed by management. This quality assurance program shall be used as a guideline for their development, use and revision.

Technical standard operating procedures are documented in the SOP Manuals, located at each laboratory facility. These SOPs include step by step procedures for the preparation, analysis, and reporting of data.

General and Administrative SOPs include:

EMSL Complaint Resolution SOP – *Standard Operating Procedures for Complaint Handling and Resolution*

EMSL Corrective Action SOP – *Standard Operating Procedures for Non-Conformities and Corrective Actions*

EMSL Preventive Action SOP – *Standard Operating Procedure for Preventive Actions*

EMSLQCPRGMSOP – *Standard Operating Procedures for the Quality Control Program*

EMSL Electronic Sig - *Procedures and Policy for Final Report Approval Using Electronic Signature*

EMSL.Controlled Document SOP – *Standard Operating Procedures for Document Control Program*

EMSL.DocumentMasterList SOP – *Standard Operating Procedures for Maintaining Master Lists of Documents*

EMSL.Control of Records SOP – *Standard Operating Procedure for Control of Laboratory Records*

EMSL.QAAUDSOP – *Standard Operating Procedure for Internal Quality Assurance Audits*

EMSL Annual Management Review – *Standard Operating Procedure for Annual Management Review Reporting*

Analytical SOPs – A list of relevant analytical SOPs for each analytical method is found in the appropriate modules. These SOPs cover methodology for analytical procedures, calibrations, contamination checks, reporting procedures and quality control frequency.

The laboratory manager is responsible for ensuring the SOP's reflect the actual laboratory procedures. Managers are to submit suggestions for revisions to the QA manager for review. The QA manager is responsible for controlling revisions and distribution of the SOPs. (See “Document Control and Control of Records” section of this manual).

If analysis is performed using modifications to the EMSL SOP or the standard published methods, the final report will describe the modification in the report title or in the form of a disclaimer. See method SOPs for specific detail.

3.2 Method Validation

The majority of the procedures utilized by EMSL laboratories are based on published methods issued through governmental regulatory agencies and independent standards organizations. Our procedures rely on the validations provided in these methods. Methods used by EMSL are continually validated through the review of QC analysis including analysis of known standards, inter/intra analyst reanalysis of samples, participation in round robin programs and proficiency testing programs.

3.3 Non-standard Methods/Departures from Standard Operating Procedures

3.3.1 Use of Non-standard Methods

Before any non-standard method is implemented, the customer (or other recipient) must be consulted on the new procedures. The customer should provide approval prior to beginning the work.

Non-standard analytical procedures must be written and validated. The method validation process should prove that the alternate method:

- Meets acceptable criteria for precision and accuracy (see validation section below)
- Meets or exceeds analytical sensitivities required by the customer
- Does not introduce uncontrolled or unknown biases, including matrix interferences

3.3.2 Departures from Standard Operating Procedures

Major departures from the EMSL standard operating procedures must go through a review by the national directors, regional managers or quality assurance manager prior to use. Major departures include but are not limited to:

- Different sample preparation procedures
- Use of alternative analytical instrumentation
- Use of additional or different reagents.

Departures from standard operating procedures may be a result of a customer request. Review and documentation of major departures include:

- Reason for deviation from method
- Validation of procedure
- Applicability of alternative method
- Availability of needed resources (if applicable)
- Assurance that data is reported with appropriate references and disclaimers (if applicable)
- Record of alternative procedure or policy is maintained as part of the corporate files.

3.3.2.1 Validation of Non-standard Methods or Departures from Standard Operating Procedures

A validation study must be performed for any non-standard method or departure from method. A validation study involves:

- Comparison against established methods (if available)
- Effects of deviation
- Results are equal to or better than the original method (if original method exists)

The procedure used to validate a method can be an ongoing process with continuous review of the QC data - including analysis of standards, inter/intra analyst reanalysis of samples, participation in round robin programs and proficiency testing programs.

Standard quality control acceptance criteria are applied to monitor performance of the method unless other QC criteria are established. If other criteria are used, it should follow general Good Laboratory Practice (GLP) guidelines.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Updated list of General and Adminstrative SOPs. Revised last sentence of 3.2 to describe how validation is conducted.

4.0 ACCEPTANCE OF WORK

4.1 Scope

Our services are generally offered as line item tests which reference documented methodologies. Laboratory services are typically requested by the customer as "open order" requests. Samples may be delivered to the laboratory at any given time, without a firm documented arrangement. Analytical services are often performed on verbal contract. In these situations, our general terms and conditions apply. Management review procedures for open orders, verbal contracts and for the cases where a written contract is established are discussed in this section.

4.2 Procedures for Review of Contracts, Requests and Tenders

A request or contract for services may be made directly to the laboratory manager, corporate management or sales staff. In either case, before the samples are accepted, laboratory management or corporate management must review the request. This review must cover:

- Requirements for analysis - method requested is a standard method (i.e., available on price list) and understood. Special handling procedures (if any) are noted.
- Applicability of the method requested - method is available and applicable for the sample type and result(s) will provide the customer with required information.
- Technical capabilities- training, experience and qualifications of the staff.
- Understanding of the method(s) requested.
- Equipment resources - equipment is available, in working order and calibrated.
- Staff resources – number of personnel to perform the work is suitable.
- Subcontracting - identification of outside services needed to support the request or contract (including other EMSL laboratories).

Under general circumstances, the status of the laboratory capabilities is well established. For example, technical ability and equipment resources are monitored with performance of QC analyses, proficiency testing and compliance with the QA policies documented in this manual (e.g., documentation of SOPs, training requirements, analyst's qualifications, and calibration requirements). Applicability of method and staff resources is more subjective. It is the responsibility of the laboratory management to review the requests and ensure that the laboratory (or laboratory that will be subcontracted to) can perform the services.

4.2.1 Documentation of Review

These management reviews are documented in a manner appropriate to the type of request. The majority of the work being received by EMSL laboratories is established as line item, open ended requests. Requests are generally made by the customer through the sales representative, corporate management or laboratory management. Requests are reviewed and checked against the requirements listed above in section 4.2.

This review - and ultimately the acceptance of the work - is documented with the acceptance of the samples by the laboratory. The acceptance of a sample batch constitutes the review and acceptance of the request (or contract). The initials of the responsible laboratory staff member recorded on the internal chain of custody (in the 'sample accepted' box) document the contract review.

For more formal or complex contracts which involve review by the president or vice president (s), documentation of review is evidenced with the signature of president or vice president on the contract.

4.2.2 Changes to Contracts, Requests and Tenders

If a laboratory is providing services under a written or verbal contract, that contract must be acceptable to both the laboratory and the customer. Any differences identified shall be resolved before the work begins. The customer shall be informed of any deviations to the contract or requests.

Documentation of changes (or resolutions) is to be made as appropriate to the type of request. A simple notation on the chain of custody is sufficient for a change in turnaround time requirements, for example. More complex changes must be more formally recorded.

If a written contract needs to be amended after the commencement of the project, both the laboratory management and customer must agree to those amendments. These amendments must be documented.

4.3 Beginning New Work

The Laboratory Manager must not accept any new work without evaluating the current resources. This includes the availability of not only equipment, but staffing as well. For example, a laboratory must not accept an increase in workload, if the laboratory staff is currently at capacity.

Any question regarding the capability of the laboratory to perform such new work must be brought to the attention of corporate management. The corporate management will either:

1) Provide the additional equipment and/or staff
2) Allocate work through the EMSL network
3) Reject the new work

4.4 New Technical Service

Prior to the implementation of any new technical service, corporate management performs a comprehensive review. This review includes market applicability and availability of resources. The vice president of laboratory services or the president must grant approval. The Quality Assurance Department will ensure that standard operating procedures are written and quality control parameters are established for new methods.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Updated section headers to refer to Contracts, Requests and Tenders to mirror 17025 terminology

5.0 SAMPLE TRACKING & CHAIN OF CUSTODY

5.1 Scope

Rigorous sample tracking is fundamental to a QA program. The most thorough and complete analysis is useless if performed on the wrong sample.

Our sample-tracking program is designed, to the extent that it is possible, to meet all litigation requirements. It is also designed to have redundancy safeguards wherever possible.

The procedures summarized below are described in detail in the EMSL Sample Chain of Custody SOP.

5.2 Chain of Custody

In order to ensure the integrity of any sample, records of its custody must be maintained throughout the sample collection in the field, acknowledgement of receipt, acceptance by the laboratory and analysis. The custody of the sample will be tracked via the completion of a chain of custody form.

EMSL Analytical, Inc. does not collect samples. Therefore, the chain of custody begins with the customer in the field. EMSL maintains Chain of Custody documents that customers are encouraged to use where they do not have their own form. Customers delivering samples without a chain of custody form will be required to complete a chain of custody prior to samples being logged-in at the laboratory. EMSL takes possession of samples by signing the "Received" section of the chain of custody form. The chain of custody then accompanies the samples through the laboratory until analysis and final reporting is complete. Original chain of custody forms are returned to the customer with the final test report.

5.3 Sample Receipt

Upon receipt of samples, the administrative coordinator will verify receipt of all samples against the chain of custody form and will check for obvious signs that the samples have been compromised. Any problems with the samples will be reported to the customer immediately. Once samples are deemed acceptable the Chain of Custody will be signed indicating samples have been received by the laboratory.

5.4 Sample Acceptance

Samples are not accepted for analysis until they have been received and reviewed by the analyst or preparatory personnel. If samples are found to be unacceptable for analysis (see SOP for examples of reasons for unacceptability) this will be communicated to the customer immediately and this communication and any resulting instructions recorded.

Before a sample can be analyzed for compliance purposes, it must fall under the scope of the required analytical method. It must be suitably sampled, properly preserved (if appropriate), packaged and have a proper chain of custody. Customers are instructed to ship samples in clearly labeled, non-breakable airtight containers and to package such samples so as to minimize damage or change in condition of the samples. Samples shipped by air must be placed in containers that minimize jostling and damage. Samples should be packaged in non-static packaging. Sampling guides are available in the EMSL Products and Services Catalog.

5.5 Log-In & Internal Chain of Custody

Log-in of samples is accomplished by authorized personnel using the Laboratory Information Management System (Sample Master XP or SMXP). It is at this point that unique order ID numbers and Sample ID numbers are assigned. This order number is physically attached to the sample batch and

serves to identify the sample set throughout the analysis. This, in combination with the customer ID number uniquely identifies each sample. An internal chain of custody is also generated at log-in which documents the handling of samples throughout the laboratory. See the EMSL Sample Chain of Custody SOP for additional details on log-in and internal chain of custody procedures.

5.6 Samples Shipped to Other EMSL Branch Laboratories

Specific procedures are established for situations where a laboratory has received a sample and subsequently chooses to ship out to another EMSL laboratory. Because each of our labs (except NVLAP sub-facilities) maintains their own accreditations, this constitutes a 'subcontracted laboratory'. See section "Subcontracting" in this manual.

5.7 Archival and Disposal of Samples

Once the analysis is complete and the analytical worksheet is signed, the analyst stores the sample in the appropriate storage area. All storage boxes are to be stored in a safe manner for the period indicated for that category of waste, in accordance with regulatory requirements. When a storage box is full, the month in which the samples were analyzed (or similar reference numbering system as appropriate for the operations, i.e., billing number) is marked on it. A new storage box replaces the old one, which is then stored until time of disposal. All samples will be stored so as to provide protection from any possible contamination or loss of integrity.

Specific storage requirements for each analytical method are discussed in the program modules.

Upon request, samples will be returned to the customer.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Changed title by adding "Chain of Custody". Much information previously in this section moved to the EMSL Sample Chain of Custody SOP. Modified Section 5.2 by removing most information and replacing with a summary of policy and procedure. Reference to sampling guides in EMSL Services and Products Catalog has been added. Changed references to "Sample Receiving Coordinator" to "administrative coordinator" to correspond to Section 2.0 of QAM. New Section 5.3 added which summarizes sample receipt procedures. Subsequent sections are renumbered as necessary. Section 5.3 renumbered to 5.4 and renamed "Sample Acceptance." Summary of policy replaces first paragraph. Sample Rejection Criteria removed to Sample Chain of Custody SOP. Reference to sampling guides added to last paragraph. Section 5.4 renumbered to 5.5 and renamed "Log-In & Internal Chain of Custody". Replaced contents with summary of policy and procedure. Moved procedure to Sample Chain of Custody SOP. Sections 5.4.1, 5.4.2 deleted.

		Section 5.5 renumbered to 5.6. 5.6 deleted and moved to Sample Chain of Custody SOP. Added final sentence to Section 5.7 noting that upon request samples may be returned to customers.

6.0 SUBCONTRACTING

6.1 Scope

EMSL laboratories do not generally subcontract technical services outside of the EMSL laboratory network. However, in the event such services are required, the laboratory manager will ensure all procedures are performed by laboratories that comply with the quality management systems as addressed in this document and the policies of the accreditation program(s) currently held by this laboratory. Laboratories must subcontract only to outside laboratories that maintain accreditations appropriate for that analysis.

The receiving laboratory is responsible to the customer for the subcontractor's work, except in the case where the customer or a regulatory authority specified which subcontractor is to be used.

A summary of qualifications of each EMSL laboratory can be found in the "EMSL Laboratory Qualification Summary" available on E-link.

6.1.1 Subcontracting Analysis to Outside Laboratories

The Quality Assurance Department or national director must perform final approval for use of a non-EMSL subcontract vendor for laboratory services. The customer must be notified and provide approval prior to any subcontracted work that is performed. This approval must be documented. The final report submitted to the customer must be that from the subcontract laboratory.

Subcontract labs will be deemed competent to perform analysis if they hold accreditations appropriate to the analysis being subcontracted or if they can otherwise demonstrate competency through their quality system and performance. If subcontracting analyses for which EMSL is accredited, the subcontract lab must hold equivalent accreditation to EMSL for that analysis. The QA department or national directors must approve all outside subcontract laboratories.

6.1.2 Subcontracting Analysis to EMSL Laboratories

The network of EMSL laboratories provides the customer with a valuable resource. Samples may be shipped out for analysis to other EMSL laboratories when a laboratory is at workload capacity, turnaround time can not be reached or the laboratory does not have the analytical capability.

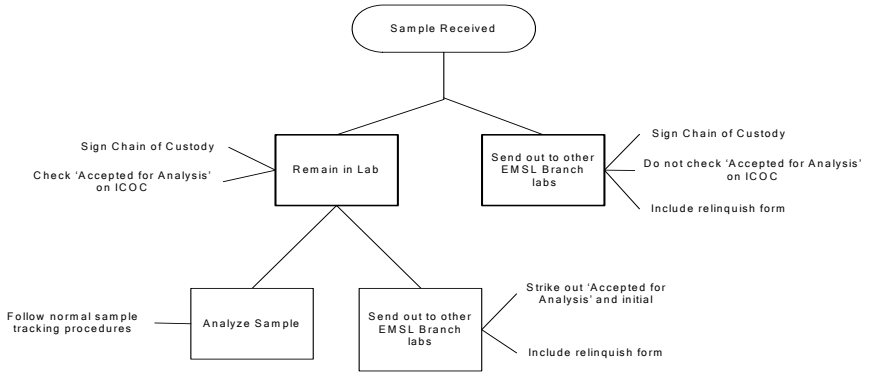
Where a laboratory subcontracts samples to another EMSL facility, a 'contract review' must be performed. This review consists of:

- Verification that the subcontract lab maintains the applicable accreditations
- Check on available staffing resources
- Check on available equipment

When samples are received by a laboratory and the samples cannot be analyzed in that laboratory, the receiving laboratory signs the chain of custody acknowledging receipt (continuing the custody) but does not approve for analysis. The laboratory completes the EMSL relinquish form. This form must be faxed to and signed by the customer – acknowledging notification. If there is a standing relationship with the customer where it is understood that samples will be shipped (for example: where a customer routinely submits samples which will automatically be shipped to another EMSL laboratory for analysis at the customers direction), one relinquish form may be completed covering the whole project.

If the laboratory manager chooses to send the samples out to another branch laboratory after the samples are accepted for analysis, the laboratory must strike out the 'Accepted for Analysis' on the internal chain of custody.

A relinquish form is completed, including customer approval, and then form is shipped with the samples. All relinquish forms are filed in one folder or binder.



When selecting an EMSL laboratory to which to subcontract, the receiving laboratory must ensure that the laboratory maintains the appropriate certifications for the type of work being subcontracted (see "EMSL Laboratory Qualification Summary" available on E-link). The qualifications and capacity of the lab should be verified prior to samples being sent.

6.2 Turnaround Time

The turnaround time for the subcontracted analyses begins at the time the samples are received by the original lab, not the subcontract laboratory. If the requested turnaround time can not be met, this should be discussed with the customer immediately and a new turnaround time agreed upon. The conversation and agreed upon turnaround time shall be documented and communicated to the subcontract laboratory.

6.3 Reporting

The final report submitted to the customer must be generated by the analyzing laboratory.

For analysis performed by another EMSL laboratory, the analyzing laboratory may issue the report directly to the customer using the normal EMSL reporting procedures and format.

When subcontracting to an outside laboratory, reporting will be done from EMSL using the report from the subcontract lab and a cover page from EMSL containing order and customer information and the name of the subcontract lab used.

6.4 Retention of Subcontracted Samples

When samples are sent to another EMSL laboratory for analysis, the samples will be retained by the laboratory conducting the analysis unless otherwise documented in project specific instructions. The original laboratory shall ensure that sample retention policies at the subcontract lab require retention for length of time equivalent or longer than EMSL policies.

When samples are subcontracted to an outside laboratory, the original laboratory shall ensure that EMSL retention policies are communicated to the subcontracting lab and samples retained for the stated period of time.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Reference to the laboratory qualifications summary has been updated in Section 6.1. Paragraph added to 6.1.1 regarding selection of outside subcontract laboratories. Section header 6.1.2.1 removed. Content remains in 6.1.2. Moved Section 6.1.3 ("Subcontracting Equipment") to Section 9.0. New Sections 6.2, 6.3 and 6.4 added dealing with "Turnaround Time", "Reporting" and "Retention of Subcontracted Samples" respectively.

7.0 DATA PROCESSING AND VALIDATION

7.1 Scope

EMSL utilizes an automated Laboratory Information Management System (LIMS) to record, document and assimilate pertinent field, laboratory, and administrative data. The LIMS system is referred to as Sample Master XP (SMXP).

The validation of the SMXP software, including final report templates are performed by the corporate IT Department and the Quality Assurance Department. The IT Department is responsible for maintaining updates and revisions and for tracking distribution. Release notes for each release of SMXP are prepared and distributed by the IT Department. A complete release history and historical release notes can be obtained from the IT Department at any time.

Data validation is a continuing process that takes place every time samples arrive at the laboratory and is carried through during log-in, analysis and final reporting. This process is performed by the laboratory manager each time a final report goes through the procedures of review and signature.

Note: Sampling is a significant factor in the meaningfulness of results; however, because sampling is not performed by EMSL, this aspect is out of EMSL's control and will not be dealt with in this section.

7.2 Validation of Computer Software, Data and Final Reports

Analytical data storage, processing, and reporting are facilitated through use of SMXP. SMXP software is run on Windows-based, PC computers. The corporate IT staff are responsible for ensuring that all computer systems, hardware and software, are documented, inventoried and adequate for use. All systems are operated in safe environments and maintained to ensure proper operation. The computer systems responsible for handling of analytical data have been set up to process data in a way that ensures integrity.

All computerized systems, especially the software used for data reporting, must be initially validated prior to use and then subsequently periodically re-checked during the ongoing validation process.

7.2.1 Initial Validation

All calculations and reporting performed by the software is implemented by the laboratory management, the corporate IT staff or the QA manager. This coordination between the QA Department, laboratory management and the IT Department allows the software to be reviewed and altered as necessary to comply with regulatory agencies and/or accrediting organizations requirements.

EMSL employs a system to periodically test and verify that the software used for sample log-in and report generation is performing properly. To do this, a "dummy" set of samples has been created for each type of analysis that the lab performs. Each set has a sufficient number of samples to be able to test as many variables as possible. Examples are:

- No volume
- Low volume / low sample weight
- High volume
- Low concentration
- High concentration
- None detected
- Overloaded sample

The "dummy" sample reports are proofread for accuracy of all text fields and all results have

been verified by hand calculation. The results of each periodic software validation are documented along with the date performed. If there is any discrepancy from the master that cannot be attributed to data entry error, the QA Department is notified and corrective actions implemented.

7.2.2 Continuous Data Validation

In addition to the initial verification, there is a continual validation process that occurs each time that the laboratory manager proofs a report prior to release to the customer. If any of the errors that are found during this proofing process are not traced back to transcription or analytical error, then the computer system is suspect and will be investigated. The processes that undergo this continuous validation include:

7.2.2.1 Sample Receiving

At completion of the log-in phase, the internal chain of custody and bench sheets appropriate to the analysis requested are produced by SMXP. Also at this time an internal chain of custody is produced. This document summarizes the sample set with customer and sample information (including ID's), and generates a chain of custody log that is initialed and dated by everyone that handles the samples in the laboratory. The laboratory manager checks the accuracy of this information generated SMXP.

7.2.2.2 Sample Preparation

After log-in, the samples and all its corresponding paperwork are sent to the lab for preparation prior to analysis. Upon receipt, the prep person and/or analyst initials and dates the internal chain of custody. At this stage too, any problems with the samples or paperwork are noted and brought to the attention of the laboratory manager.

7.2.2.3 Sample Analysis

After sample prep, the samples and all corresponding paperwork are sent to the analyst. Upon receipt, the analyst initials the requested analytical method on the original chain of custody and dates the internal chain of custody in the appropriate section. At this stage too, any problems with the paperwork (or samples) are documented on the sample paperwork and also brought to the attention of the laboratory manager.

The analytical process is obviously one of the most important stages in assuring data validity. The procedures taken to ensure the validity of the sample result include calibration of equipment, formulation of method detection limits, instrument detection limits, determination of analyst qualifications, instrument, and lab precision and bias, etc. are very specific to the particular analysis being performed. Details of these procedures can be found in the SOPs for the various analyses.

7.2.2.4 Analytical Results Entry

Once sample analysis has been completed, all paperwork including field data sheets, field chain of custodies, internal chain of custodies, sample bench sheets, and any other paperwork that was generated to this point is sent to the data entry personnel. At this stage results are transcribed from the bench sheets and instrumental printouts into the LIMS (or Excel) reporting spreadsheet. Analytical results are entered either by approved data entry personnel, or by the analysts themselves. The software stores the analytical data, performs calculations, and generates the final report. The person performing the data entry would be aware of any error or unusual performance of the LIMS system and would bring this to the attention of the laboratory manager.

This final report is reviewed by the laboratory manager (or designee) and approved before being forwarded to the customer. Chains of custody are copied and placed in the laboratory master files along with the analytical worksheets and raw data.

7.2.2.5 Proofing of Reports

After data entry, reports are sent to the laboratory manager or designee for review. The reports are scanned for completeness and accuracy. A check on the quality control analysis performed in association with the results is performed. This is also the point where transcription errors are caught and corrected. In addition, if the analytical data looks questionable for any reason, hand calculations are performed to verify results. If errors are found, the report is returned to data entry for transcription error corrections or back to the lab if there are problems with the data. The laboratory manager is to investigate the error and the cause determined and corrected. All corrective actions must be documented whether analyst, instrument, or LIMS related.

7.3 LIMS (SMXP) Data & Security

SMXP data is retained in a "live" redundant replicated instances of SQL Server 2005 in a Master database for a minimum of 2 years. Data older than 2 years is migrated to an archive instance of Sample Master LIMS data. This production database contains analytical data for all local and remote company labs. All data from the remote labs is consolidated into the Publisher and Master database using Microsoft SQL Server replication services.

Although our computer equipment has proven to be reliable, unexpected problems do occasionally occur. In the event a problem should arise, the IT staff follows specific procedures to deal with such situations. All SMXP data is replicated to a central SQL Server 2005 database, which functions as the primary backup for the LIMS data. LIMS data is also copied (backed up) onto a backup disc subsystem nightly and transferred to high density tapes which are relocated to secure, temperature controlled, fire proof vaults within Iron mountain to prevent permanent data loss in the case of systems failure, accidents or disasters. The IT staff has the ability to failover to hot spares providing the ability to replace or repair malfunctioning or damaged equipment with a minimum of down time. In most cases, duplicate equipment has been provided, so that if one computer experiences unexpected problems, a duplicate computer can be utilized while the other is being repaired. Systems are in place that ensures computer-related difficulties do not negatively impact the performance of the laboratory.

More information on the backup and archiving of SMXP data can be found in the EMSL Control of Records SOP.

The security of the software is controlled by the corporate IT staff and the laboratory manager. Each computer user is assigned password protected rights and privileges specific to the tasks that the user is allowed to perform. Access to all LIMS analytical related software is password protected on a user-by-user basis to ensure security. The IT staff is responsible for ensuring access to SMXP is controlled and assignments are held secure, using laboratory management approval.

The corporate IT staff are responsible for ensuring that all computer systems, both hardware and software, are documented, inventoried and adequate for use. All systems are operated in safe environments and maintained to ensure proper operation. The computer systems responsible for handling of analytical data have been set up to process data in a way that ensures data integrity with password specific approval assignments. Data integrity is also maintained by performance of daily tape backups as discussed in the Records Management SOP.

7.4 Changes to LIMS (SMXP) Final Report Templates

Changes are made to the SMXP Final Report Templates by way of a “Sample Master Change Request Form” submitted to the QA manager or national directors. The QA manager or national director reviews the requested changes for applicability to methodology, technical validity and regulatory compliance. The QA manager may also consult with the sales and marketing staff on the impact of any change to the

customer and/or business market. Once a Change Request is approved it will be forwarded to the IT department in order to implement the change in the SMXP system.

7.5 Electronic Record Retention Policies

Record retention policies for electronic records are analogous to policies for retention of non-electronic records maintained by EMSL laboratories. These policies are discussed fully in the "Document Control and Control of Records" section of this manual and the EMSL Control of Records SOP, including retention times and disposal.

All digital analytical records are permanently archived. The data is transferred to a disk-to-disk back-up system nightly, and once a week is transferred to high density tapes and transferred to Iron Mountain for storage. Access to these records are restricted and controlled by EMSL record policies and procedures. The record keeping system allows for the reconstruction of all activities required to produce an analytical result.

7.6 Exported Data

Exported data is provided in a variety of formats, depending on the specific needs of our customers. Export formats for data deliverables are implemented and controlled by the corporate IT staff, which has the flexibility to implement new export formats as required. Electronically delivered data is not intended to replace hard copy results. Final, signed customer reports are to be submitted in addition to delivery by email or diskette. In this way, exported data can be verified. Electronically transmitted results meet the requirements of the QA policies as documented in this manual.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Clarified that SMXP is the LIMS system used by EMSL. First paragraph in Section 7.3 moved from "Electronic Data" section of 7.6. Information on backup of LIMS data extracted from section and reference to the "Control of Records SOP" added. Updated form name in Section 7.4. Added last sentence of section. Changed name of Section 7.5 to "Electronic Record Retention Policies", removed text from this section and moved to the "Control of Records SOP" and referenced this SOP. Added final two paragraphs of this section. Deleted old Section 7.6 and moved to "Control of Records SOP". Renumbered subsequent section.

8.0 QUALITY OF MATERIALS AND SERVICES/PURCHASING

8.1 Scope

The high quality of materials used in the laboratory shall be assured through specific purchasing and verification procedures and proper handling techniques.

8.2 Reagents, Reference Materials and Reference Standards

Selection of the appropriate grade of reagent(s) is designated in the reagent section of each analytical SOP and in addition may be specified by the laboratory manager in unusual circumstances. As a general practice, reagents will be of at least ACS reagent quality.

Reagents, reference standards and reference materials shall be purchased in accordance with the analytical needs of the laboratory as determined by the laboratory manager. Reference materials and standard reagents shall be obtained from the vendor with a certificate of analysis (certificate must identify the lot number). This certificate will be maintained in the laboratory files.

When received by the laboratory, the labels of the reagents and reference materials are dated and initialed with date received and expiration dates provided by the manufacturer. Labels are also dated and initialed when opened and/or when reagent mixtures are prepared.

If no expiration date is given by the manufacturer, one must be assigned. Using a relatively subjective method, the lab manager assigns a date, depending on the material. For example, an expiration date for an (extremely stable) asbestos standard could be assigned at 10 years. At the 10 year date, the standard would be evaluated for possible contamination, change in concentration (if a mix of materials) and verified by calibration. In all cases, every reagent and standard must have an expiration date assigned.

Laboratory managers are to purchase reference materials and reagents in the smallest quantities practical to help reduce inventory. A reduced inventory will be used up more frequently, avoiding the possibility of having the standard stored in the laboratory past the expiration date.

Reference standards shall be NIST-traceable and include a certificate showing traceability. This certificate shall be stored in the laboratory.

8.2.1 Verification of Reagents and Reference Materials

Verification will consist of confirming that the purity grade recorded on the reagent or reference material label conforms to the requirements of the SOP unless analysis difficulties indicate a possible problem (with QC or sample analysis) or regulatory agency requirements specify otherwise. In the latter case, the analytical SOP will identify the appropriate reagent.

8.2.2 Storage and Handling of Reagents, Reference Materials and Reference Standards

Reagents, reference materials and reference standards are to be stored in a manner which will conserve the purity and integrity. Reagents and reference materials are stored following manufacturers requirements (temperature, humidity, etc.). Care must be taken when handling reagents to avoid contamination or evaporation. Lids must be kept secure when not in use. Reference standards shall be stored according to manufacturer requirements and used only for calibration unless it can be shown that their performance as reference standards would not be invalidated.

8.3 Consumable Supplies

Consumable supplies are to be purchased based on laboratory needs as determined by the laboratory manager. SOPs will indicate the specific grades and classes of consumable supply items to be used. Analysts are not to re-use expendable materials intended for single use purposes such as microscope slides, plastic centrifuge tubes, etc.

8.4 Purchasing

Supplies are purchased through the corporate Purchasing Department based on requests made by the laboratory manager. This allows for company wide control and standardization of consumable supplies. EMSL purchases critical supplies from well-known industry vendors such as VWR, Fisher and Health Link. For the most part, EMSL relies on the vendor's certification in ISO programs and business reputation for the quality of products and services. Evaluation is also performed during the actual application of the product during the laboratory's daily work. This type of product quality evaluation is an effective and on going process. The quality of the products purchased is continuously monitored with the normal quality control checks. These checks include:

- Laboratory blank analysis data
- Calibration measurements
- The analysis of standards
- Review of reanalysis data

The laboratory manager will notify the corporate Purchasing Department if any product is found to be defective or not within standard acceptance criteria, The Purchasing Department maintains records of consumable supplies that have not met the standards set forth in the analytical SOP or have been identified by the laboratories as not meeting the quality criteria. This department is responsible for ensuring these types of supplies are not purchased, or otherwise utilized by the laboratory facilities.

The laboratory manager is responsible for approving supplies used for analysis (such as reagents, slides, disposable funnels, etc.) once received. The manager is to ensure that the product received meets the requirements for grade and quality according to the QA policies, SOPs and published methods. The approval is documented by the lab manager (or designee) with his/her signature on the packing slip received with the product. This packing slip is then forwarded to the corporate Accounting Department.

8.5 Service Providers

Where outside services are contracted that effect analytical testing such as calibrations, repairs to equipment, adjustments to instrumentation, checks on performance, etc., the vendor must be accredited under the ISO 17025 standard, where applicable.

The laboratory and/or the corporate Purchasing Department maintains list of approved service providers. Considerations for the approval of providers include:

- accreditation in the ISO standard (where relevant)
- reputation
- history of performance
- referrals

All service must be documented and filed by the laboratory.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes

10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Section 8.2 title revised. Section updated to take account of reference materials in addition to reference standards. Last sentence added to Section 8.2. Section 8.2.1 updated to apply to reference materials. Section 8.2.2 updated to apply to reference materials and standards. Last sentence added to section.

9.0 ANALYTICAL EQUIPMENT/INSTRUMENTS

9.1 Scope

The quality and maintenance of equipment plays a critical role in providing quality analytical services. This section discusses the overall policies and procedures used to ensure that laboratory equipment meets quality standards.

9.2 Equipment Maintenance

The laboratory manager in cooperation with the corporate QA department shall determine whether an instrument is maintained and repaired in-house or by an outside service firm. Servicing will also be performed when a need has been identified by calibration or other QC checks. When special service is needed, the laboratory manager should notify the national director and corporate QA manager of the need and reasons for service.

A maintenance file will be maintained for all equipment. In addition to a schedule of normal preventive maintenance, this file will contain a record of servicing. Each instrument service entry shall contain the following information:

- Date and time.
- Initials of servicing individual (include if in-house or outside agency).
- Description of problem.
- Maintenance element examined and if any repairs/replacement of component were made.
- Pertinent comment(s).

Where regular maintenance schedules are necessary (spectrophotometric instrumentation, for example), the schedules are documented in the analytical SOP. The laboratory manager is responsible for ensuring maintenance schedules are met.

9.3 Instrument Calibration

Accrediting authorities and standard published methods have specified the frequency and manner in which a laboratory must calibrate their instruments. Specific calibration requirements are found in the appropriate program module. Generally, outside calibration services (for example, Mettler) are used for calibrating a single reference thermometer per laboratory, as well as a set of weights which can be used as standard references which are in turn used by the laboratory to calibrate all working thermometers and balances. EMSL laboratories service all analytical balances in-house.

9.4 Defective Equipment

Analytical and support equipment found to be defective or performing poorly (out of calibration) is removed from operations until they can be repaired. The defective equipment is to be clearly labeled as "out of service". The laboratory manager is to investigate whether the defect has effected any reported analytical results.

9.5 Instrument Manuals

The laboratory manager is responsible for maintaining and reviewing all instrument manuals pertaining to use, calibration and maintenance. Instrument manuals are to be made available to the analysts. The laboratory manager is responsible to be informed of, and keep current with, all new releases of information on all equipment.

9.6 Authorization to Operate Equipment

The laboratory manager is responsible for ensuring that only authorized personnel operate the major laboratory instrumentation. Authorization is granted based on training and experience as detailed in each of the method sections. Authorization may be given to personnel through the completion of the qualifications checklist or verbally, depending upon type of instrumentation. For example, approval for operation of the transmission electron microscope or spectrophotometer is recorded on the training checklist while the approval for an acetone vaporizer or water bath may be done verbally.

9.7 Equipment Serviced or Calibrated by an Outside Vendor

In the event any major equipment is sent out of house for repair, the laboratory manager will maintain a file documenting:

- Date of shipment
- Vendor information
- Service needed
- Date of return

This information is to be recorded on the "Equipment Maintenance Log" form.

The laboratory is responsible for ensuring all equipment is calibrated prior to placing back into service. Calibrations must meet the acceptance criteria established for that equipment.

Where reference materials or equipment is sent to an outside vendor for calibration, the calibration must be performed by an ISO accredited company. The certificate of calibration must indicate the calibration had been performed following the ISO standards.

9.8 Subcontracted or Leased Equipment

Any laboratory equipment, which is to be used during analysis, other than EMSL equipment, (e.g., equipment borrowed/eased from an outside organization such as an academic institution), must undergo complete calibration, applicable start-up procedures and QC checks, as described in the laboratory SOP for the utilized instrument. These procedures must be performed prior to the start of any sample analysis. All maintenance records, manuals, and performance records must be made available for review and approval by EMSL staff.

Records are to be maintained which include:

- Type of instrument subcontracted
- Date and purpose
- All raw QC data generated including calibration information

9.9 Equipment Handling, Transport and Storage

The management of major laboratory instrumentation is performed at the corporate level by the Department of Instrumentation and Planning. This department purchases, tracks and ships primary analytical instrumentation and a variety of support equipment.

9.9.1 Shipping

Equipment is assigned a serial number and inventoried. Packaging and shipping is handled internally for equipment which is relatively easy to handle such as optical microscopes, hot

plates, etc.

A professional hauling service vendor may be used for large equipment (generally > 100 lbs.) such as TEMs, spectrophotometers and fume hoods or where equipment is fragile.

Once equipment has been received by the laboratory, the instrumentation must undergo performance checks including:

- Calibrations
- IDL and MDL study (where applicable)
- Quality control checks.

These performance checks may be completed by the Laboratory Manager and/or the Department of Instrumentation and Planning depending on the type of instrument and the ability of the laboratory manager. All checks are documented in the laboratory equipment maintenance log. *(Note: see also the analytical SOP for that test applicable to the specific instrumentation*).

9.9.2 Storage

Laboratories are to adhere to the manufactures' requirements for the storage of instrumentation.

9.9.3 Local Equipment Inventory

Each laboratory is required to maintain an inventory of all critical equipment in use at the laboratory. Since each laboratory's inventory varies according to size and scope of work performed at the laboratory, it is the responsibility of the lab manager to ensure that this equipment inventory reflects actual equipment at that laboratory and includes wherever available the manufacturer, model, serial number, date put into service and date taken out of service. This equipment inventory is maintained in the "Equipment Inventory" spreadsheet.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Section 9.2 updated to clarify decision making authority for equipment maintenance requests. Last two sentences added to Section 9.3. Section 9.7 - Updated name of Equipment Log template used to record service and/or calibration of equipment. New Sections 9.8 and 9.9 (and subsections) added addressing "Subcontracted or Leased Equipment" and "Equipment Handling, Transport and Storage", respectively.

10.0 CONTAMINATION MANAGEMENT

10.1 Scope

This section describes reagent control and contamination management. Proper observance of these procedures is necessary to guarantee accuracy of results and the safety of laboratory staff members.

Contamination of samples, the laboratory environment and reagents used in analysis must be avoided to provide the highest quality, legally defensible data to our customers. In order to achieve this goal, laboratory staff must adhere to various preventative measures and use the testing procedures for contamination detection.

Contamination control is focused both on sources and on targets of contamination.

Sources would include:
- Samples
- Laboratory debris

Targets would include:
- Samples
- Equipment, such as tools
- Supplies, such as microscope slides and reagents
- Work areas

Contamination control consists of 3 parts:
- Avoidance
- Detection
- Resolution

10.2 Contamination Avoidance

To avoid contamination, the following procedures must be followed:

- Maintain good housekeeping
- Clean all tools before and after preparing each sample
- Clean tool sets at the end of the workday
- Dispose of wipers after use. Do not let them pile up during the workday
- Wipe all work surfaces before and after sample preparation. Surfaces include bench tops, slide trays, stereo microscope stage, and slide preparation surface
- Controlling work areas
- Work only on clean surfaces

Only one active sample should be processed at each time. The sample containers are kept closed when not being processed. Inactive samples are stored in a suitable, out-of-the-way area. Target items – samples, reagents, and containers are opened one at a time as practical.

10.3 Detection of Contamination

Contamination control is verified by the evaluation of blank sample analysis and results of air/surface sampling.

10.3.1 Blank Analysis

The number of blank samples analyzed is specified in the quality control section in the appropriate SOP. This data is generated and tracked for the purposes of monitoring any possible contamination only and is not to be used for statistical quality control.

10.3.2 Ambient Air Monitoring/Wipe Sampling

On a quarterly basis, or if there is a reason to suspect contamination, the laboratory is to perform ambient air monitoring and/or wipe sampling through out the facility. This procedure not only helps to monitor possible sample contamination, but also provides data to evaluate any possible personnel exposure.

For air samples, a sampling pump is set up in a location that represents areas of most activity. The pump's rotometer must be calibrated against a primary standard, annually. Sampling is conducted according to the appropriate NIOSH, OSHA or other published method as available. Flow rates, sampling times, media and all other parameters will be in accordance with appropriate methods and good scientific practice.

Specific sample volume, method of analysis and acceptance criteria for the targeted compounds are listed in the individual modules.

Results of these samples are filed in the laboratory. If any result is above the contamination/exposure limit, the laboratory manager must immediately notify the Quality Assurance Department and/or the corporate health and safety officer. An investigation into the source of contamination/exposure is performed and a corrective action implemented. All actions are documented.

See the program specific modules for additional details on quarterly contamination monitoring.

10.4 Resolution

If contamination is detected in any situation, the source of contamination must be traced and the problem resolved to prevent reoccurrence. A Corrective Action Record (CAR) should be completed to document the analysis of the source of the contamination as well as actions taken to resolve a contamination circumstance.

After corrective actions have been completed, and the contaminated areas have been cleaned, re-sampling and analysis shall be performed in order to ensure that the contamination has been eliminated. A subsequent contamination check prior to the scheduled quarterly check may be warranted depending on source and/or type of contamination in order to ensure effectiveness of corrective actions.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Section 10.2 updated to require that only a single sample be process at one time. Section 10.3.2 updated to require re-sampling after corrective

		actions for contamination. Also, added reference to the Modules. Section 10.4 revised to address actions to be taken if contamination is detected.

11.0 DOCUMENT CONTROL and CONTROL OF RECORDS

11.1 Scope

EMSL document and record control procedures have been established to meet the requirements of ISO 17025:2005 and the accreditation requirements of AIHA, The NELAC Institute and NVLAP. Procedures and policies apply to all EMSL laboratories.

11.2 Document Control

The EMSL document control procedures are documented in the Document Control SOP and Master List of Documents SOPs. EMSL's document control program covers the initiation of new controlled documents, annual review and maintenance of controlled documents, and retirement of obsolete documents.

EMSL controls documents to ensure the laboratories are performing analysis and reporting data following EMSL quality standards. The controlled document program also helps ensure the laboratories are using the latest methodologies and following the most recent procedures. This program also establishes company wide standardization and preserves company property.

The system is briefly described below.

11.2.1 Document Inventories

A corporate Master List of documents will be maintained by the corporate QA department for all controlled documents distributed by corporate which will list how documents are distributed to branch laboratories. Each laboratory will also maintain a local Master List showing distribution of documents within the laboratory.

11.2.2 Initiating New Documents

New documents may be initiated by any EMSL employee but are ultimately approved by the corporate QA manager or national directors following a review for technical applicability, compliance with requirements, and impact on business processes. Once approved, an authorizing signature will be included on all corporately approved SOPs and controlled headers and footers will be added to the document.

11.2.3 Protection of Controlled Documents

Controlled documents will be protected based on the type of document. SOPs and other documents which are text-based are usually converted to PDF prior to distribution. Excel spreadsheets and form templates will be protected using the write protection tools included in Word, Excel and Adobe Acrobat, usually locking the form except for data entry fields. Templates such as bench worksheets which are printed from Sample Master XP (SMXP) are protected through the permissions for accessing Sample Master which restrict the ability to alter the templates.

11.2.4 Distribution of Controlled Documents

Most corporately issued controlled documents are distributed through the E-link site. Once posted an e-mail notification is sent to laboratories notifying them of the new or revised document. In addition, the document is updated on or added to the Corporate Master List of Documents which is also available on the E-link site.

11.2.5 Review of Controlled Documents

Controlled documents will be reviewed once every 12 months to determine their continued suitability. For corporately issued documents, the QA department or national directors will conduct these reviews although they may assign review of documents to other EMSL employees with sufficient experience to determine the suitability of the document. Whenever a document is revised, it will be considered reviewed as of the revision date.

11.2.6 Amendments and Revisions

Documents may be changed through the use of revisions and amendments. Amendments are intended to be minor changes made to a controlled document interim to a full document revision. Revisions will be a complete re-issue of a document.

11.3 Control of Records

The EMSL control of records procedures are documented in the Control of Records SOP. The SOP outlines the requirements of record maintenance but each laboratory is responsible for the logistics of record control in their laboratory. Each laboratory is responsible for maintaining a Records Management Log which documents where records are located and how they are indexed, accessed and stored in the laboratory. General policies include:

All laboratories will retain records of original observations in addition to derived information.
If a record contains a mistake that must be corrected, the mistake shall be crossed out and signed, initialed and dated using indelible ink and the correction made alongside.
Records must never be corrected by erasing, deleting or otherwise making the mistake illegible (e.g., use of correction fluid, correction tape, scratch outs).
Records shall be retained in order to ensure that sufficient information is maintained to allow for an audit trail which includes calibration records, staff records, test report, etc.
Records shall be retained for a minimum of 5 years or for the period of time established by relevant accrediting authorities or contract requirements.
Records shall be protected against fire, theft, loss, environmental deterioration, vermin, and, in the case of electronic records, electronic or magnetic sources.

11.4 Signature/Initials Log

A log of the signatures and initials of laboratory staff will be maintained on file in the laboratory and the QA Department. This log contains:

- Printed name
- Signature
- Initial
- Date of entry

This log facilitates the identification of initials and/or signatures entered on laboratory documentation such as chain of custodies, analytical worksheets, final reports, etc.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Section 11.1 updated to reference those agencies for which the

		policy has been designed to meet document and record control requirements. Old sections 11.2-11.9 and 11.11 deleted. Previous content has been moved to the "EMSL Control of Records SOP" and "EMSL Document Control SOP". New Section 11.2 added containing a summary of document control policy and procedures as found in "EMSL Document Control SOP". Reference to SOP included. New Section 11.3 added containing a summary of record control policy and procedures as found in "EMSL Document Control of Records SOP". Reference to SOP included. Section 11.10 renumbered to 11.4.

12.0 REPORTING RESULTS

12.1 Scope

The customer report is, ultimately, our "final product". This report reflects on our standard of quality. This section describes EMSL corporate policy on the procedures, policies and formats for reporting analytical data. Additional, test specific requirements are listed in the program modules.

12.2 Recording Analytical Information

Before beginning analysis of a batch of samples, the analyst is responsible for checking that the labels on the sample containers agree with the data recorded on the chain of custody for that sample. The analyst is also responsible for checking (to the extent possible) that the samples have been collected on appropriate sampling media. Any discrepancies are to be noted on the chain of custody and reported to the laboratory manager.

All analyses must be carried out in accordance with the SOP(s) indicated. All SOPs used in the laboratory will be found in the EMSL Laboratory Standard Operating Procedure Manuals or online via e-link.

Data generated in the laboratory shall be recorded on preprinted analytical data worksheets. Each analytical procedure has its own specific worksheet. Many of these worksheets are generated by the LIMS system at the time of log-in.

Observations, data and hand calculations are recorded at the time they are made and are identifiable to the task. The analyst is to ensure entries on all records are made legibly and using indelible ink. Corrections are made using a single line strikeout with the correct entry written in. Corrections are to be initialed and dated. Obliterating data using ink or correction fluid is prohibited.

12.3 Customer Report Requirements

Each final report will have at a minimum the following information:

- Laboratory identification and address
- Name and address of customer
- Date of receipt by laboratory (or original chain of custody attached)
- Unique sample IDs
- Description of sample (or original chain of custody attached)
- Identification and description of test procedures performed
- Results of testing and analysis
- Any deviations or additions to test specifications
- Name and signature of responsible person (Laboratory Manager or designee)
- Date of issue
- Any applicable disclaimers and statements (See specific SOPs)
- For reports issued under the NVLAP, a statement that the report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.
- Information on any analyses that had been subcontracted (attach subcontract labs report)

The signature of the analyst is not made a part of the final report unless requested by the customer. Analysts accept responsibility for the data generated by signing the worksheets.

Any modifications to the methods cited on the report will include all applicable comments and disclaimers as issued by the QA manager. Approved lists of disclaimers are documented in the analytical SOPs.

12.3.1 Listing of Accreditation/Required Statements

Laboratory accreditation is presented on the report with a reference to the agency, followed by the Lab ID code (such as: NVLAP Lab Code 000000-0).

The citation of the accreditation will not be used in a manner, which misrepresents a laboratory's accreditation status. Citation of accreditation will be provided for the type of analytical test applicable to that accreditation only. If a particular analysis is performed which is not covered by an accreditation program, the report contains no reference to that accreditation agency or contains the statement, "This report contains data that are (is) not covered by the XXXX accreditation". If a final report contains a combination of data for both accredited and non-accredited analysis, the non-accredited tests will be marked as such.

Reference to an accreditation by an applicant laboratory that has not yet achieved accreditation shall include a statement accurately reflecting the laboratory's status. Certificates of accreditation (applicable to the analysis) may be made part of the report if requested by the customer.

The title of the approval signatory shall appear on the final report that displays the accreditation.

In the rare cases where the analysis (or part of the analysis) has been subcontracted, the report will clearly state that the data had been subcontracted. The report will include the statement "This report contains data that were produced under subcontract by Laboratory X." If the subcontract laboratory is accredited, the report will cite the accreditation agency and the Lab's ID code.

12.3.2 Proficiency Testing

Ambiguous reference to a Proficiency Testing Program (PAT) must be avoided. For example, listing of a PAT Identification number must be clearly identified with a statement such as **"EMSL XXXX (location) Participates in the AIHA Proficiency Analytical Testing (PAT) Program for Asbestos: ID #123546"** to avoid inappropriate representation of full accreditation.

12.3.3 Certification of Test results for NELAC labs

For those laboratories, which maintain NELAC certification, final reports will state "the test results contained within this report meet the requirements of NELAC unless otherwise noted".

12.3.4 Statement on Quality Control Results – ELLAP AIHA requirements

For those laboratories, which maintain the ELLAP AIHA certification, final reports will state: "The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA, unless specifically indicated otherwise."

12.3.5 Suspension of Accreditation

In the unlikely event that a laboratory's accreditation is revoked or suspended, reference (logo and lab code number) to the accreditation and the scope of accreditation will be removed from all applicable documentation until accreditation is reinstated. Documentation includes:

- Final reports
- Marketing materials such as brochures, mailers, etc.
- EMSL website

12.3.6 Reporting to Governing Agencies (Notification of Compliance Reports)

At the request of the customer, EMSL can report analytical results directly to a compliance agency (state water authority, state environmental department, etc.) Results can be submitted on

the agencies specialized forms if requested. In these cases, the original EMSL report must also be submitted.

12.4 Approval/Report Clearance

Final customer reports are released only after the ldata has been reviewed by an approved reviewer. For AIHA accredited analysis the data reviewer must be different from the analyst. This review includes:

Quality Control Review
Quality control analysis performed for that specific batch of customer samples, if any QC was performed related to that sample batch, is compared against acceptance criteria. (*Note: Our quality control program is designed to comply with the requirement of State, Federal and independent accrediting authorities' policy for reanalysis. A minimum of 10% of the total sample volume analyzed by the laboratory is reanalyzed. The analysis of standard and blank samples are also included in the total number required for QC, therefore, this number may vary. The laboratory randomly selects the number of quality control samples out of all the samples analyzed within any given time period for this reanalysis. The quality control samples may or may not include samples associated with the set of results being approved for reporting).*

In addition to QC review, analytical data is reported with confidence based on compliance with this QA program. The traceability of the data reported is ensured through the procedures and policies as documented in this manual, including:

- Delineation of responsibility
- Compliance with analytical standard operating procedures
- Following calibration protocols
- Fulfillment of the required amount of quality control analysis
- Satisfaction of training requirements

Review of Data
A review of raw data (from bench sheets, prep logs, printouts from instrumentation) and the information on the chain of custody is reviewed for correctness and compared against the typed information on the final report.

Appropriate Methodology
Verification that the correct methodology was performed on the samples. This is done with a check on the customers request documented on the chain of custody.

12.4.1 Approved Signatories

An approved signatory is responsible for the technical content of the report and is the person to be contacted by the accrediting authorities or customers in case of questions or problems with the report. Signatories shall be persons with responsibility, authority and technical capability for the results provided. Technical capability is defined as the having the aptitude for understanding the analysis and to be able to recognize an error. It does not mean that the approval signatory must be an approved analyst.

The Quality Assurance Department, regional manager or national director can qualify the laboratory manager as an approved EMSL signatory. (See "Final Report Approval Form and Electronic Signature Sample.")

The laboratory manager may assign designated personnel to perform the task of final review and approval. This designation must be clearly documented (See "Final Report Approval Form and Electronic Signature Sample.")

12.4.1.1 Peer Review by Second Analyst (for AIHA Accredited Laboratories)

Results of analysis must be checked by a second analyst onsite before the final report is

released to the customer. This review is in addition to the laboratory manager's report approval process (resulting in the signing of the final report). The peer reviewer may be the laboratory manager.

This peer review process shall be an independent review, conducted by a qualified individual other than the analyst. The review will consist of a check on raw data, check of calculations (may be brief overview), typographical errors and the 'sensibility' of the results.

This review is documented with the initials of the reviewer, which is placed on the internal chain of custody or the analytical worksheet.

12.5 Verbal Results

Where it is necessary to provide verbal results, it is EMSL policy to discuss analytical methodology and results only. Results are provided 'verbatim' by giving sample number and concentration only. Under no circumstances are results given as fail, pass, meeting acceptance criteria, etc. Interpretation of results is the responsibility of the customer. A note to the file must be made each time verbal results are given (note on the chain of custody and a customer communication log).

12.6 Preliminary Reports

Corporate policy discourages the issue of draft or preliminary data (for example, results that have not yet gone through a quality control review). However, there are circumstances where this may be unavoidable as a result of turnaround time issues, staffing situations etc. If the laboratory manager chooses to provide preliminary data, the report is not signed and will clearly state "preliminary results".
A report is defined as 'preliminary' when it has not been reviewed following the procedures in section 12.4 (i.e., QC checks, manager's review, peer review).

A final, signed report must eventually be provided to the customer. If any changes are made between the preliminary and final reports, the customer is notified with a statement on the final report or by verbal contact.

12.7 Amendments to Final Reports

In the event of any change to the final report after issue, the amended report must indicate that the report is revised, the date of that revision and the reason for the amendment. The revisions must include the original reference number. The statement: "Amended report – this report is an amendment to the test report dated 00/00/00" and the reason for amendment must be included in the report. This statement is added in the report comments area of the report. Customers must be informed immediately of the changes.

The laboratory sample set is not re-logged into the LIMS program. Tracking is done with the laboratory files, which include a printout of the original and amended report. When amendments to the final report result from a non-conformity, a corrective action form will be completed and filed by appropriate personnel following the EMSL Corrective Action SOP.

Changes requiring an amended report include but are not limited to:

- Errors in sample results
- A typographical error (sample location, sample volume, sample id, etc.) that impacts the final results
- Reports issued to incorrect customer

- Changes requested by customer

12.8 Confidential Transmission of Results

In order to ensure that customer confidentiality is maintained when results are reported, a confidentiality statement is included with the results report.

There are a number of forms of result transmission used by EMSL. These include:

1) Fax through Sample Master - A fax cover sheet is automatically included with the transmission. The fax cover sheet includes the standard confidentiality statement. - *"If you are not the stated recipient of this fax and have received this in error, please discard immediately and contact EMSL Analytical, Inc."*

2) Email through Sample Master – The confidentiality statement is (automatically) included in the body of the e-mail - *"If you are not the stated recipient of this email and have received this in error, please discard immediately and contact EMSL Analytical, Inc."*

3) Manual fax – the cover page and report is printed through Sample Master and manually faxed to the customer. The cover page includes the confidentiality statement. *"If you are not the stated recipient of this fax and have received this in error, please discard immediately and contact EMSL Analytical, Inc."* Note: Evidence of transmittal (fax receipt or email record) is to be retained and will serve as a formal record of receipt.

4) Use of LabConnect – The user must agree to the terms before using this service. The agreement includes the statement: *"The results available on this site are provided as a matter of service and convenience for customers of EMSL. They are intended for use only by authorized parties and are confidential in nature. It is the responsibility of our customers to maintain and update their user accounts to ensure that no unauthorized access is allowed by its employees. If you are not an authorized user, do not attempt to enter. While the results have been verified for accuracy against our analytical reports, they are not intended as substitute for a hardcopy or approved electronic report. Please contact your Account Representative if you have any questions regarding the available information*"

5) Mail (US Postal Service) – the front of the mailing envelope includes a statement – *"The information contained in this correspondence may contain privileged and confidential information and is solely for the use of the sender's intended recipient'). If you received this correspondence in error, please notify EMSL Analytical and return to sender".*

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Section 12.3.1 reference to NVLAP lab code corrected. Note to "Quality Control Review" section of Section 12.4 updated from "Approximately 10%" to "A minimum of 10%". Updated name of "EMSL authorization for report approval" form to "Final Report Approval Form and Electronic Signature Sample."

		Section 12.7 updated to remove required corrective actions for amended reports. Corrective actions are only required when the amendment was the result of a non-conformity. Deleted sections 12.9 & 12.9.1 which have been moved to Control of Records SOP.

13.0 NON-CONFORMITIES, CORRECTIVE AND PREVENTIVE ACTIONS, AND COMPLAINTS

13.1 Scope

This section describes the mechanisms used to identify, prevent and communicate conditions adverse to quality (a non-conformity), determine cause, initiate corrective action, document and report the activities, and verify implementation of the corrective action.

A nonconformity is defined as any failure to meet stated requirements whether these be technical (e.g., failure to meet internal statistically derived limits, use of wrong testing method), regulatory (e.g., AIHA, NVLAP, NELAC requirements) or managerial requirements (e.g., corrective action procedures, log-in procedures).

This section summarizes the requirements set forth in the EMSL SOP on Non-Conformities and Corrective Actions.

13.2 Identification of Non-conformities

A non-conformity is an error or a lack of compliance with the procedures or policies documented in this manual or other requirements as set forth in SOPs or external agency requirements. Errors and other non-compliance issues which are the results of customer actions are not considered non-conformities under this program.

Non-conformities can be identified by anyone. Laboratory technical and support staff, internal and external auditors, and customers may all identify non-conformities in the laboratory's operation.

Non-conformities are detected in a variety of ways. Detection can occur during an audit (external and internal), review of QC data, reported by a customer and evaluations of proficiency testing results.

13.3 Documenting Non-conformities and Corrective Action

Whenever a non-conformity is identified, it will be documented using the Non-Conformity/Corrective Action Record (CAR) form. The template for the CAR is available on e-link, and its use is discussed in detail in the Non-Conformities and Corrective Action SOP. It is used to document the non-conformity, the investigation of the non-conformity, and what actions were taken to resolve the non-conformity and prevent its recurrence.

13.4 Effect of Non-conformities/Stop Work

In order to evaluate the extent of effect a deficiency may have on a result, the laboratory management will consider the following:

1) The significance of the nonconforming work
2) The acceptability of the nonconforming work (is it suitable for use?)
3) Whether customer notification is required
4) The most likely root cause of the corrective actions
5) Whether it is necessary to stop work to prevent additional nonconforming work
6) Determine what is required to resume work (if work is stopped)

A stop work order may be given where a breech in the quality system jeopardizes analytical quality or a failure in procedures presents an eminent safety concern. Any EMSL employee is authorized to stop their own work immediately upon finding a non-conformity that may affect other work or for safety concerns and shall immediately notify laboratory management. The necessity of broader work stoppages will be determined by laboratory and corporate management.

13.5 Root Cause and Corrective Actions

All non-conformities must be handled in a manner which will provide a way to help ensure the deficiency is not repeated. This includes identification of the root cause of the error, determination of corrective actions which will eliminate those root causes and the initiation of those corrective actions. The investigation of the non-conformity will consist of a review of all steps leading up to the non-conforming condition or event. This will include review of QC data, sample tracking, data transcription, instrument calibration, training documentation, and discussion with personnel. See "Corrective Action SOP" for additional details.

13.5.1 Root Cause

Identification of root cause is one of the keys to corrective action and prevention. It helps identify the actual reason for the error. Some examples of a root cause might be human error (e.g., a basic lack of attention by the analyst), or shortage of resources, improper maintenance of equipment, or insufficient training. The Non-conformities and Corrective Action SOP contains a discussion of root cause analysis.

13.5.2 Corrective Actions

When a non-conformity occurs, corrective actions must be initiated and documented. The type and extent of corrective action put into place will depend on the severity and type of non-conformity and determined root cause. Corrective actions may include: additional training of staff, repairs to equipment, additional personnel resources, etc. Corrective actions should not only resolve the non-conformity, but eliminate the root cause of the error in order to prevent its recurrence.

In some cases, a deficiency may be cause to initiate an audit of related activities in order to: 1) help identify cause of the error, 2) ensure no other areas are effected by the error, or 3) provide direction for preventative actions. For example, if a customer makes a complaint about a test result, an audit may be conducted involving:

- Review of calibration measurements and QC data associated with the analysis
- Check on analyst qualifications
- Inspection of log-in procedures

The audit can be 'free flowing' (no use of checklist) but must be documented.

13.6 Time Frame and Follow-Up to Corrective Actions

Corrective actions are to be documented and carried out within a reasonable time frame so as to not jeopardize the quality of results. For example, if a primary instrument calibration is not within stated acceptance criteria (and will effect the sample results), work is to be stopped immediately and the problem corrected.

The laboratory quality control coordinator and/or laboratory manager are responsible for ensuring that corrective actions have been addressed in a timely matter. The lab quality manager must include proof of compliance with the Corrective Action Report.

The laboratory quality manager (QM) and/or laboratory manager is responsible for tracking and reviewing the corrective actions filed for non-conformities. The lab QM and/or laboratory manager must indicate when corrective actions are complete. Follow-up to the corrective action shall also be scheduled and completed in order to determine whether the actions taken have been effective in preventing its recurrence.

The QA Department is responsible for following up on those corrective action reports submitted to the department by the laboratory (see "Reporting of Corrective Action Form" section above). The follow-up shall indicate that the corrective action has been satisfactorily completed and will include a review of the effectiveness of the correction action.

13.7 Preventive Actions

It is EMSL's intention to maintain an active program to prevent occurrences which require corrective actions or where there is a trend in QC data or activities which can eventually result in an error. A proactive program is an important part of the objectives of this EMSL quality program. All staff members are encouraged to assist in identifying potential sources of non-conformities and to identify opportunities for improvement.

Preventive actions consist of the policies discussed in this QA Manual. For example, the quality management system procedures and policies require:

- Analysts satisfy training requirements
- Laboratories perform QC activities at required frequencies
- QC data is reported to the QA Department for review
- Management reports are submitted to corporate management
- Laboratories participate in proficiency testing programs
- Laboratories maintain accreditations from regulatory and other independent agencies

Preventive action measures also include those specific actions taken outside of the normal quality assurance/quality control activities. These actions are those opportunities for improvement associated with a potential non-conformity. This policy requires laboratory staff to attempt to identify potential non-conformities, and apply actions which will prevent an occurrence. These actions are documented using the "Preventive Actions" form.

See "EMSL Preventive Action SOP" for additional information.

13.8 Complaints

Complaints are considered any statement of dissatisfaction with the product or processes of the laboratory for which a reply is expected. Complaints may be received from any party, inside or outside of EMSL. They may be submitted in any form.

It is the policy of EMSL to take all reasonable actions to resolve complaints as quickly as possible. Whenever a complaint is received, it is immediately investigated to determine whether the complaint is factually sound and able to be resolved by EMSL. If a complaint is not factually sound or EMSL is incapable of resolving the complaint (for example, the complaint is not about EMSL, or would require violating regulatory requirements), EMSL will follow-up with the complainant to ensure they are aware of why EMSL cannot resolve their complaint.

If a complaint is sound and capable of being fairly resolved, EMSL will take all reasonable actions to come to a resolution with the complainant that satisfies the complainant's needs while not damaging or

threatening the integrity of the laboratory, its personnel or its results. EMSL's complaint resolution procedure is documented in the EMSL Complaint Resolution SOP.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Added discussion of complaints to section revising section title and adding Section 13.8. Revised definition of "nonconformity" in Section 13.1. Section 13.2 restructured and re-written. Much of the information found in this section removed to Non-conformity/Corrective Action SOP. • New 2nd paragraph added • Old 13.2.1-13.2.3 deleted. New Section 13.3 added based on a modified Old Section 13.3.3. Section contains a reference to CAR form and Corrective Action SOP. Old Section 13.5 becomes 13.4. Clarified that any employee may stop their own work, need to notify laboratory management, and management responsibilities for broad work stoppages. Reference added to Corrective Action SOP. Old Section 13.3 becomes 13.5 with modifications. • Reference to Corrective Action SOP added. • Re-numbered Section 13.5.1 "Root Cause" contains a modified list of root cause examples and reference to SOP discussion of root cause • Re-numbered Section 13.5.2 revised to include severity in determination of extent of corrective actions taken. Sentence added clarifying need to eliminate root cause. • Old Sections 13.3.2.1 – 13.3.2.3 deleted. Old Section 13.4 becomes 13.6. Clarified requirement for scheduled effectiveness follow-up. Added reference to "Preventive Action SOP" to Section 13.7

14.0 ANALYTICAL PERFORMANCE CRITERIA

14.1 Scope

The procedures and policies for the measurement of performance are discussed in this section.

14.2 Performance Criteria and Standards

Performance will be determined by the following criteria:

- Results from intra-lab and inter-lab testing
- Performance in on-site assessments from accrediting agencies
- Performance in proficiency testing programs
- Completion of internal quality audits
- Continued analysis of standard and reference materials traceable to third party programs
- Quality control reanalysis
- Calibration measurements

Quality control is performed continuously throughout the course of laboratory operations regardless of laboratory productivity and is made part of the normal course of laboratory sample analysis. Frequency and volume of QC analysis is based on regulatory requirements and good laboratory practice. The frequency of QC analysis must be consistent and reflect the sample volume at any given time (QC is not performed all at one time - in preparation of an audit, for example).

Performance criteria will be maintained for both individual analysts and for the entire laboratory. The standards for acceptance criteria, frequency and volume are documented in the program modules.

14.3 Quality Control Program and Review

The overall quality control program is established and managed by the QA manager in order to ensure that the laboratory produces quality data. This process ensures fulfillment of our commitment to our customers, that our data is legally defensible, and that all personnel perform their responsibilities properly.

In addition to the review of quality control data for final report approval, the overall QC performance of the laboratory shall be reviewed on a regular basis in accordance with regulatory agency requirements. Specific quality control procedures are detailed in the program modules.

In general, QC analysis represents at least 10% of all analysis performed. QC analysis will entail inter-analyst reanalysis, intra-analyst reanalysis, intra-laboratory reanalysis, analysis of reference standards and blanks at the frequencies required by the analytical method and/or program specific QAM Modules.

In the event a small number of samples have been received for a particular test (<10 samples for example), the laboratory manager and/or the lab quality manager must ensure that at least one of the samples are subject to quality control. Inter-analyst reanalysis is performed by authorized analysts. Re-analysis by a trainee is not to be considered as true duplicate analyses.

The laboratory manager reviews the data sheets and the reanalysis data on a monthly basis (minimum). If the quality control analyses are within control limits, the results will be cleared for reporting. As long as those statistics are deemed acceptable, customer reports will continue to be processed.

If the difference between analyses exceeds control limits, the laboratory manager and the analyst will

review the sample data and resolve the differences. A detailed corrective action report recording all activity is submitted to the QA manager. (See "Non-Conformities, Corrective and Preventive Actions" section of this manual.)

The quality review also includes a check on calibration data. Measurements are checked against the acceptance criteria. If any measurement is out of compliance, the Laboratory Manager is responsible for investing the cause and initiating a corrective action.

In cases where analysts are transferred temporarily to another laboratory, QC data produced by that analyst will be associated with the laboratory at which the data was produced for purposes of determining percentages of QC analysis performed. Likewise, inter-analyst data produced by that analyst will be associated with the lab at which it was produced. The analyst's CV from their original lab shall be utilized when applicable.

However, a transfer analyst's QC data will also be associated with the analyst for purposes of determining on-going competency. A copy of the data may be held by the analyst and placed in their ongoing training records at their home lab. This may include intra-analyst samples as well as analysis of known samples or PT/RR results.

14.3.1 Internal Quality Audits

An audit is an on-site, qualitative review of the various aspects of the total laboratory system. It represents a subjective evaluation using an interactive program with respect to strengths, deficiencies and potential areas of concern.

EMSL performs annual internal audits in all laboratory facilities to verify that work activities are being performed in full compliance with the established standard operating procedures, this quality assurance program, and ISO 17025 and NELAC standards. Non-conformities identified during the internal audit will be corrected through the corrective action process.

EMSL's internal audit procedures are located in the EMSL SOP for Internal Quality Audits (EMSL.QAAUDSOP).

14.3.2 Annual Management Reviews

Management reviews are designed to provide the top management of EMSL with an overview of the performance of the management system and laboratory operations. It addresses the quality topics documented in the ISO 17025 and the NELAC standard for each laboratory location and includes:

- The suitability of policies and procedures
- Reports from managerial and supervisory personnel
- The outcome of recent internal audits
- Corrective and preventive actions
- Assessments by external bodies
- Results of inter-laboratory comparisons or proficiency tests
- Changes in the volume and type of work
- Customer feedback
- Complaints
- Recommendations for improvement
- Other relevant factors, such as quality control activities, resources and staff training

In the first quarter of each year, the Quality Assurance Department, national directors, and vice presidents of laboratory operations and laboratory services meet to review labs for the previous calendar year.

The report shall be based on the recorded information and non-recorded observations made by the QA department, national directors, outside accrediting agencies and customer feedback. It is a tool to ensure the laboratory activities comply with the procedures and policies of the quality assurance program, ensure the programs continued effectiveness and to introduce any necessary changes or improvement.

Follow-up on action items identified in the management review is performed by the corporate management, QA Department and EMSL branch laboratories. Those action items must be completed according to the schedule set forth by the corporate QA manager and Vice President of Laboratory Services.

Management Review procedures can be found in the "EMSL Management Review SOP".

14.3.3 Quarterly Report

The person responsible for overseeing the QA in the lab (i.e., the lab quality manager or laboratory manager) completes a report every quarter for the laboratory manager. In the cases where the laboratory manager is the QA person, the report is written for the regional manager. In the cases where there is no regional manager assigned, the report is written to the national director or corporate QA manager. These reports are designed to express concerns, address needs and report any major changes to management.

Format shall include the following topics:

- Summary of quality control data (e.g., QC reanalysis that may been out of control limits and the corrective action)
- Calibration/Instrument Maintenance: report any calibrations out of acceptance criteria or equipment problems and the corrective action
- Contamination: problems with checks and the corrective action
- Customer Problems
- Report of internal audits (where applicable or planned)
- Report of external audits (where applicable or planned)
- Results of proficiency testing analysis
- Corrective actions
- Preventative actions (where applicable)
- Misc.

14.3.4 Proficiency Testing Programs

Laboratories participating in proficiency testing (PT) programs will ensure the analysis is performed using the same sample tracking procedures, analytical methodology and analyzed by the same analyst(s) as under normal, customer sample conditions. At no time is there inter-laboratory exchange of samples.

EMSL laboratories participate in PT programs administered by:

- NVLAP – for PLM bulk and TEM airborne asbestos analysis
- AIHA – for environmental microbiology, environmental lead, organics, metals, silica, asbestos
- New York State ELAP – for asbestos in air, bulk and water
- RTC – for asbestos in drinking water
- Micro Check – for microbiology
- ERA – for microbiology
- Bowser-Morner – for radon

Samples with instructions and accompanying report sheets are distributed to the appropriate laboratory staff or designee. The samples are incorporated into the normal sample load and

analyzed as would a normal customer sample. Results are calculated and reported on the supplied forms. The result forms are double-checked against the raw data for data entry transcription or omission errors.

Records of proficiency testing analysis are to be completed and maintained in a separate laboratory PT file. This data is also maintained for each participating analyst in his or her personal training file.

Laboratory managers are to ensure that all PT results prepared for submittal are carefully reviewed prior to release. Any calculations are to be reviewed and checked closely.

This review will include a check of raw data against final concentrations for final reporting. All qualified analysts shall analyze the proficiency samples. One result is submitted to the providing agency for scoring. Results from all analysts are reviewed by the laboratory manager, but are not averaged. The laboratory manager indiscriminately (randomly) chooses which result to submit to the agency for scoring.

The data is reported using the appropriate format and method. Data may be reported by mail, fax or by the internet depending on the requirements. If email results are required – the instructions given by the submitting agency are followed. Data will be submitted via Internet connections by the laboratory manager or designee. Copies of confirmation of "data sent and received" are place in the file with the data. The laboratory manager is responsible for submitting the scored results from each PT round to the Quality Assurance Department where it is tracked and evaluated against acceptance limits.

The laboratory must maintain Proficiency status "P" for all parameters tested and reported. If the laboratory becomes non-proficient, this will be indicated in the report to the laboratory containing the results of a given study. The QA manager will investigate the reasons for the poor performance. A corrective action plan will be developed by the QA manager and the lab manager. The plan will be written by the laboratory manager who will submit the plan to QA manager. The plan will include all actions that will be taken (along with a timetable) to bring the quality of data to an acceptable level.

All records for proficiency samples are kept in files for each analyst along with the scored results.

EMSL authorizes the release of proficiency testing results from the proficiency testing provider to its various accrediting authorities whenever such disclosures are required. When possible, standing authorizations are granted. The QA department is responsible for ensuring the distribution of proficiency testing results to outside agencies when requested or required.

14.3.4.1 Round Robin Proficiency Testing Programs

For fields of testing not covered by a proficiency testing program provider, laboratories participate in a round robin program designed to demonstrate competency. One of the participating laboratories shall generate and distribute the round robin samples to other participating laboratories. Results must be reported for all analysts. The originating lab shall also be responsible for receiving and processing resulting data and distributing a report of results to all participating laboratories. The round robin program shall have a minimum of three participating laboratories (can be all EMSL laboratories).

14.3.5 Standard Reference Materials

Having multiple laboratory operations can facilitate the cost savings associated with the variety of standard materials required to calibrate both instrument and analyst. EMSL Analytical allocates and distributes these standard reference materials, where possible from 3 sources:

- The corporate laboratory facility
- The Quality Assurance Department
- The regional managers or national directors

In order to track the transfer of standards and reference materials between the original sources and the laboratory(ies) a chain of custody type form must be completed (see "EMSL Standard and Reference Material Traceability Form"). This form ensures traceability of measurements to a national standard and verification of measurements to reference samples. Reference materials are to be clearly labeled and stored as to maintain integrity.

14.3.6 EMSL Round Robin Programs

Periodically, the Quality Assurance Department and/or national directors will provide a company-wide round robin program. Samples are to be analyzed by all active analysts. The laboratory manager is to choose one result for submitting to the Quality Assurance Department, where it will be scored and graphed using standard deviation statistics.

The laboratory manager is responsible for ensuring that the individual results of the participating analysts are compared against the national report, once the program is completed (using the mean and standard deviations generated by the national program).

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Section 14.3 – Added requirement that interanalyst reanalysis shall be performed by authorized analysts. Added final two paragraphs to Section 14.3 on QC performed by transfer analysts. Removed final two paragraphs from 14.3.1, and subsequent subsections 14.3.1.1 – 14.3.17 and replaced with reference to the EMSL Internal Audit SOP (EMSL.QAAUDSOP). Section 14.3.2 revises the timing and responsibility for annual management review in 2nd paragraph. Changed time allowed for responding to action items from management review from a set 30 days to timeframe set by QA manager. Added reference to "EMSL Management Review SOP." Last paragraph added to Section 14.3.4 discussing authorization to release PT results to outside agencies.

15.0 DEMONSTRATION OF TRACEABILITY

15.1 Scope

This program is designed to provide a method, which achieves traceability of data to national standards. This is accomplished by setting specific requirements, including:

- Use of Standard Reference Materials (SRMs) as certified and traceable to the National Institute of Standards and Technology (NIST). SRMs are used for QC analysis and training for achieving measurements of analysts and overall laboratory accuracy.
- Calibration of instrumentation against NIST traceable standards
- Laboratory participation in independent (non-EMSL) proficiency testing programs
- Analysis of consensus standards

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes. Added Revision History. Divided QAM into separately controlled sections for simplified revision.

16.0 CUSTOMER COMMUNICATIONS

16.1 Scope

The key to any successful quality assurance program is communication. This is especially true for communication with the customer. This section provides the policies and procedures for effective communication.

16.2 General

Clear, continuous and open communication between the laboratory and the customer is one of the keys to maintaining a successful, quality operation. Communication should be established prior to the start of any work. Information must be clearly understood between laboratory management and the customer. This information should include (but not be limited to):

- Type of analysis requested
- Turnaround times
- Expected deliverables (any requested changes to the standard report format)
- Sampling guidelines (media, recommended sample volume, etc.)
- Type of packaging for sample shipping
- Submission of final report (via fax, hard copy, mail, overnight shipment)

EMSL will cooperate with customer requests to monitor laboratory performance on their projects. Upon request, customers may be granted accompanied access to the laboratory to witness performance of testing so long as doing so does not jeopardize the confidentiality of other customer information.

16.3 Documentation of Customer Correspondence

Correspondence with customers shall be recorded by each EMSL laboratory. Project related information may be recorded on the Chain of Custody forms for the project to ensure that the information is available and associated with the project. Other correspondence may be manually recorded utilizing the Customer Correspondence Log template available on E-link. The customer correspondence log shall be maintained at each laboratory according to the instructions included in the template document. Correspondence may also be recorded using electronic means when available to the laboratory (e.g., Outlook Journal feature.) Regardless of how correspondence is recorded, the date of correspondence and initials of person making the entry is required.

Customer complaints shall be documented utilizing the EMSL Complaint Resolution procedure and recorded on the Complaint Record form available from E-link. Where customer correspondence leads to corrective action, these corrective actions will be documented via the EMSL Corrective Action system.

16.4 Technical Support

EMSL provides quality assurance information and technical support to the customer to assure continued quality service. The support and information provided in relation to the work performed includes:

- Field sampling guides
- Availability of pertinent QC records
- Access to the Quality Assurance Department for technical assistance
- Security of data (confidentiality)
- Reasonable access to the relevant areas of the laboratory for the witnessing of analysis

EMSL also provides a variety of sampling equipment and procedures to support the customer's needs. Equipment is available such as sampling pumps, sampling cassettes and sampling media. Instructions are provided along with the equipment.

16.5 Notification of Non-Compliance

If a major deficiency in policy or procedure is identified which directly effects customer results, the customer will be notified immediately of the problem. Major non-conformities may be discovered during an internal audit, external audit or a regular quality control review. A major deficiency may be defined as (but not limited to):

- Quality control reanalysis data outside acceptance limits
- Calibration measurements outside acceptance limits
- Sample contamination (positive blanks)
- Analysis performed outside the scope of accreditation
- Analysis performed by unqualified personnel
- Incorrect method performed on samples

16.6 Confidentiality (see also "Confidential Transmission of Results" section)

It is understood that confidentiality and proprietary rights must be respected throughout the performance of services for any customer or for those that may include national security concerns. Information will not be given to those for whom it is not intended and the proprietary rights of our customer will be protected. Data reports and/or other related information will not be given out to any person or agency other than the customer unless we have received prior approval from the customer.

The laboratory manager is responsible for ensuring that the sample results and related information is disseminated appropriately. In the event there is a question regarding applicability of confidentiality, the quality assurance manager, national director and/or vice president are to be consulted.

16.7 Notice of Performance

The laboratory manager shall provide the customer with information as it relates to the performance of the analysis and turnaround time. The laboratory must notify the customer if:

- Analysis cannot be performed on time
- Integrity of the sample has been jeopardized (either by the laboratory or the customer)
- A discrepancy in the analysis has been found during QC analysis.

16.8 Customer Feedback Program

The EMSL customer feedback program includes:

- Continuous correspondence between customer and the client service representatives
- Communication tools available on company website
- Direct contact with customer and laboratory manager
- Collecting comments offered by customers during seminars and conferences
- Periodic use of active solicitation of feedback such as through the use of customer survey.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Added active solicitation of feedback to Section 16.6. New Section 16.2, 16.3 added.

COMPLIANCE DISCLOSURE

In executing this Compliance Disclosure, I attest and confirm that I have read and understand the entire contents of this document. My signature represents that I agree to fully comply with, implement, and enforce all requirements, procedures, and protocols specified in these procedures set forth in this document and any supporting reference materials or methodologies. I acknowledge the proprietary nature of this document. Furthermore, I understand that this document is the most recent version and any revisions, modifications, additions, or amendments to this document will only be recognized and executed upon review, final approval, and reissue of this document by the Quality Assurance Department management.

LABORATORY MANAGEMENT				
#	Print Name	Signature	Department	Date
1				
2				
3				
4				

LABORATORY STAFF				
#	Print Name	Signature	Department	Date
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

APPENDIX A

Glossary:

ACS – American Chemical Society

AHERA – Asbestos Hazard Emergency Response Act

AIHA – American Industrial Hygiene Association

Alternative Method (procedure) - A major modification to standard methods and EMSL Standard Operating Procedures

Amended Report (see also revised report) – A report which reflects a change or correction to an original report

Analytical Sensitivity - The lowest concentration that can be detected by the method, based upon the amount or portion of sample analyzed (e.g., for methods involving a count = 1 raw count per amount or portion of sample analyzed, calculated and expressed in the final reporting units).

Analytical Worksheet (Bench Sheet) – The form used by the analyst to collect the raw analytical data during analysis.

Bench Sheet- (see Analytical Worksheet)

Branch Laboratory – All EMSL laboratories excluding those located at 107 Haddon Ave. Westmont NJ and 3 Copper St. Westmont, NJ

Chain of Custody – An unbroken trail of accountability that ensures the physical security of samples, data and records.

Chemical Hygiene Plan – A program which defines the work practices and procedures to ensure that employees of EMSL Analytical are protected from health hazards associated with hazardous chemicals with which they may work or be exposed.

Consensus standards – Samples with values assigned based on a statistically significant number of repetitive analysis.

Corporate Management – Staff members which include the Company President, Vice Presidents, QA Manager, National Directors, MIS Manager, Controller, Collection Manager and Equipment Manager.

Coefficient of Variation - Standard deviation divided by the mean

Culturable - Capable of, or fit for, being cultivated. (antonym: non-culturable).
Note: Prior to Revision 10 of the QAM the terms Viable/Non-viable were used in place of Culturable/Non-culturable. This terminology may still occur in some documents published prior to the date of publication of Revision 10.

Customer – Any person or entity that receives products or services from EMSL.

EMSL Environmental Laboratories – Laboratory facilities/locations performing the analysis for the analytical programs including asbestos, environmental lead, environmental microbiology, various IH parameters (organics, metals, etc.) and environmental chemistry parameters (metals, organics, inorganics, wet chemistry).

Integrity – Sound, honest, true

Inter – analyst/lab – Re-analysis of the same sample by a different analyst/lab

Intra – analyst/lab – Re-analysis of the same sample by the same analyst/lab

Method Detection Limit (MDL) - The minimum concentration of an analyte that, in a given matrix and with a specific method, has a 99 percent probability of being identified, qualitatively or quantitatively measured, and reported to be greater than zero.

NIST – National Institute of Standards and Technology

NLLAP- National Lead Laboratory Accreditation Program.

Non- conformance – A deficiency, error or a lack of compliance with the procedures or policies documented in this manual.

Non Standard Method – An analytical procedure which has little or no relationship to a procedure documented by a regulatory agency, a recognized group or organization, a known industry expert or previously established corporate method. Examples of these type of documented procedures are those released by Federal and State authorities, groups such as the ASTM or ISO or industry experts, i.e., Chatfield.

NVLAP – National Voluntary Laboratory Accreditation Program

NYS ELAP – New York State Environmental Laboratory Approval Program

Proficiency Testing (PT) – As systematic program in which one or more standardized samples is analyzed by one or more laboratories to determine the capability of each participant.

Program Module – Sections of the Quality Assurance Manual which address analytical method specific requirements, i.e., asbestos, lead, microbiology, IH organics and IH inorganics.

Quality Assurance (QA) – The total integrated program for assuring reliably of the measurement and monitoring of data.

Quality Assurance Department - The QA Department is headed by the Quality Assurance Manager. The Department minimally consists of the QA Manager and Administrative Assistant, but may also include other EMSL staff members or outside consultants assigned to special projects or teams as assigned.

Quality Control (QC) – The routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process.

Quality Management System – A set of policies, processes and procedures required for planning and execution.

Reagents – A substance reacting with another substance. Lab reagents are compounds such as hydrochloric acid used in the analysis.

Reanalysis – A second analysis of the same sample (see also inter or intra).

Red Line Document – A document which shows the changes from one revision to the next.

Reference materials – General term used to describe samples, which have a known value. These could include standards, proficiency testing samples and consensus standards.

Reporting Limit – The lowest concentration of analyte in a sample that can be reported with a defined, reproducible level of certainty. This value is based on the low standard used for instrument calibration. For environmental lead analyses, the reporting limit must be at least twice the MDL.

Revised Report (see also amended report) – A report which reflects a change or correction to an original report.

Round Robin – An exchange of samples with other laboratories. May be 2 or more.

RPD – Relative Percent Difference. Calculated as $RPD = \frac{R1 - R2}{R} \times 100$

R1-R2 = absolute difference in two values
R = average of the two values

SRM – Standard Reference Material

Standards – Samples (materials) of known concentrations

Standard Methods - Methods published by regulatory agencies such as EPA, NIOSH, OSHA, State agencies. Also includes methods developed by recognized scientific agencies and/or individual groups such as ASTM and Chatfield.

Standard Operating Procedure – A written document that details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

Sub-facility – Term used associated with the NVLAP program. A sub-facility is considered an extension of the Main Facility (Westmont – 107 Haddon Ave.). It receives technical direction and quality management from the Main Facility.

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Minor editorial changes throughout. Added Revision History. Divided QAM into separately controlled sections for simplified revision. Added definitions for “Analytical Sensitivity”, “Culturable”, “Customer”, “Method Detection Limit”, “Reporting Limit.”

APPENDIX B

Forms Referenced in this Manual

1) Demonstration of Capability Certificate
2) Corrective Action Report Form
3) Preventive Action Form
4) Final Report Approval Form and Electronic Signature Sample
5) Standard/Reference Material Traceability Form
6) Sample Master Change Request
7) Relinquish Form
8) Equipment Maintenance Log Form

Revision History below begins with Revision 10 of all modules. All prior revision history is available through the corporate QA department

Revision	Date	Changes
10	12/19/08	Previous Appendix B & C made obsolete. Information from Appendix B moved to Corrective Action SOP, information from Appendix C moved to QAM Section 1.7. This appendix renamed Appendix B (previously Appendix D). Divided QAM into separately controlled sections for simplified revision. Added Revision History. Updated forms to newest revisions and names.

1) Demonstration of Capability Certificate

EMSL Demonstration of Capability Certificate
Revision 6
November 10, 2008

EMSL Demostration of Capability Statement
Certification Statement

Analyst Name: _____

Lab Name: _____

Lab Address: _____

Matrix	Technology	Method	Analyte	Date

We, the undersigned, CERTIFY that:

1. The analyst identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program and the EMSL Quality Program, have met the Demonstration of Capability
2. The test method(s) was performed by the analyst(s) identified on this certification.
3. A copy of the test method(s) and the laboratory-specific SOPs are available for personnel on-site
4. The data associated with the demonstration of capability are true, accurate, complete and self-explanatory.
   True: Consistent with supporting data.
   Accurate: Based on good laboratory practices consistent with sound scientific principals/practices.
   Complete: Includes the results of all supporting performance testing.
   Self-Explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility and that the associated information is well organized and available for review by authorized assessors

This Demonstration of Capability is issued by the EMSL Quality Assurance Department

Lab Manager	**Signature**	**Date** *(date the information listed above was verified as correct)*

Patricia Kirkland

QA Manager	**Signature**	**Date** *(date the information listed above was verified as correct)*

This certification form must be completed each time a demonstration of capability study is completed.
Note: This Certificate is modeled after the 2003 NELAC Quality System standard.

Controlled Document Confidential Business Information/Property of EMSL Analytical, Inc. Page 1 of 1

2) Corrective Action Report Form

Non-conformance/Corrective Action Report

Section 1: Complete at time problem is identified					
Lab:		CAR# (Assigned by Lab Mgr):			
Date:		Person Reporting Problem (Last Name, First Initial):			
Description of Non-conformance/ problem:				Nature of Problem (Select One):	
				Auditing Body:	
				Policy Reference(s):	

Section 2: Complete at time problem is identified (if applicable)			
Analyst: (Last Name, First		QC Analyst (Last Name, First Initial)	
Order Number:		Sample(s):	
Method of Analysis:		Reported to Corp QA?:	

Section 3: Complete when initial evaluation is performed							
Evaluation/ Investigation Details							
Evaluating Party:				Date Evaluation Completed:			
Corrective Action Required (Yes/No)?							
Work Stop Necessary?		Person stopping work (Last Name, First Initial):					
Date of work stop:		Time of work stop:		Corporate Acknowledgment of Stop (more than 1 hr.):			
Client Notification Required?		Date Notified:		Report Change Needed?			
Report Re-issued?		Date of re-issued report:				Revised Report #:	

Section 4: Complete whenever a corrective action is required					
Root Cause:					
Corrective Action:					
Corrective Actions Assigned to (Last Name, First Initial):		Corrective Actions Due Date:			
Proof of Compliance (e.g. a policy, memo):		Evidence of Compliance (e.g. specific record):			
Lab Signoff:		Date:			
Corporate Signoff (where necessary):		Date:			
Date Work Can Resume:					
Time Work Can Resume					
Authorization for work resumption:					

Section 5: Complete after implementation of corrective action					
Follow-Up Due Date:		Follow-up Notes (i.e., how was effectiveness determined, findings):			
Follow-Up Completed By:					
Date Completed:		Outcome:		New CAR # (when necessary):	

3) Preventive Action Form

EMSL Preventive Action
Revision 1
Effective Date: July 9, 2007

EMSL Analytical, Inc.
Preventive Action Form

Lab:

Department:		**Equipment:**		
Order Number:		**Sample(s):**		
Issue:		**Date:**		
Name of Person Reporting Action		**Reported to Corporate QA:**		
Preventive Measure:				
Effectiveness of Measure (include non-conformities avoided, if applicable) :				
Evidence of Compliance:	**Lab Signature:**	**Date:**	**Corporate QA Approval (if needed):**	**Date:**
Does work need to be stopped: YES / NO	**Lab Signature:**	**Date:** **Time:**	**Corporate QA Approval:**	**Date:** **Time:**
Date & Time work can resume:	**Lab QAC Signature:**	**Date:** **Time:**	**Corporate QA Approval:**	**Date:** **Time:**

Revision Notes:
7/5/07: Added Footer "Page 1 of 1", Added "Revision Notes", Added "Effective Date" to header

4) Final Report Approval Form and Electronic Signature Sample

EMSLrptapprove
Revision 2
October 23, 2006

Final Report Approval Form and Electronic Signature Sample

The Employee listed below has been given the authority to approve the final client report(s) identified .
This Employee is qualified to validate the accuracy of the information in the final report for every report he/she approves.

Authorized by: _____
Laboratory Manager or Quality Assurance Department Representative

Employee:		Date:	
Lab:			
Authority: *What type of results can you approve?*	❑ All results for the lab ❑ All Asbestos results ❑ PLM results only ❑ PCM results only ❑ TEM results only ❑ Microbiology ❑ Chemistry ❑ Industrial Hygiene ❑ Lead		

As an employee with permission to authorize laboratory results, a sample of your signature and initial is needed.
Please keep the signature centered inside the box, as anything outside the box will not be scanned into the system. Use as much of the box as possible (the larger the signature, the better the scan). Please use blue ink only to ensure a high-quality scan.

Sign here

Initial here

Please return this sheet to: EMSL Analytical
107 Haddon Ave.
Westmont, NJ 08108
Attn: MIS department

Do not fax or send a photocopy or scan this sheet. MIS must have the original.

[revision notes: removed black ink (use blue only)

5) Standard/Reference Material Traceability Form

EMSL Standard and Reference Material Traceability Form
Revision 1
Effective Date: January 8, 2008

STANDARD/REFERENCE MATERIAL TRACEABILITY FORM

This form is intended to track the transfer of standards and reference materials between the original sources and the laboratory(ies). It maintains chain of custody of these materials. This form insures traceability of measurements to a national standard and verification of measurements to reference samples. (see section: Standard and Reference Materials *in the QA manual)*

This form is stored along with the material at all times

Standard Material/Identification:_____

Source:_____

Handling:

Date	Responsible Person	Custody transfer Notes

Revision Notes:
(REV 1) 1/8/08: Added Control Document Identifiers

6) Sample Master Change Request Form

Sample Master Change Request
Revision 2
February 28, 2008

Sample Master Change Request

To be submitted to corporate QA department (pkirkland@emsl.com)

Method Identifier		Version	
Requested by		Date	
Description of Change (please include only one change on each form)			
Reviewed by		Date	
Status	☐ Approved	☐	Rejected
Reviewer Notes			

MIS Department Use Only

Accepted by		Date	
Design notes			
Completed by		Date	
New Version		SM Build (if applicable)	
Objects changed			

Revision Notes:
REV 1 (7/5/07): Added Footnotes, Added "Revision Notes", Added EMSL to Document name.
REV 2 (2/28/08): Added "To be submitted to corporate QA Department (pkirkland@emsl.com). Revised title name.

7) Relinquish Form

EMSL Relinquish Form
Revision 2
Effective Date: July 9, 2007

EMSL Analytical, Inc.
Relinquish Form

Initial Lab:		Phone Number:	
		Fax Number:	
Relinquished to:		Phone Number:	
		Fax Number:	
Does new Lab hold equivalent or additional accreditation*			Yes/ No

Client Name:			
Client Project:			
Date Received:			
Date Relinquished:			
Date Due:			
Special Instructions:			
Relinquished by (Signature):	Date:	Received by (Signature)	Date:
Relinquished by (Signature):	Date:	Received by (Signature)	Date:

Client Notification- Please sign this form and fax to the original laboratory. By signing below you agree to allow the above named laboratory to relinquish the samples to a new laboratory with equivalent or additional certification.			
Name (please Print)	Signature	Agent of:	Date:
If this is a reoccurring project or sample type that will require samples to be relinquished on a regular basis please sign below and the laboratory will keep this form on file.			
Name (please Print)	Signature	Agent of:	Date:

- All accreditation information and certificates can be found at www.emsl.com.

8) Equipment Maintenance Log Form

EMSL Equipment Maintenance Log
Revision 2
December 7, 2008

Equipment Maintenance Log

Equipment Description: _____
Manufacturer: _____
Model: _____
Serial Number: _____
Equipment Location: _____
Current Working Condition: _____

ISSUE			ACTION TAKEN		
Description of Problem	Reported by (initials)	Date	Description of Action	Performed by (initials)	Date

Controlled Document
Confidential Business Information/Property of EMSL Analytical, Inc.

General Engineering Laboratories, LLC

Charleston, SC

General Engineering Laboratories, LLC

Charleston, SC

QC Limits May 2009

Test	Tracer	%Tracer REC	Spike (LCS & MS)	%REC	DUP	%RPD*
Alpha Spec U	U-232	15-125%	U-238	75-125%	U-238	0-20%
Alpha Spec Th	Th-229	15-125%	Th-232	75-125%	Th-232	0-20%
Ra-226	NA	NA	Ra-226	75-125%	Ra-226	0-20%
Ra-228	Ba-133	25-125%	Ra-228	75-125%	Ra-228	0-20%

*%RPD is 0-20% if the result is > 5 times the MDA; if the result is between the MDA & 5 times the MDA, the %RPD is 0-100%; if the result is < the MDA the %RPD is not applicable.

VERIFY THE VALIDITY OF THIS SOP EACH DAY IN USE

GEL LABORATORIES, LLC

QUALITY ASSURANCE PLAN

(GL-QS-B-001 REVISION 22)

PROPRIETARY INFORMATION

TABLE OF CONTENTS

SECTION 1
INTRODUCTION

Section 1 - Introduction

GEL Laboratories, LLC (GEL) is a privately owned environmental laboratory dedicated to providing personalized client services of the highest quality. Our mission is to be the "Analytical Firm of First Choice."

GEL was established as an analytical testing laboratory in 1981. Now a full service lab, our analytical divisions use state of the art equipment and methods to provide a comprehensive array of organic, inorganic, radiochemical, and bioassay analyses and related support services to meet the needs of our clients.

This Quality Assurance Plan provides an overview of our quality assurance program for analytical services. Outlined in this plan are the responsibilities, policies, and processes essential to maintaining client satisfaction and our high quality of performance. The Director of Quality Systems is responsible for revising, controlling, and distributing the QAP. It is updated/reviewed at least annually.

Everyone on our staff is expected to understand the policies, objectives, and procedures that are described in this plan and to fully appreciate our commitment to quality and their respective roles and responsibilities with regard to quality. We also expect any analytical subcontractors we employ to perform in accordance with the quality assurance requirements delineated in this plan. All GEL employees are required to participate in Annual Quality Systems training.

This Quality Assurance Plan (QAP) has been prepared according to the standards and requirements of the US Environmental Protection Agency (EPA), ANSI/ISO/IEC 17025-2005, and the National Environmental Laboratory Accreditation Program (NELAP) Quality Systems Standards June 2001 effective July 2003.

1.1 Quality Policy

GEL's policy is "to provide high quality, personalized analytical services that enable our clients to meet their environmental needs cost effectively."

We define quality as "consistently meeting the needs and exceeding the expectations of our clients." As such, we consistently strive to:

- meet or exceed client and regulatory requirements
- be technically correct and accurate
- be defensible within contract specifications
- provide services in a cost-effective, timely and efficient manner

At GEL, quality is emphasized at every level—from the Chairman, CEO, CFO and COO to the newest of employees. Management's ongoing commitment to good professional practice and to the quality of our testing services to our customers is demonstrated by their dedication of personnel and resources to develop, implement, assess, and improve our technical and management operations.

The purpose of GEL's quality assurance program is to establish policies, procedures, and processes to meet or exceed the expectations of our clients. To achieve this, all personnel that support these services to our clients are introduced to the program and policies during their initial orientation, and annually thereafter during company-wide training sessions.

GEL's management is committed to compliance with and continual improvement of our quality assurance program. The program is designed to comply with the guidelines and specifications outlined in the following:

- NELAC 2003
- ASME/NQA-1
- ANSI/ISO/IEC 17025-2005
- QAPPs, U.S. EPA QA/R5
- Department of Energy Order 414.1B and 414.1C
- Current U.S. EPA CLP statements of work for inorganic and organic analyses
- ANSI N42.23-1996 Measurement and Associated Instrument Quality Assurance for Radioassay Laboratories
- DOE STD 1112-98
- Performance Criteria for Radiobioassay- ANSI N13.30-1996.
- Energy Reorganization Act, 1974, Section 206, 10 CFR, Part 21
- MARLAP
- 10 CFR Part 21- Reporting of Defects and Noncompliance

- 10 CFR Part 50 Appendix B -Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants
- 10 CFR Part 61- Licensing Requirements for Land Disposal of Radioactive Waste
- NRC REG Guide 4.8
- NRC REG Guide 4.15

1.2 Quality Goals

GEL's primary goals are to:

- Ensure that all measurement data generated are scientifically and legally defensible, of known and acceptable quality per the data quality objectives (DQOs), and thoroughly documented to provide sound support for environmental decisions.
- Ensure compliance with all contractual requirements, environmental standards, and regulations established by local, state and federal authorities.

Additional goals include:

- A comprehensive quality assurance program to ensure the timely and effective completion of each measurement effort.
- A commitment to excellence and improvement at all levels of the organization.
- Early detection of deficiencies that might adversely affect data quality.
- Adequate document control.
- Effective quality assurance objectives for measurement systems and for quality data in terms of accuracy, precision, completeness, and comparability through the use of proven methods.
- The establishment of procedures that demonstrate that the analytical systems are in a state of statistical control.
- The implementation of corrective actions and improvements to ensure the integrity of data.
- Reduction of data entry errors through comprehensive automated data handling procedures.
- The development and implementation of good laboratory and standard operating procedures (SOPs).
- Ability to customize quality assurance procedures to meet a client's specific requirements for data quality.
- Good control of instruments, services, and chemical procurement.
- A continuously capable laboratory information management system (AlphaLIMS).
- Validated and documented computer hardware and software.

1.3 Key Quality Elements

A sound quality assurance program is essential to our ability to provide data and services that consistently meet our high standards of integrity. The key features of our program are:

- An independent quality assurance (QA) validation and Quality Systems Department.
- A formal quality policy and QAP.
- Management review.
- Stated data quality objectives.
- A comprehensive employee training program.
- Ethics policy and education program.
- Internal audits and self-evaluations.
- A closed-loop corrective action program.
- State-of-the-art facilities and instruments.
- Adherence to standard operating procedures.
- EPA/NIST traceable reference materials.
- Electronically based document control.
- Chain of custody and electronic sample tracking.
- Inter-laboratory comparison programs.
- Formal laboratory accreditations.
- The evaluation of subcontractor laboratories.
- Statistical controls for analytical precision and accuracy.
- Replicate, method blank, matrix spike, tracer yield, internal standards, and surrogate measurements.
- The preventive maintenance of instrumentation and equipment.
- Independently prepared blind standard reference materials.
- Multi-level review processes.
- Focus on client satisfaction.
- Electronic tracking of client commitments, nonconformances and corrective actions.
- Trend analysis of nonconforming items.

1.4 Management Reviews

The effectiveness of the Quality System is reviewed at least annually by Senior Management. These reviews address issues that impact quality, and the results of the reviews are used to develop and implement

improvements to the system. Records of the review meetings are maintained as quality documents.

1.5 Disposition of Client Records

In the event that the laboratory should change ownership, the responsibility for the maintenance and disposition of client records shall transfer to the new owners. In the unlikely event that the laboratory ceases to conduct business, clients shall be notified and asked to provide instructions as to how their records should be returned or disposed. If a client does not provide instructions, those records will be maintained and disposed in a manner consistent with regulations and good laboratory practices for quality records.

1.6 Supporting Documents

Our laboratory operations and the quality of our analytical data comply with the specifications described in the documents listed in Appendix A.

1.7 Definitions

Applicable definitions are listed in Appendix B.

SECTION 2
ORGANIZATION, MANAGEMENT, AND PERSONNEL

Section 2 - Organization, Management, and Personnel

The chart found in Appendix C depicts our corporate organization, chain of command and flow of responsibility. The illustration in this appendix is designed to ensure the overall quality and cost efficiency of our company's analytical products and services.

Our structure is based on customer-focused divisions that follow a project from the point of initial contact to the final invoicing of work. These divisions include expertise in project management, sample receipt and custody, sample preparation and analysis, data review, and data packaging. An independent Quality Systems Management Department monitors the adherence of these divisions to the Quality Assurance Program.

The general responsibilities associated with the following position levels are discussed in this section:

- Chairman
- Chief Executive Officer (CEO) and President
- Chief Financial Officer (CFO)
- Chief Operating Officer (COO)
- Quality Systems Director
- Laboratory Directors
- Project Managers
- Group Leaders
- Laboratory and Technical Staff
- Information Systems Manager
- Environmental Manager

An overview of GEL's employee training protocol is also provided at Section 2.12.

2.1 Chairman, CEO/President, Chief Financial Officer and Chief Operating Officer

Operational responsibility rests with GEL's three owners and COO. Kathleen H. Stelling, James M. Stelling, and Douglas E. Earnst are GEL's owners and serve respectively as Chairman, CEO/President, and CFO. Carey J. Bocklet occupies the position of COO. As the highest level executives, their philosophical approach to quality, technology and customer service keeps GEL unique.

The Stellings, Mr. Earnst and Ms. Bocklet comprise our Executive Committee. They are also part of a Leadership Team that works to create a workplace environment that attracts and retains highly qualified professionals.

As Chairman, Ms. Stelling oversees the Executive Committee and leads management in implementing total quality initiatives that ensure quality services that meet stringent criteria of excellence. She has responsibility for public relations efforts and community affairs. Ms. Stelling holds a Bachelor of Arts in Education from the University of South Carolina.

As CEO and President, Mr. Stelling has overall operational responsibility for GEL. He operates the laboratory according to corporate policies and applicable licenses and regulations.

Mr. Stelling also has primary responsibility for the development and administration of our analytical testing and environmental consulting services. He holds a Bachelor of Science in Commerce from the University of Virginia.

Douglas E. Earnst is GEL's Chief Financial Officer and oversees our financial management. He is responsible for contracts administration, invoicing, purchasing, payroll, accounts payable and receivable, inventory control, property control, and financial forecasting. Mr. Earnst holds a Bachelor of Science in Business Administration from the Citadel.

The Chief Operating Officer is Carey J. Bocklet. Ms. Bocklet is responsible for the daily operations of the laboratories and client services. Ms. Bocklet holds a Bachelor of Science in Chemical Engineering, and a Master of Science in Business Administration, both from Clemson University.

Together, the Chairman, CEO/President, CFO and COO form GEL's Executive Committee. Their responsibilities include the following:

- Ensuring that the individuals who staff our technical and quality positions have the necessary education, training, and experience to competently perform their jobs.

- Ensuring that all staff members receive ancillary training, as needed, to enhance performance in assigned positions.
- Budgeting, staffing, managing, and equipping the laboratory to meet current and future analytical program requirements.
- Overseeing the implementation and overall effectiveness of our Quality Assurance Plan, health and safety initiatives, and environmental programs.
- Managing production and cost control activities.
- Ensuring development of capabilities in response to new or revised regulations, instrumentation and procedures, and quality assurance initiatives.

2.2 Technical Laboratory Co-Directors

To enhance our responsiveness to clients through dedicated expertise and teamwork, our laboratory is divided into two major divisions, Chemistry and Radiochemistry, each with its own Technical Laboratory Director.

The Technical Directors report to the Executive Committee and are ultimately responsible for the technical content and quality of work performed within each division. They are also responsible for strategic planning, profitability and growth, personnel management and business development. Other responsibilities include:

- Monitoring and meeting profitability and growth objectives of the division.
- Establishing and implementing short and long range objectives and policies that support GEL's goals.
- Defining the minimum level of qualification, experience, and skills necessary for positions in their divisions.
- Establishing and implementing policies and procedures that support our quality standards.
- Ensuring that technical laboratory staff demonstrates initial and continuing proficiency in the activities for which they are responsible.
- Documenting all analytical and operational activities of the laboratory.
- Supervising all personnel employed in the division.
- Ensuring that all sample acceptance criteria are verified and that samples are logged into the sample tracking system, properly labeled, and stored.
- Documenting the quality of all data reported by the division.
- Developing internal mechanisms and measurements to improve efficiency.
- Overseeing activities designed to ensure compliance with laboratory health and safety requirements.
- Allocating the resources necessary to support an effective and ongoing quality assurance program.
- Representing the company to the public and to clients.
- Ensuring the appropriate delegation of authorities during periods of absence.
- Ensuring compliance to the ISO 17025:2005 Standard.

Due to high volume and variety of analytical tests performed in the Chemistry Laboratory, the Technical Director for the Chemistry Laboratory has the daily assistance of a Production Manager.

2.3 Quality Systems Director

Our Quality Systems Director (QSD) reports directly to the CEO. The QSD manages the design, implementation and maintenance of our quality systems in a timely, accurate, and consistent manner.

In addition to having responsibility for the initiation and recommendation of corrective and preventive actions, the QSD is responsible for:

- Establishing, documenting, and maintaining comprehensive and effective quality systems.
- Developing and evaluating quality assurance policies and procedures pertinent to our laboratory functions, and communicating these with the division directors and managers.
- Ensuring that the operations of the lab are in conformance with the Quality Assurance Plan and meet the quality requirements specific to each analytical method.
- Ensuring that laboratory activities are in compliance with local, state, and federal environmental laws and regulations.

- Reviewing project-specific quality assurance plans.
- Ensuring that quality control limits are established and followed for critical points in all measurement processes.
- Initiating internal performance evaluation studies using commercially purchased certified, high-purity standard reference materials.
- Performing independent quality reviews of randomly selected data reports.
- Conducting periodic audits to ensure method compliance.
- Conducting or arranging periodic technical system evaluations of facilities, instruments and operations.
- Overseeing and monitoring the progress of nonconformances and corrective actions.
- Communicating system deficiencies, recommending corrective action to improve the system, and defining the validity of data generated during out of control situations.
- Preparing and updating quality assurance documents and reports to management.
- Coordinating inter-laboratory reviews and comparison studies.
- Overseeing Stop Work Orders in out-of-control situations.
- Administering accreditation and licensing.
- Administering our document control system.
- Providing guidance and training to laboratory staff as requested.
- Evaluating subcontractors and vendors that provide analytical and calibration services.
- Designating quality systems authorities in times of absence to one or more appropriately knowledgeable individuals.
- Overseeing notification if required for compliance with Energy Reorganization Act, 1974, 10 CFR, Part 21, should data recall be necessary.

2.4 Quality Systems Review

The effectiveness of the Quality System is reviewed on a regular basis during meetings of the Leadership Team, which may be as often as weekly, but not less than quarterly. These meetings address issues that impact quality, and the subsequent discussions are used to design and implement improvements to the system. At least annually, a management assessment of GEL's Quality System is conducted and reported. The QSD maintains records of these assessments.

2.5 Manager of Client and Support Services

Project Managers (PMs) serve as primary liaisons to our clients. PMs, under the guidance of the Manager of Client and Support Services, manage the company's interaction with clients. They are the client's first point of contact and have responsibility for client satisfaction and for communicating project specifications and changes to the appropriate laboratory areas.

Additional responsibilities include:

- Retaining clients and soliciting new work.
- Managing multiple sample delivery orders and preparing quotes.
- Working with clients to define analytical methodologies, quality assurance requirements, reports, deliverables, and pricing.
- Overseeing sample management and informing laboratory staff of the anticipated arrival of samples for analysis.
- Conducting a review of client documents (i.e. quotes, invoices, routine and specialized reports).
- Working with the accounting team on invoicing and collection issues.
- Working with the Laboratory Directors and Production Manager to project workloads and determine schedules.

2.6 Production Manager and Group Leaders

Group Leaders are a critical link between project management, lab personnel, and support staff. They report to the Technical Directors and have the following responsibilities:

- Planning and coordinating the operations of their groups to meet client expectations.
- Scheduling sample preparation and analyses according to holding times, quality criteria, and client due dates.
- Ensuring a multi-level review of 100% of data generated by their groups.
- Coordinating nonconformances and corrective actions in conjunction with the Quality Systems Management team.

- Serving as technical resources to their groups, including data review.
- Managing special projects, reviewing new work proposals, and overseeing the successful implementation of new methods.
- Monitoring and controlling expenses incurred within their groups such as overtime and consumables.
- Providing performance and career development feedback to their group members.

2.7 Laboratory and Technical Staff - General Requirements

At GEL, every effort is made to ensure that the laboratory is sufficiently staffed with personnel who have the training, education, and skills to perform their assigned jobs competently.

Depending upon the specific position, laboratory personnel are responsible for:

- Complying with quality assurance and quality control requirements that pertain to their group and/or technical function.
- Demonstrating a specific knowledge of their particular function and a general knowledge of laboratory operations.
- Understanding analytical test methods and standard operating procedures that are applicable to their job function.
- Documenting their activities and sample interactions in accordance with analytical methods and standard operating procedures.
- Implementing the quality assurance program as it pertains to their respective job functions.
- Identifying potential sources of error and reporting any observed substandard conditions or practices.
- Identifying and correcting any problems affecting the quality of analytical data.

2.8 Information Systems Manager

The Information Systems Manager reports directly to the COO. The responsibilities of this position include management of the Computer Services Team and AlphaLIMS, our laboratory information management system.

The combined responsibilities of the Information Systems Team, performing under the leadership of the Information Systems Manager, include the:

- Development and maintenance of all software and hardware.
- Translation and interpretation of routines for special projects.
- Interpretation of general data and quality control routines.
- Optimization of processes through better software and hardware utilization.
- Customization, testing and modification of data base applications.
- Maintenance and modification of our computer modeling, bar coding, CAD, statistical process control, project management, and data packaging systems.
- Development and maintenance of client and internal electronic data deliverables.
- Validation and documentation of software used in processing analytical data.

2.9 Environmental Manager

The Environmental Manager oversees our physical facility, laboratory and radiation safety programs, and instrumentation. This position reports to the COO, and manages and supervises the functions and staff assigned to these areas.

Responsibilities of the Environmental Manager include:

- Planning, evaluating, and making recommendations for facility maintenance, additions and renovations.
- Overseeing building renovations and new construction activities.
- Implementation of the Chemical Hygiene and Radiation Safety programs.
- Installing, maintaining, repairing, and modifying analytical instrumentation.
- Providing technical expertise and training in instrumentation operation, calibration, and maintenance.
- Monitoring and ensuring regulatory compliance for waste management operations and off-site disposal.

2.10 Radiation Safety Officer

The Radiation Safety Officer (RSO) reports to the Environmental Manager. The RSO is responsible for the administration and execution of GEL's Radiation Protection Program. This person provides technical guidance and leadership for all issues concerning radiation health and safety as well as direct operations to ensure compliance with South Carolina Department of Health and Environmental Control (SCDHEC) regulations for radioactive materials.

Responsibilities of the RSO include:

- Establishing and enforcing policies consistent with the principles and practices designated to maintain all exposure to ionizing radiation "As Low As Reasonably Achievable" (ALARA).
- Supervising Radiation Protection Specialists in the execution of radiological surveys and maintenance of the Radioactive Material License inventory.
- Executing the Personal Dosimetry, Air Effluent Monitoring, and Sealed Radioactive Source Leak Test Programs.
- Developing procedures and protocols to establish and maintain compliance.
- Providing training for staff in proper radiation protection practices.

2.11 Director of Human Resources

The Director of Human Resources reports directly to the CEO. The DHR manages the design, implementation, and ongoing development of our Human Resources. Responsibilities of the DHR include:

- Administration, orientation, and indoctrination of all new employees.
- Administration and compliance with Federal, State, and Local employment regulations.
- Sourcing candidates for all functional positions to maintain and strengthen the technical services provided by GEL.
- Management of occupational health and safety as it relates to Federal, State, and OSHA regulations.

2.12 Employee Training

To ensure that our clients receive the highest quality services possible, we train our employees in the general policies and practices of the company, as well as the specific operating procedures relative to their positions. We conduct and document this training according to GL-HR-E-002 for Employee Training and GL-QS-E-017 for Maintaining Technical Training Records.

New employees participate in a company orientation shortly after they are hired. During orientation they receive information on quality systems, ethics/data integrity, laboratory safety, and employment practices. Each new employee is also provided a manual that reiterates our policies on equal opportunity, benefits, leave, conflicts of interest, employee performance, and disciplinary action. Employees can access standard operating procedures, the Quality Assurance Plan, Safety, Health, and Chemical Hygiene Plan, and the Laboratory Waste Management Plan on GEL's Intranet.

Other training provided on an ongoing basis may include:

- Demonstration of initial proficiency in analytical methods and training to SOPs conducted by a trainer who has been documented as qualified and proficient in the process for which training is being provided.
- Demonstration of continued analyst proficiency is updated annually, usually during the first quarter of each year. Proficiency is demonstrated using the same processes as those used for initial Demonstration of Capability. (Refer to Section 8.3.1.)
- Company-wide, onsite training.
- Courses or workshops on specific equipment and analytical techniques.
- University courses.
- Professional and trade association conferences, seminars, and courses.

Documentation of employee training is the joint responsibility of the employee and the applicable Group Leader. If an SOP is revised during the course of the year, training to the revised SOP must be documented.

2.13 Ethics and Data Integrity

As our corporate vision statement explains, "We are a company that values: Excellence as a way of life, Quality Service, a Can-Do attitude, and a fundamental commitment to Ethical Standards." Employees attend ethics education programs that focus on the high standards of data integrity and ethical behavior mandated by our company and expected by our clients.

The annual ethics training includes:

- Specific examples of unethical behaviors for the industry and for the laboratory.
- Explanation of Internal Auditing for unethical behaviors and practices.
- GEL use of electronic audit functions using instrument and AlphaLIMS software.
- Explanation of GEL's Ombudsman policy for reporting inappropriate activities.
- Examples of consequences of inappropriate or unethical behaviors/practices.

All employees sign an Ethics and Data Integrity Agreement that reflects their commitment to always perform their duties with these high standards. (Refer to Appendix F.)

2.14 Confidentiality

The laboratory maintains the confidentiality and proprietary rights of information including the type of work performed and results of analysis. Laboratory personnel and staff are informed of this policy and sign a confidentiality agreement.

A confidentiality statement accompanies the electronic transfer of data from GEL via telefacsimile (fax) or electronic mail systems (email). Government affiliated auditing agencies have access to pertinent laboratory records. However, contract, third party, and client auditors have access only to those records that may be applicable to their inspection and shall not be granted access to client records that may be considered in conflict with their interests, unless prior authorization has been given by the submitting client. Confidential information may be purged of references to client identity, project and/or sample identity by the laboratory so that records may be provided to other entities (e.g. auditors) for review.

SECTION 3
QUALITY SYSTEMS

Section 3 - Quality Systems

Our Quality Systems include all quality assurance (QA) policies and quality control (QC) procedures necessary to plan, implement, and assess the work we perform. GEL's QA Program establishes a quality management system (QMS) that governs all of the activities of our organization.

GEL's quality management system is designed to conform to the requirements specified in the standards referenced in Appendix A. Essential elements of our quality management system are described in this section.

3.1 Quality Systems Team

The quality systems team is responsible for managing GEL's QA Program. This team functions independently of the systems it monitors and is comprised of the Quality Systems Director, Lead Auditor, QA Officers, and/or Specialists.

Following is a summary of the responsibilities of each position.

3.1.1 Quality Systems Director

- Reports to the CEO
- Demonstrates strict adherence to and support of the company ethics policy
- Serves as management's representative for quality
- Responsible for the implementation and maintenance of the QMS
- Supervises the Quality Systems Team and their functions
- Initiates and recommends preventive action and solutions to quality problems
- Implements appropriate action to control quality problems until solutions are implemented and verified to be effective
- Verifies that effective solutions are implemented
- Demonstrates knowledge of the Quality System as defined by NELAC, ANSI/ISO/IEC 17025, DOECAP, and DOELAP.

3.1.2 Quality Systems Lead Auditor

- Reports to the Quality Systems Director
- Demonstrates strict adherence to and support of the company ethics policy.
- Demonstrates knowledge of the Quality System defined under NELAC, DOECAP, and DOELAP and other quality standards such as ANSI/ISO/IEC 17025-2005.
- Plans, schedules and participates in GEL's client audits, internal audits, and subcontractor audits
- Conducts conformance audits as necessary to verify implementation and closure of audit action items
- Serves as liaison to client and third party auditors
- Coordinates laboratory responses to audit reports and prepares final response
- Monitors progress of corrective actions
- Prepares and monitors progress of internal and subcontractor audit reports

3.1.3 Quality Assurance Officers

- Report to the Quality Systems Director
- Demonstrate strict adherence to and support of the company ethics policy.
- Demonstrate the ability to evaluate data objectively without outside influence
- Have documented training and/or experience in QA/QC procedures and knowledge of the Quality system as defined under NELAC and ISO 17025
- Have knowledge of analytical methods
- Assist in the conduct of internal and supplier audits and requests for pricing reviews
- Administer corrective actions and nonconformances
- Monitor and respond to client -identified nonconformances and technical inquiries
- Implement and maintain statistical process control (SPC) system
- Ensure the monitoring of balances and weights, and temperature regulation of ovens, water baths, and refrigerators
- Coordinate the monitoring of DI water system and volatile organics storage coolers

- Maintain Method Detection Limit studies
- Write or review quality documents and standard operating procedures under the direction of the QS Director
- Provide training in quality systems and good laboratory practices.
- Manage laboratory certification processes
- Coordinate the receipt and disposition of external and internal performance evaluation samples.

NOTE: Once PE samples have been prepared in accordance with the instructions provided by the PE vendor, they are managed and analyzed in the same manner as environmental samples from clients. The analytical and reporting processes for PE samples are not specially handled.

3.1.4 Quality Systems Specialists

- Reports to the Quality Systems Director
- Demonstrates strict adherence to and support of the company ethics policy.
- Assist the team as directed with respect to Records Management, Document Control, Laboratory Certification, temperature and weight calibrations, logbook review, training documentation, and nonconformances, etc.

3.2 Quality Documents

Our Quality Systems policies and procedures are documented in the QA Plan (GL-QS-B-001) and other supporting documents. GEL's management approves all company quality documents. Pre-approval is secured for any departures from such documents that may affect quality.

In addition, to the QA Plan, Quality Systems allows for QA Project Plans (QAPjP) and includes standard operating procedures and any other quality assurance program requirements defined by individual contracts. The QA Plan describes the quality standards that we apply to our laboratory operations. We use Quality Assurance Project Plans to specify individual project requirements. The QA Plan and supporting documents are verified to be understood and are implemented throughout the laboratory fractions to which they apply.

Finally, our Standard Operating Procedures (SOPs) are used to describe in detail those activities that affect quality. SOPs are prepared, authorized, changed, revised released, and retired in accordance with GL-ADM-E-001. SOPs are accessible electronically via GEL's Intranet.

3.3 Document Control

The control of quality documents is critical to the effective implementation of our Quality Program. We define and control this process in accordance with GL-DC-E-001 for Document Control. Responsibilities for document control are divided between the Group Leaders and the Document Control Officer (DCO).

Group Leaders are responsible for:

- Supporting the development and maintenance of controlled documents that apply to their respective departments.
- Reviewing all quality documents annually for continued validity.
- Ensuring documentation that the affected employees are aware of revisions to documents or manuals.

The Computer Services Team is responsible for:

- Electronic maintenance of all records required for control, re-creation, and maintenance of analytical documentation.
- Maintenance of electronic copies of archived data and the electronic log of how they were determined.

The DCO is responsible for:

- Demonstrating strict adherence to and support of the company ethics policy.
- Managing the system for the preparation, authorization, change, revision, release, and retirement of the Quality Manual, QAP, project plans, and standard operating procedures.
- Ensuring that current controlled documents are accessible via GEL's Intranet.
- Managing a system to document current revision numbers and revision dates for all distributed documents and manuals.
- Managing a system to identify the nature of document revisions.
- Maintaining hard or electronic copies of obsolete documents.
- Maintaining electronic or hard copy originals of all controlled documents.

Revisions to controlled quality documents are made by replacing individual sections or the entire document, as determined by the DCO.

3.4 Controlled Document Review

Internally generated controlled documents undergo a multi-level review and approval process before they are issued. These levels include a procedural review, technical and/or quality review and the final authorization of the appropriate manager or director. To ensure that new or revised standard operating procedures are not implemented prematurely, SOPs are effective upon the date of the final approval signature.

3.5 Quality Records

Quality records provide evidence that specified quality requirements have been met and documented. We generate them in accordance with applicable procedures, programs, and contracts. Quality records include but are not limited to:

- Observations
- Calculations
- Calibration data
- Certificates of analysis
- Certification records
- Chains of custody
- Audit records
- Run logs, instrument data, and analytical logbooks
- Instrument, equipment, and building maintenance logs
- Material requisition forms
- Monitoring logs
- Nonconformance reports and corrective actions
- Method development and start-up procedures including method detection limit studies
- Technical training records
- Waste management records
- Standard logs
- Software validation documentation
- Standard Operating Procedures (SOPs)
- Sample collection and field data

Our quality records are:

- Documented in a legible manner.
- Indexed and filed in a manner conducive to ready retrieval.
- Stored in a manner that protects them from loss, damage, and unauthorized alterations.
- Accessible to the client for whom the record was generated.
- Retained and disposed in the identified time period.

The generation, validation, indexing, storage, retrieval, and disposition of our quality records are detailed in GL-QS-E-008 for Quality Records Management and Disposition. The quality records of subcontracted services are also required to meet the conditions established in this SOP.

3.6 Internal and Supplier Quality Audits

We conduct internal audits annually to verify that our operations comply with the requirements of our QA program and those of our clients. We perform supplier audits as necessary to ensure that they too meet the requirements of these programs. Both internal and supplier audits are conducted in accordance with GL-QS-E-001 for the Conduct of Quality Audits.

3.6.1 Audit Frequency

Internal audits are conducted at least annually in accordance with a schedule approved by the Quality Systems Director. Supplier audits are contingent upon the categorization of the supplier, and may or may not be conducted prior to the use of a supplier or subcontractor (Refer to GL-QS-E-001.) Type I suppliers and subcontractors, regardless of how they were initially qualified, are re-evaluated at least once every three years.

Additional internal and supplier audits may be scheduled if deemed necessary.

3.6.2 Audit Team Responsibilities

Internal and supplier audits are conducted by qualified staff under the direction of the Lead Auditor or Quality Systems Director. A qualified audit team member shall have the technical expertise to examine the assigned activities.

We do not allow staff to audit activities for which they are responsible or in which they are directly involved. It is the responsibility of the Lead Auditor to ensure that such conflicts of interest are avoided when the audit team is assembled.

The Leadership Team has a significant role in the internal audit process, including:

- Provision of audit personnel

- Empowerment of the audit team with authority to make the audit effective
- Development and implementation of timely corrective action plans

3.6.3 Identification and verification of OFIs

Opportunities for Improvement are identified conditions that may adversely affect the quality of products or services. Several examples of objective evidence are used to support an OFI, which might be classified as a finding, concern, observation, and/or recommendation.

The Lead Auditor may initiate a Nonconformance Report (NCR) or Corrective Action Request and Report (CARR) referencing the OFI. The NCR or CARR is then entered into the NCR system per GL-QS-E-012 for NCR Database Operation.

Implementation of a corrective action is later verified by a re-audit of the deficient area, review of new or revised documents, or, if the OFI does not warrant immediate action, the corrective action may be verified during the next scheduled audit.

3.7 Managerial and Audit Review

Our Leadership Team reviews the audit process at least annually. This ensures the effectiveness of the corrective action plan and provides the opportunity to introduce changes and improvements.

We document all review findings and corrective actions. Implementation plans and schedules are monitored by the Quality Systems Team.

3.8 Nonconformances

Processes, materials, and services that do not meet specifications or requirements are defined as nonconforming. Such nonconformances can include items developed in-house or purchased from vendors, samples received from clients, work in progress, and client reports.

At GEL, we have a nonconformance reporting system (NCR) that helps us prevent the entry of defective goods and services into our processes and the release of nonconforming goods and services to our clients. Our NCR system provides a means for documenting the disposition of nonconforming items and for communicating these to the persons involved in the process affected by the adverse condition(s).

Nonconformances are documented according to GL-QS-E-004 for the Documentation of Nonconformance Reporting and Dispositioning and Control of Nonconforming Items. We regularly review SOPs, client complaints, and quality records, including completed NCRs, to promptly identify conditions that might result in situations or services that do not conform to specified quality requirements.

Our Quality Group processes, categorizes and trends nonconformances. Trending information may be provided to the Leadership Team and Group Leaders of the affected areas.

3.9 Corrective Action

There are two categories of corrective action at GEL. One is corrective action implemented at the analytical and data review level in accordance with the analytical SOP. The other is formal corrective action documented by the Quality Systems Team in accordance with GL-QS-E-002. Formal corrective action is initiated when a nonconformance reoccurs or is so significant that permanent elimination or prevention of the problem is required.

We include quality requirements in most analytical SOPs to ensure that data are reported only if the quality control criteria are met or the quality control measures that did not meet the acceptance criteria are documented.

Formal corrective action is implemented according to GL-QS-E-002 for Conducting Corrective/Preventive Action and Identifying Opportunities for Improvement and documented according to GL-QS-E-012 for NCR Database Operation.

Any employee at GEL can identify and report a nonconformance and request that corrective action be taken. Any GEL employee can participate on a corrective action team as requested by the QS team or Group Leaders. The steps for conducting corrective action are detailed in GL-QS-E-002.

In the event that correctness or validity of the laboratory's test results is doubted, the laboratory will take corrective action. If investigations show that the results have been impacted, affected clients will be informed of the issue in writing within 5 calendar days of the discovery.

3.10 Performance Audits

In addition to internal and client audits, our laboratory participates in annual performance evaluation studies conducted by independent providers. We routinely participate in the following types of performance audits:

- Proficiency testing and other inter-laboratory comparisons.
- Performance requirements necessary to retain certifications (Appendix D).
- Evaluation of recoveries of certified reference and in-house secondary reference materials using statistical process control data.
- Evaluation of relative percent difference between measurements through SPC data.

We also participate in a number of proficiency testing programs for federal and state agencies and as required by contracts. It is our policy that no proficiency evaluation samples be analyzed in any special manner.

Our annual performance evaluation participation generally includes a combination of studies that support the following:

- US Environmental Protection Agency Discharge Monitoring Report, Quality Assurance Program (DMR-QA). Annual national program sponsored by EPA for laboratories engaged in the analysis of samples associated with the NPDES monitoring program. Participation is mandatory for all holders of NPDES permits. The permit holder must analyze for all of the parameters listed on the discharge permit. Parameters include general chemistry, metals, BOD/COD, oil and grease, ammonia, nitrates, etc.
- Department of Energy Mixed Analyte Performance Evaluation Program (MAPEP). A semiannual program developed by DOE in support of DOE contractors performing waste analyses. Participation is required for all laboratories that perform environmental analytical measurements in support of environmental management activities.
- ERA's MRAD-Multimedia Radiochemistry Proficiency test program. This program is for labs seeking certification for radionuclides in wastewater and solid waste. The program is conducted in strict compliance with USEPA National Standards for Water Proficiency study.
- ERA's InterLaB RadCheM Proficiency Testing Program for radiological analyses. This program completes the process of replacing the USEPA EMSL-LV Nuclear Radiation Assessment Division program discontinued in 1998. Laboratories seeking certification for radionuclide analysis in drinking water also use the study. This program is conducted in strict compliance with the USEPA National Standards for Water Proficiency Testing Studies.
- Water Pollution (WP). Biannual program for waste methodologies. Parameters include both organic and inorganic analytes.
- Water Supply (WS): Biannual program for drinking water methodologies. Both organic and inorganic parameters are included.

At GEL, we also evaluate our analytical performance on a regular basis through statistical process control acceptance criteria. Where feasible, this criterion is applied to both measures of precision and accuracy and is specific to sample matrix.

We establish environmental process control limits at least annually. In Radiochemistry, quality control evaluation is based on static limits rather than those that are statistically derived. Our current process control limits are maintained in AlphaLIMS.

We also measure precision through the use of matrix duplicates and/or matrix spike duplicates. The upper and lower control limits (UCL and LCL respectively) for precision are plus or minus three times the standard deviation from the mean of a series of relative percent differences. The static precision criteria for radiochemical analyses are 0 - 20% for activity levels exceeding the contract required detection limit (CRDL).

Accuracy is measured through laboratory control samples and/or matrix spikes, as well as surrogates and internal standards. The UCLs and LCLs for accuracy are plus or minus three times the standard deviation from the mean of a series of recoveries. The static limit for radiochemical analyses is 75 - 125%. Specific Instructions for out-of-control situations are provided in the applicable analytical SOP.

3.11 Essential Quality Control Measures

Some quality control measures are method-specific. There are, however, general quality control measures

that are essential to our quality system. These quality measures include:

- Monitoring of negative and positive controls
- Defining variability and reproducibility through duplicates
- Ensuring the accuracy of test data including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, etc.
- Evaluating test performance using method detection limits and quantitation limits or range of applicability such as linearity
- Selecting the appropriate method of data reduction
- A copy of GEL's Ethics and Integrity Agreement is provided in Appendix F.

SECTION 4
FACILITIES

Section 4 - Facilities

Our laboratory is designed with a full-service approach to handling environmental needs. The layout provides dedicated space for radiochemical analyses, bioassay analysis, organic extractions, semi-volatile organic analyses, volatile organic analyses, metals analyses, general chemistry analyses, and air analyses.

The laboratory and support offices occupy approximately 85,000 square feet engineered to meet the stringent quality control and utility requirements of the modern environmental laboratory. Records are temporarily stored on-site then warehoused in a climate-controlled building off-site. The diagram in Appendix H depicts the layout of the laboratories.

Discussed in this section are:

- Facility security
- Utility services and deionized water
- Prevention of contamination
- Assessment of contamination

4.1 Facility Security

Our facility features secured laboratory and storage areas. Restricted entry assures sample integrity and client confidentiality, which satisfies clients and potential national security interests.

Visitors cannot gain entry without being escorted through the laboratory by authorized personnel. A designated sample custodian and a bar-coded chain-of-custody provide a second level of security.

4.2 Utility Services

Each defined laboratory area is equipped with the following utilities:

- Cold water
- Hot water
- Deionized water
- Compressed air
- Natural gas
- Vacuum
- 110 Volt AC
- 208 Volt AC (at selected stations)
- Specialty gases (as required)

4.2.1 Deionized Water

We have two independent deionized water (DI) systems. One serves radiochemistry while the other serves the remaining laboratories. DI water is made from city water flowing through a deionization system capable of producing 5 gallons per minute of Type II laboratory water. Tables 1 and 2 list the minimum requirements for Type I and Type II DI water.

Table 1: ASTM Type I DI Water

Quality Parameter	Limits
Bacteria, CFU/mL	< 10
pH	not specified
Resistivity, min. MΩ-cm at 25° C	> 16.67
Conductivity, max. µmho/cm at 25° C	≤ 0.06
Trace Metals, Single (Cd, Cr, Cu, Ni, Pb, Zn)	< 0.05 mg/L
Trace Metals, Total	< 0.1 mg/L
Free Chlorine	not specified
Ammonia/Organic Nitrogen	not specified
TOC	not specified
Organic Contaminants	Activated carbon

Table 2: ASTM Type II DI Water

Quality Parameter	Limits
Bacteria, CFU/mL	< 1000
pH	not specified
Resistivity, min. MΩ-cm at 25° C	> 1.0
Conductivity, max. µmho/cm at 25° C	≤ 1.0
Trace Metals, Single (Cd, Cr, Cu, Ni, Pb, Zn)	< 0.1 mg/L
Trace Metals, Total	not specified
Free Chlorine	< 0.1 mg/L
Ammonia/Organic Nitrogen	< 0.1 mg/L
TOC	< 1.0 mg/L
Organic Contaminants	not specified

We monitor compliance with the above limits according to GL-LB-E-016 for The Collection and Monitoring of the DI Water Systems. Our monitoring activities and frequencies can be found in Table 1 of the SOP.

4.3 Prevention of Contamination

Work areas that are free of sample contaminants, constituents and measurement interferences are important to the generation of quality data. With this in mind, we designed our laboratories to prevent contamination and reinforce this design with good laboratory practices.

In addition to keeping our work areas free of dust and dirt accumulations, policies and features that prevent or minimize contamination include:

- An air conditioning system that controls the environment of individual laboratories for optimum performance of sensitive instruments and to eliminate potential cross contamination.
- Segregation of volatile and semi-volatile laboratories to minimize potential contamination associated with the use of commonly required solvents.
- Negative and positive pressure air locks to isolate selected laboratories to prevent the entry of airborne contaminants.
- Fume hoods to remove fumes and reduce the risk of aerosol and airborne contaminants and personal safety hazards are monitored in accordance with GL-FC-E-003 for Fume Hood Face Velocity Performance Checks.
- Restricted access to the volatiles laboratory (authorized personnel only).
- Designated area for glassware preparation wherein all glassware used in sample prep and analysis is cleaned according to GL-LB-E-003 for Glassware Preparation.
- Segregated storage areas for volatiles and radioactive samples.
- Production, use, and monitoring of Type I and Type II DI water.
- Tracking and trending of any significant sample and/or reagent spills using the AlphaLIMS NCR system, allowing efficient analysis of any potential contamination.

4.4 Assessment of Contamination Levels

We evaluate contamination resulting from the following sources on the basis of quality assurance and quality control data derived from the analytical method and method blanks.

- Sample containers
- Reagent water
- Reagents and solvents
- Sample storage
- Chemical and physical interference
- Constituent carryover during analysis

Contamination in each of the volatile storage coolers is monitored by the weekly analysis of water blanks. Four DI water blanks are placed in the cooler at the beginning of each month with one being analyzed each week. If the concentration of any target analyte exceeds the PQL, corrective action is implemented to eliminate the source of contamination, evaluate the effect of samples stored in the cooler, and to notify clients.

SECTION 5
EQUIPMENT AND REFERENCE MATERIALS

Section 5 - Equipment and Reference Materials

GEL's ability to efficiently generate data that are reproducible, accurate, and legally defensible is attributable to our use of high-quality instruments, equipment, and reference materials.

Provided in this section are:

- GEL's policies governing instruments, equipment, and reference materials
- Identification of instrumentation and support equipment
- Procurement protocol

5.1 General Policies

It is our policy to purchase instrumentation, equipment and high-quality reference materials that meet or exceed the method and regulatory requirements for the analyses for which we are accredited. If we need to use instruments or equipment not under our permanent control, we ensure that it also meets these standards.

Instrumentation and equipment are placed into service on the basis of ability to meet method or regulatory specified operating conditions such as range and accuracy. All laboratory instrumentation and testing equipment is maintained in accordance with standard operating procedures (SOPs).

Instrumentation and equipment is used in a manner that assures, where possible, that measurement uncertainty is known and consistent with specified quality requirements. Instruments and equipment are taken out of service and segregated or labeled as such under the following conditions:

- Mishandling and/or overloading
- Results produced are suspect
- Demonstrated defect or malfunction

Tagged or segregated instruments and equipment remain out of service until repaired and shown by test, calibration, or verification to perform satisfactorily. Instruments that are in service and normally calibrated prior to and during use are not tagged.

Each item of equipment, including reference materials is, if appropriate, labeled, marked or otherwise identified to indicate its calibration status. We maintain records for each major item of equipment, instrumentation, and all reference materials significant to quality performance. These records are often in the form of maintenance logs, which are kept in accordance with GL-LB-E-008 for Basic Requirements for the Use and Maintenance of Laboratory Notebooks, Logbooks, Forms, and Other Recordkeeping Devices.

Documentation included in these records includes but is not limited to:

- Equipment name
- Manufacturer's name
- Type identification
- Serial number or other unique identification
- Date received and date placed in service (if available)
- Current location
- Condition when received (if known)
- Manufacturer's instruction, where available
- Dates and results of calibrations and or verifications
- Date of next calibration and/or verification, where written procedures do not specify frequency
- Details of maintenance carried out to date and planned for the future
- History of any damage, malfunction, modification or repair

5.2 Instrumentation and Support Equipment

Appendix G lists the instruments we use for the analysis of environmental, radiochemical and bioassay samples. Where feasible, our instruments are equipped with autosamplers that improve efficiency and facilitate consistent sample introduction to the sample detector. They are also connected to an area network to facilitate data transfer.

Devices that may not be the actual test instrument but are necessary to support laboratory operations are referred to as support equipment. We also maintain this equipment in proper working order. Support equipment utilized at GEL includes:

- balances
- ovens
- refrigerators

- freezers
- incubators
- water baths
- temperature measuring devices
- volumetric dispensing devices
- muffle furnaces
- distillation apparatus
- grinders and homogenizers
- hot plates and heating mantles
- ultraviolet sterilizers.

Guidelines for the required calibration and evaluation of this equipment are discussed in Section 7.

We perform radiochemical and bioassay analytical services in accordance with the instrumentation and reference methods approved by the Department of Energy (DOE), the Environmental Measurements Lab (EML), the Environmental Protection Agency (EPA), ASTM, and Los Alamos Health and Environmental Chemistry (LAHEC). Modifications to these methods may be appropriate as a result of Performance Based Measurement Systems (PBMS).

SOPs are used to describe our procedures for all routine analyses performed by our labs. These procedures include step-by-step instructions for sample collection, storage, preparation, analysis, instrument calibration, quality control, disposal, and data reporting.

5.3 Procurement and Control of Purchased Items

Materials, equipment, and services that affect the quality of our products are designated as Quality Materials, Equipment, and Services and are only purchased from approved suppliers. We approve and document suppliers according to GL-QS-E-001 for the Conduct of Quality Audits.

At GEL, we maintain documentation of specific quality requirements for Quality Materials and Services. Records that document the quality of a product or service may include:

- certificates of analysis and traceability
- verifications of chemical quality
- inspections of equipment or materials
- verifications or inspections of vendor product specifications

Our procedure for requisitioning supplies, instruments, equipment and other common use material is described in GL-RC-E-002 for Material Requisition. These requests typically include:

- The date and name of person(s) requesting materials
- Account, department, project number to which the material is to be billed
- Recommended supplier or vendor
- Additional information necessary to expedite the purchase request
- Specifications that could affect the quality of products and services
- Vendor's material part number
- Amount of material needed
- Description of material
- Cost per unit
- Person(s) authorizing the purchase
- Time frame in which the material is needed

The equipment, instruments, and reference materials we purchase are inspected upon receipt in accordance with GL-RC-E-001 for the Receipt and Inspection of Material and Services. This inspection is to verify that procured items meet the acceptance criteria defined in the procurement documentation. Staff performing initial inspection routinely:

- Open and inspect all items for damage
- Compare the items with the issued purchase order or contract for catalog or part number, description or procurement specification, quality requirement, and acceptance criteria
- Label items with a limited shelf life with the date received
- Determine if the items conform to the specifications agreed to by the vendor.

The individual responsible for the technical acceptance of the item provides procurement and receiving staff with the proper acceptance documentation. Items found not to conform to quality standards are returned to the supplier, identified as nonconforming or disposed according to the established procedures in GL-QS-E-004 for Documentation of Nonconformance Reporting and Dispositioning and Control of Nonconforming Items. These nonconforming items may also include those identified as suspect/counterfeit items as identified in DOE guide DOE G 414.-3 for use with DOE 414.1B.

SECTION 6
HEALTH AND SAFETY

Section 6 - Health and Safety

GEL maintains a safe work environment and promotes healthy work practices. Our corporate Safety, Health, and Chemical Hygiene Plan was developed by a resident certified industrial hygienist. Procedures outlined in the plan are consistent with Occupational Safety and Health Administration, CERCLA, the Environmental Protection Agency, and SCDHEC.

All employees are trained in the safety practices applicable to their job functions. This training is conducted in accordance with GL-HR-E-002 for Employee Training.

Discussed in the section are:

- Fire safety and safety equipment
- Safety equipment and procedures related to handling radioactive samples

6.1 Fire Safety

Our facility is equipped with a fire alarm system designed to detect smoke in all areas of the facility. Certain high-risk areas, such as, the cold and ambient storage areas, organic sample preparation lab, hazardous waste lab, and solvent storage are additionally equipped with automatic halon systems. Fire blankets and dry chemical extinguishers are located at strategic points throughout the lab. We routinely inspect these extinguishers in accordance with GL-FC-E-004. Lab personnel are trained in the proper use and selection of fire extinguishers.

In order to decrease the risk of fire, bulk solvents are stored in a halon-protected storage room.

6.2 Evacuation

In the unlikely event of a fire (or other emergency), we have defined evacuation routes depicted in Appendix H. This diagram is posted in pertinent areas of the facility and designated staff members serve as evacuation leaders for the work groups.

6.3 Safety Equipment

Safety equipment, including safety glasses, lab coats, safety goggles, protective gloves, hard hats, and coveralls, is available to all employees as needed. We also provide respirators when needed to those who have completed training in the use of this specialized equipment.

Eyewashes and overhead showers are located throughout the laboratory. We routinely inspect these as directed in GL-FC-E-002 for Testing Emergency Eyewash and Shower Equipment.

6.4 Radiation Safety

Since GEL specializes in the handling of radioactive material, we have health physics procedures to ensure its safe handling. While lab personnel do not encounter significant levels of radiation requiring personal monitoring, a Dosimetry Program is in effect utilizing personal dosimeters for designated personnel. These dosimeters are exchanged quarterly and records of exposure are maintained. Instructions for the proper use of dosimeters are addressed in GL-RAD-S-009 for Personnel Dosimetry.

We take special precautions to ensure that samples are safely processed. Upon receipt, trained personnel use a survey meter to screen all samples for the presence of radioactivity. Protocols for the receipt of radioactive samples and for surveying suspected or known radioactive samples are detailed in GL-RAD-S-007 for Receiving Radioactive Packages and GL-RAD-S-001 for Radiological Surveys. This process is described in Section 9.

Upon leaving a radiologically controlled area, personnel check their hands and feet for potential contamination. This is done utilizing detection instrumentation that employs Geiger-Mueller or scintillation technologies. In addition, stations with portable detection instruments are set up for personnel frisking and in-process contamination surveys.

Key areas throughout the facility are surveyed:

- Laboratory analytical areas (Monthly smears)
- Radioactive Sample Storage Areas (Monthly smears and exposure rate)
- Sample Receipt and Waste Handling Areas (Monthly smears and exposure rate)
- Unrestricted and Radioactive Material Prohibited Areas (Quarterly smears)

SECTION 7
MEASUREMENT, TRACEABILITY, AND CALIBRATION

Section 7 - Traceability and Calibration

Traceability of measurements and the calibration of testing equipment are imperative to our ability to produce accurate and legally defensible data. As such, we have implemented procedures to ensure that equipment calibration and measurement verification are traceable to nationally recognized standards.

Where possible, calibration certificates provide traceability to national standards of measurement. Calibration certificates provide measurement results and any associated uncertainty of measurement, and/or a statement of compliance with the identified specification. Calibration certifications are maintained as quality records.

When traceability to a national standard is not applicable, verification of measurement is achieved through inter-laboratory comparisons, proficiency tests, or independent analyses.

The following measurement and traceability practices are described in this section:

- Calibration criteria for support equipment
- General requirements
- Balances
- Temperature-sensitive devices and temperature monitoring
- Air displacement pipets
- Calibration criteria for instruments
- Calibration verification
- Initial calibration verification
- Continuing calibration verification

7.1 Calibration Criteria for Support Equipment

This section addresses calibration protocols for support equipment, including balances, temperature - sensitive equipment, and air displacement pipets. The general criteria applicable to the calibration of support equipment are as follows:

- Equipment is maintained in proper working order. Records of all maintenance activities including service calls are kept.
- Calibrations or verifications over the entire range of use, using NIST-traceable references when available, are conducted annually.
- If results of calibration and verification are not within the specifications for the equipment's application, then:
  1. The equipment is removed from service until repaired
  2. Under certain conditions, a deviation curve may be prepared. All measurements are corrected for the deviation, recorded and maintained.
- Prior to use each day, balances, ovens, freezers, refrigerators, incubators, and water baths are checked with NIST-traceable references (where possible) in the expected use range.
- If prescribed by the test method, additional monitoring is performed for a device used in a critical test (such as an incubator or water bath).
- Support equipment is used only if the reference standard specifications (provided by the supplier or described in the analytical method) are met.
- Reference standards of measurement such as Class S or equivalent weights or traceable thermometers may be used for calibration when demonstrated that their performance as reference standards will not be invalidated.
- Reference standards of measurement are calibrated by a body that can provide, where possible, traceability to a national standard.
- Reference standards and measuring and testing equipment are, subject to in-service checks between calibrations and verifications, in accordance with ANSI/ISO/IEC 17025-2005.
- Reference materials, where possible, are traceable to national or international standards of measurement, or to national or international standard reference materials.
- Mechanical volumetric dispensing devices, except Class A glassware, are checked monthly for accuracy.

7.1.1 Balances

Our balances are under a service contract for annual calibration, maintenance, and cleaning. Each balance is labeled with a serial number, service date, date of next service, and signature of the service technician.

Balances are set up, calibrated, and operated in the range required by the analytical method in accordance with GL-LB-E-002 for Balances. Prior to using a balance, the analyst is responsible for checking its calibration.

Calibration and calibration verification are performed using weights that are or have been calibrated against Class S or equivalent weights. These weights are traceable to NIST and calibrated annually by a calibration service provider that meets the requirements of the ANSI/ISO/IEC 17025-2005 standard.

Calibration and calibration verification are recorded in the balance calibration logbook. If the calibration or calibration verification does not meet the specified acceptance criteria, the balance is recalibrated. If the calibration criteria are still not met, the balance is removed from service and tagged as such.

7.1.2 Refrigerators, Freezers, Incubators, Ovens, Water Baths, and Similar Devices

Careful control of temperature is often central to the production of acceptable data. Temperature excursions beyond the established limits may invalidate a procedure and the associated data. Constant monitoring in accordance with GL-LB-E-004 for Temperature Monitoring and Documentation Requirements for Refrigerators, Freezers, Ovens, Incubators, and Other Similar Devices assures us that regulatory and/or method temperature requirements are being met.

We measure temperatures with thermometers that are verified annually against a NIST-traceable thermometer. The NIST traceable thermometers are independently verified at least annually by a verification service that meets the requirements of the ANSI/ISO/IEC 17025-2005 standard. The protocol for thermometer verification is described in GL-QS-E-007. We monitor the temperature of the following equipment according to GL-LB-E-004:

- Refrigerators and freezers used to store samples, standards, and other temperature-sensitive materials
- Incubators
- Ovens
- Water baths
- Autoclaves

We monitor the temperatures of refrigerators and freezers prior to use on each working day. The temperatures of ovens, water baths, and other devices used as part of an analytical process must be monitored prior to, during, and immediately after use. Incubators and other devices used for microbiological or other specialized analytical methods may require more frequent monitoring as specified in the corresponding SOP.

Temperature measurements are documented on logs specific to each piece of equipment. The logs are posted on or near each refrigerator, freezer, water bath, oven, or other temperature control device. Each log includes the following information:

- Date and time of each measurement
- Initials of person taking measurement
- Acceptance limits for device being monitored
- Whether device conforms with specifications at time of measurement
- Name, location, and number of device being monitored
- Notation of any out-of-control condition

The sterilization pressure of each autoclave run must be documented in addition to the sterilization temperature. When the process to maintain and document temperatures within acceptance limits does not conform to specifications, a nonconformance report (NCR) is issued. Appropriate action is then taken to disposition the nonconformance according to GL-QS-E-004 for Documentation of Nonconformance Reporting and Dispositioning and Control of Nonconforming Items.

Examples of nonconformances are:

- Failure to maintain process temperature within acceptance limits
- Failure of device to achieve calibration
- Total failure of temperature control device
- Failure to monitor the temperature as required

7.1.3 Air Displacement Pipets

Air displacement pipets offer a level of precision and accuracy exceeded only by Class A transfer pipets. Due to disposable tips, these pipets eliminate the possibility of cross-contamination.

We calibrate air displacement pipets monthly using five replicate measurements of a frequently used volume setting in accordance with GL-LB-E-010 for Maintenance and Use of Air Displacement Pipets. As specified in the SOP, the calibration of an air displacement pipet is verified daily prior to use, based on a single point measurement.

The acceptance criteria for each measurement are based on the standard deviation of the five calibration measurements. Tolerance limits for commonly used verification volumes and accuracy and precision checks are included in the pipet calibration logbook. Calibrations and daily calibration verifications are traceable to each pipet using the unique identification found on its label.

If a pipet does not meet the calibration tolerance limits, it is removed from service until it again demonstrates compliance after being cleaned and/or repaired. Analysts whose jobs may require the use of air displacement pipets are trained in their proper use and calibration.

7.2 Instrument Calibrations

To ensure that the data generated by an instrument are accurate, we calibrate the instrument using standards containing known concentrations of target analytes. We verify the accuracy of calibration standards by analyzing an additional standard containing the target analytes. This initial calibration verification standard (ICV) originates from a second source. The stability of the instrument over the calibration range is verified by the analysis of a continuing calibration verification standard (CCV).

Traceability of calibration, calibration verification, and other quality control standards to the recognized standard is documented per GL-LB-E-007 for Laboratory Standards Documentation. Individual identification numbers are assigned to each source standard and each subsequent intermediate and working standard prepared.

The identification number makes it possible to trace a standard to a parent standard and ultimately to the source standard. The date each standard is prepared, the protocol used in the preparation, the person preparing the standard, and the standard's expiration date are documented in the appropriate standards log, usually maintained in AlphaLIMS. The information is accessible via the standard ID number.

We record standard and reagent ID numbers on instrument run logs, analytical logbooks, sample preparation logs, and instrument raw data. Calibration standards that are used in the analysis of a particular sample or group of samples can be traced to NIST, US EPA, or other nationally recognized standards.

Calibration procedures for specific instruments, and the frequencies of performance for defined methods, are described in the applicable operating or analytical SOP. Calibration is discussed in general terms in GL-QS-E-014 and includes standard laboratory practices and formulas used for determinations made by these practices. General guidelines include:

- Verification of initial calibrations with a standard obtained from a second source (unless one is not available).
- Analysis of verification standards (ICV and CCV) with each initial calibration within 15% of the true value unless historical data have demonstrated that wider limits are applicable.
- Preparation of calibration curves as specified in the reference method.

If a test method does not specify the number of calibration standards, the minimum number is two, not including blanks, with one at the lowest quantitation limit. The reference SOP must establish the initial calibration requirements.

7.3 Calibration Verification

Unless otherwise specified by the method or demonstrated through historical data, the recovery of target analyte(s) in calibration verification standards shall be between 85 - 115%. We discuss additional requirements below.

7.3.1 Initial Calibration Verification (ICV)

- If an initial calibration curve is not established on the day of analysis, the integrity of the curve should be verified each day of use or every 24-hour period. Verification requires the initial analysis of a blank and standard from a second source. The standard concentration should be at the method-defined level. If not specified, a standard at a mid-level concentration may be used.
- If the initial calibration verification does not meet acceptance criteria, the analytical procedure is stopped and evaluated, and appropriate corrective measures are taken. Initial calibration verification must be acceptable before any samples are analyzed.

7.3.2 Continuing Calibration Verification (CCV)

Additional standards called CCVs are analyzed after the initial calibration curve or the integrity of the initial calibration curve is accepted. CCVs are analyzed at a frequency of 5% or every 12 hours, whichever is more frequent. If an instrument consistently drifts outside the acceptance criteria before the next calibration, the frequency is increased.

CCVs may be from the same source as the calibration standards or from a second source. The concentration is determined by the anticipated or known concentration of the samples and/or method-specified levels. At least one CCV shall be at a low-level concentration.

To the extent possible, we bracket the samples in each interval (every 20 samples or every 12 hours) with CCV concentrations closely representing the lower and middle range of reported sample concentrations. If this is not possible, the standard calibration checks should vary in concentration throughout the range of the data being acquired.

If the recovery of a CCV does not meet the acceptance criteria and routine corrective actions fail to produce a second consecutive check within acceptance criteria, a new initial calibration curve should be constructed. Analytes of interest found in corresponding environmental samples may be reported, however, only if all of these criteria are met:

1. CCV recovery for target analyte exceeds the acceptance criteria (biased high)
2. Target analyte in the environmental sample is not detected at a concentration exceeding the level required by client contract (i.e., MDL, PQL).

Non-detects that meet these criteria are also referred to as "passable non-detects."

If samples are found to contain target analytes that exceed the associated quantitation limits, and the CCV recovery does not meet the acceptance criteria, the affected samples are re-analyzed. This occurs only after a new calibration curve has been established, evaluated, and accepted.

7.4 Bioassay Instrument Calibration and Frequency

Our Bioassay instruments are calibrated at the frequency of the instrument's use, stability, and method requirements. The calibration procedure for each instrument is described in the corresponding analytical SOP and is performed by those individuals proficient in the analyses described in the SOP.

SECTION 8
ANALYTICAL METHODS AND STANDARD OPERATING PROCEDURES

Section 8 - Analytical Methods and Standard Operating Procedures (SOPs)

We provide a wide array of parameters including volatile organics, extractable organics, metals, general inorganic/wet chemistry, radiochemistry, radiobioassay and limited microbiology. The procedures we use to determine these parameters are consistently executed due to our extensive system of SOPs and our training requirements for analytical staff.

A list of our SOPs and the analytical methods they represent (if applicable) is provided in Appendix I. Discussed here are:

- Selection of analytical methods
- Standard operating procedures
- Method validation and initial demonstration of capability
- Sample aliquots
- Data verifications
- Standard and reagent documentation and labeling (Refer to Section 10.1)
- Computers and data requirements

8.1 Selection of Analytical Method

Project Managers are ultimately responsible for selecting the test codes and methods assigned to a client based on client requirements and sample collection techniques. In selecting methods, our goal is to meet the specific needs and requirements of the client while providing data that are scientifically valid.

When the use of a specific test method is mandated, only that method is used. If the analysis cannot be performed by the client-requested method, we notify the client. We do not perform method substitutions without the client's consent. We recommend that clients who submit data to regulatory agencies also obtain the agency's approval of method modifications.

When clients have specific process or reporting deviations from GEL's standard practices, the laboratory may document the deviations in contracts, case narratives and/or with specific work instructions from the Project Management Team to the laboratory. Approval of the deviations is made after consideration of all safety and quality concerns have been resolved by GEL's management.

A Project Management AlphaLIMS Manual (GL-CS-M-001) is available to assist PMs and PMAs in selecting test codes and methods and communicating the client's analytical and data reporting specifications.

8.2 Standard Operating Procedures (SOPs)

We determine each parameter by the protocol detailed in the corresponding SOP. The defined protocol originates from the analytical method or methods referenced in the SOP and may incorporate regulatory and client requirements. Descriptions of the methods we employ can be found in:

- EPA SW-846, 3rd Edition, Revision III
- EPA/600/479/020
- Official Methods of Analysis of the Association of Official Analytical Chemists (AOAC)
- American Society for Testing and Materials (ASTM)
- Standard Methods for the Examination of Water and Wastewater (SM)
- South Carolina Department of Health and Environmental Control (SCDHEC)
- Code of Federal Regulations (CFR) Titles 40 and 49
- Department of Energy Environmental Measurements Laboratory (EML)
- Los Alamos Health and Environmental Chemistry (LAHEC)
- DOE
- HASL
- EPA CLP

In addition to these references, a number of our radiochemistry procedures were developed in conjunction with Florida Sate University (FSU) under the guidance of Dr. Bill Burnett.

Laboratory sections have access to GEL's SOPs to ensure that each operational system and analytical procedure is performed in a uniform manner. SOPs are controlled according to GL-DC-E-001 for Document Control and are posted on the Intranet by the Document Control Officer.

We write and issue SOPs in accordance with GL-ADM-E-001 for the Preparation, Authorization, Change, Revision, and Release of Standard Operating Procedures. A technical and/or quality review is made of each new or revised SOP prior to its implementation.

Technical reviews ensure that procedures are technically sound and method-compliant, and are conducted by a senior analyst, group leader, or data reviewer. The quality review is an independent review by a member of the Quality Systems team and ensures that the quality requirements of the method, regulatory agencies, and GEL are adequately and accurately identified.

SOPs are modified when:

- Instruments or equipment change
- An error is identified
- Improvements in technology and/or reagents need to be incorporated
- Reference methods are revised or discontinued

Proposed revisions are submitted for review on Documentation Initiation and Revision Request (DIRR) forms. Changes are not implemented without a technical and quality review.

We review our SOPs annually and revise them as necessary. Analytical SOPs either contain or reference other SOPs that contain:

- reference method
- applicable matrix or matrices
- method detection limit
- scope and application including parameters to be analyzed
- method summary
- definitions
- interferences and limitations
- specific safety requirements
- required equipment and supplies
- reagents and standards
- sample collection, preservation, shipment, and storage
- quality control
- calibration and standardization
- procedure
- calculations
- method performance
- pollution prevention
- data assessment and acceptance criteria for quality control measures
- corrective actions for out of control or unacceptable data
- waste management
- references
- tables, diagrams, flowcharts, validation data
- identification of any modifications we have made to the published procedure

8.3 Method Validation and Initial Demonstration of Capability

An initial demonstration of method performance is required before a new analytical method is implemented and any time that there is a significant change in instrumentation or methodology. Exempted from this requirement are microbiological analyses and any tests for which spiking solutions are not available. Analyses that are exempt include those for determining:

- total dissolved, total suspended, total volatile, and total solids
- pH
- odor
- color
- free liquids
- temperature
- dissolved oxygen
- turbidity

We conduct the initial demonstration as described in Section 8.3.1. Records of initial demonstration are maintained in accordance with GL-QS-E-008 for Quality Records Management and Disposition. These records are available upon request.

After we demonstrate our ability to perform a specific analysis, we continue to demonstrate method performance through the analysis of laboratory control samples and performance evaluation samples.

If spiking solutions or quality control samples are not available, an analyst is trained by a qualified trainer to conduct the analysis. Analyst capability and proficiency is evaluated by the appropriate Group Leader before the analyst is qualified to perform the analysis on client samples. The evaluation is documented and maintained

according to GL-QS-E-017 for Maintaining Technical Training Records.

8.3.1 Procedure for Initial and Continuing Demonstrations of Capability (IDOC and CDOC)

We conduct initial demonstrations of capability for mandated analytical or EPA reference test methods following the procedure outlined below. This procedure is adapted from the EPA test method published in 40 CFR part 136, Appendix A and the 2003 NELAC Standard. IDOCs are completed whenever there is a change in instrument type, method or personnel. CDOCs are completed annually.

Step 1: A quality control sample is obtained from an outside source (if possible). If one is not available, the sample may be prepared internally using stock standards that are prepared independently from those used in instrument calibration. The concentration is not known to the analyst.

Step 2: The QC sample is diluted in a volume of clean matrix. Sufficient volume of the diluted QC sample is prepared so that at least four aliquots of the required method are analyzed. Alternatively, four matrix spike samples may be evaluated for levels of precision and accuracy.

Step 3: Four aliquots of the diluted quality control sample are prepared and analyzed according to the analytical test method. This may occur concurrently or over a period of days.

Step 4: With the results obtained from the analysis of the diluted QC sample, the average recovery (x) in the appropriate reporting units (such as µg/L) and the standard deviation of the population sample (n-1) (in the same units) are calculated for each parameter of interest.

Step 5: For each parameter, the standard deviation (s) and the average recovery (x) are compared to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory-generated acceptance criteria. If "s" and "x" for all parameters meet the acceptance criteria, analysis of samples may begin. If any one parameter exceeds the acceptance range, the performance is unacceptable for that parameter.

Step 6: When one or more tested parameters fail one or more of the acceptance criteria, we locate and correct the source of the problem and repeat the test for every parameter of interest.

Other options for successful IDOCs are the following:

- PT Study- successful analysis of a PT Sample. The PT sample may be single-blind to the analyst or double blind to the laboratory.
- Supervised Analysis- where other options are not practical, supervised analysis of a procedure may be used to demonstrate capability.
- Analysis of authentic sample with results statistically matching those obtained by another trained analyst.
- Other – this option may be used for certain personnel having sufficient analytical skills to develop a new procedure, as deemed appropriate by the supervisor or Quality Assurance personnel.

8.4 Sample Aliquots

When obtaining aliquots from a sample, it is imperative that the subsamples be representative of the parent sample. This ensures that the results obtained from the analysis of the aliquots are representative of the entire parent sample, not just the subsample. We employ different techniques to obtain subsamples. GEL's SOP for subsampling is GL-LB-E-029.

We can obtain representative aliquots of soil samples for the determination of metals through quartering. This involves the repeated quartering of the sample until the resulting quarter is equivalent to the amount of sample needed for analysis. Quartering may not be appropriate for obtaining subsamples for volatiles or other analyses where potential contamination or loss of target analytes is a concern.

Water samples are inverted several times prior to the collection of a subsample. This ensures a thorough mix and is absolutely required for the accurate determination of analytes like total and total suspended solids.

The appropriate techniques for obtaining sample aliquots for designated analyses are discussed in the applicable SOPs.

8.5 Data Verification

All of the data we include in final reports to our clients undergoes extensive data verification. At GEL, we have a multi-level review process that takes place in all areas of the laboratory beginning with sample login. This

process and the responsibilities of each level of review are delineated in a number of procedures, including GL-GC-E-092 for General Chemistry Data Review and Packaging, GL-MA-E-017 for Metals Data Validation, and GL-RAD-D-003 for Data Review, Validation, and Data Package Assembly.

8.5.1 Sample Login:

Samples are analyzed by the methods and for the target analytes identified when samples are logged into our database. If there is an error in this entry that is not promptly identified, the incorrect analytical method may be used or certain analytes may not be determined.

To prevent this, the person who enters the information into the database is generally the client's assigned Project Manager or PM Assistant. This entered information is reviewed against the client confirmation letter and/or chain of custody. If errors are identified, they are immediately corrected.

8.5.2 Data Validation in the Laboratory

The multi-level review process in our laboratory includes initial review by the analyst, a second review by a peer, and a final review by a group leader or data reviewer. Where appropriate based on personnel and client needs, the industrial division institutes two levels of review.

Our analytical data reviews ensure that:

- The analytical procedures comply with current SOPs.
- Quality control samples are analyzed at the frequency specified in the SOP or client specifications.
- The acceptance criteria for quality control samples are met, including recoveries of matrix spikes and laboratory control samples, the relative percent difference for matrix duplicates, matrix spike duplicates, laboratory control sample duplicates, and concentrations of target analytes in the method blank.
- Instrument data, run logs, and logbooks are reviewed to ensure that all method quality control criteria were met (e.g., calibration, initial calibration verifications, and continuing calibration verifications).
- Documentation is sufficient to reconstruct the analytical procedure.
- Data are maintained according to GL-LB-E-008 for Basic Requirements for the Use and Maintenance of Laboratory Notebooks, Logbooks, Forms, and Other Recordkeeping Devices.
- Raw data are in agreement with the computer generated batch sheets and data reports.
- The calculations, dilution factors, concentration reported, and nominal concentrations are verified.
- Comments, qualifiers, or nonconformances for noncompliant or questionable data are documented.
- Data generated when the analytical process appears to be out of statistical control are not reported.

8.5.3 Validation of Data Reports and Packages

Before we report data to the client, we review the requested data report for package accuracy, completeness, and client-specifications. Responsibilities for review are dependent upon the type of report or package being generated. (Refer to Section 11 for Laboratory Report Formats.)

When a client is receiving a certificate of analysis or certificate of analysis and Quality Control Summary Report, the Project Manager (PM) or Project Manager Assistant (PMA) reviews the information for accuracy, completeness and the addition of pertinent comments made by the laboratory about the analysis or sample. The PM or PMA also reviews data for consistency as described in the Project Management AlphaLIMS Manual, GL-CS-M-001.

If a client requests a case narrative, our data validators review the analyst-prepared case narrative for accuracy and to assure its consistency with the information included on the certificate of analysis and Quality Control Summary Report. If a client requests a more detailed level of data package up to and including a CLP-like package, every laboratory fraction of data is reviewed by that fraction's data validator. The data are then compiled into a final data package.

8.6 Standard and Reagent Documentation and Labeling

The documentation and labeling of standards and reagents is addressed in GL-LB-E-007 for Laboratory Standards Documentation, and in Section 10.1 of the QAP, Recordkeeping System and Design.

8.7 Computer and Electronic Data Related Requirements

Our Information Management System (IT) SOPs describe the way in which we manage our software programs and hardware systems. Control of software development and modification activities is described in GL-IT-E-003 for Requirements, Design, Operation, Validation, and Removal of Hardware and Software Systems Used by the GEL Group, Inc. All development and revision activities are validated, verified, and controlled with revision software or other procedures prior to production use.

Analytical software that is purchased from a vendor is validated and verified in accordance with GL-IT-E-005 for Requirements, Design, Operation, Validation, and Removal of Applications Used by The GEL Group, Inc. Documentation requirements are also described in this SOP.

SECTION 9
SAMPLE HANDLING, ACCEPTANCE, RECEIPT, AND INTERNAL CHAIN OF CUSTODY

Section 9 - Sample Handling, Acceptance, Receipt, and Internal Chain of Custody

The way we receive and handle samples is critical to providing our clients with data that are of the highest quality and are legally defensible. We have strict policies that govern the acceptance and receipt of a sample, sample handling and integrity, maintenance of the internal chain of custody, and storage of the sample upon completion of the required analytical processes. This section describes the policies and practices that we employ, including the following:

- Agreements to perform analysis
- Proper labeling of submitted samples
- Chains of custody
- Sample receipt procedures
- Sample receipt procedures for radioactive samples
- Sample tracking
- Sample storage
- Sample disposal

9.1 Agreement to Perform Analysis

Before we accept samples, we should have an agreement with the client that specifies the analytical methods, the number of samples to be analyzed, the price for the analysis, the date by which the client must receive results, and the reporting format. Any special requirements the client may have, such as non-routine methods and reporting limits, should be part of that agreement.

An agreement to perform analysis should be in one of three forms, further detailed in our Analytical Services Reference Manual and the SOPs for Delegated Authoriity to Commit the Company and Request for Proposal (RFP) and Contract Review (GL-CO-E-002 and GL-CO-E-003):

- Client confirmation letter (CCL) between the client and project manager for a specific group of samples. This letter includes the cost, turn-around time, requested analysis, sample matrix, number of samples, and type of client report.
- Sample acceptance by the Project Manager from an established client based on previously agreed conditions and confirmed by the client's submission of the sample(s).
- Contractual agreement for analytical services over a designated time period or project that delineates the specifications agreed upon.
- When the laboratory agrees to perform analyses with exceptional departures from normal processes, these exceptions are clearly defined in the client-laboratory agreement.

9.2 Sample Labels and Chain of Custody Forms

Once an agreement is established, we assume joint responsibility with the client to ensure that the samples submitted are properly labeled and accompanied by full and complete documentation that includes chain of custody and, where possible, material safety data sheets. Samples that are submitted without proper documentation may be refused.

Sample labels should include the:

- client's sample identification
- location, date, and time of collection
- collector's name
- chemical preservatives used
- constituents of interest (if space permits)

When requested, we ship labeled sample containers with appropriate preservatives and a chain of custody to the client for use during sample collection. There are several advantages to using these containers, including:

- Dedication of appropriate type sample container for the intended analyte or analytical method.
- Proper sample preservation for analytical test
- Traceability of bottle lot number to the manufacturer's certification that the containers are clean and show no signs of contamination.

Chain of custody forms include the following information and are initiated at the time of sample collection:

- name and address of client
- client sample identification
- date and time of sample collection

- sample matrix
- description of sampling site location
- number of containers
- methods, chemical and physical constituents for which the analyses are to be conducted
- preservatives
- date and signature of person who collected the sample
- date of transfer and signature of person relinquishing sample to the laboratory.

When our Field Services personnel collect samples, our standard chain of custody form and certified containers are automatically used. Our standard chain of custody forms are also available to our clients and are included with each shipment of pre-labeled and preserved containers. GEL chain of custody forms should always be used unless otherwise agreed to by contract.

9.3 Sample Conditions

In addition to properly documenting sample container labels and the chain of custody form, we need to make sure that samples meet the established requirements for analytical testing. This is particularly critical for samples that are being analyzed to meet regulatory requirements.

Samples should be collected in the appropriate type of container, preserved as directed, and stored in the conditions specified in the analytical method or established regulatory guidelines. In addition, samples should be submitted with sufficient time to conduct the specified analysis within the regulatory or method holding time. Aliquots should be of sufficient volume to perform the requested analyses. A summary of these conditions and holding times for routine analyses can be found in Appendix J.

9.4 Sample Receipt

Samples submitted to us are received in a central sample receiving area by our sample custodian or login clerk. Every sample is subject to the protocols established in GL-SR-E-001 for Sample Receipt, Login and Storage.

Our sample custodian acknowledges receipt of a sample by signing the chain of custody and recording the date and time custody was transferred from the client to the laboratory. The date, time, and person receiving the sample are also recorded on a standard or client-specific Sample Receipt Review (SSR) form.

The sample custodian is also responsible for noting the condition of a sample upon its arrival. This information is recorded on both the sample chain of custody and the Sample Review Receipt form. As detailed in GL-SR-E-001, the sample custodian should:

- Inspect all sample containers for integrity.
- Document any unusual physical damage or signs of tampering with custody seals.
- Place any samples that appear to be leaking or have unusual odor under the fume hood while notifying the responsible project manager.
- Review the chain of custody submitted by the client for completeness.
- Compare descriptions and other information on the sample container labels to that listed on the chain of custody.
- Verify the sample is within the regulatory holding time for the analyses.
- Measure and record the temperature of sample aliquots that are to be used for analyses requiring thermal preservation.
- Measure and record the pH of all sample aliquots submitted for analyses that require chemical preservation to a specific pH.
- Verify that there are adequate sample aliquots for the requested analyses.
- Verify that appropriate sample containers were used for requested analyses.

If the sample custodian discovers any abnormalities or departures from standard conditions, the PM is informed immediately. The PM will then notify the client as quickly as possible so that a decision can be made to proceed with the analysis or submit another sample or additional sample aliquots.

Common abnormalities or departures from standard conditions include:

- Sample containers with signs of damage, leaking, or tampering.
- Incomplete/missing chain of custody.

NOTE: If a nonradioactive sample has no chain of custody, the sample custodian should initiate one.

"INITIATED ON RECEIPT" should be documented on the chain of custody.

- Discrepancies between the information on the chain of custody and the sample container labels.
- Method or regulatory holding time is exceeded.
- Sample is not preserved to the method or regulatory-required pH.
- The sample container does not meet method or regulatory criteria.
- The sample temperature exceeds or falls below the thermal preservation regulation or method requirement of 0° ≤ 6° C.

NOTE: If a sample is hand delivered to the laboratory immediately after collection with evidence that the chilling process has begun (arrival on ice), the sample shall be deemed acceptable.

- Radioactivity that exceeds that allowed by our radioactive license. (The handling of radioactive samples is discussed in 9.5.)

Samples that are not appropriate for the requested analyses or have no full test specifications require:

- Retention of all correspondence and records of conversations concerning the final disposition of the sample.
- Full documentation on the chain of custody and Sample Receipt Review form of the nonconforming condition and a decision to proceed with analysis.
- Documentation that the analysis is qualified appropriately on the final report.

9.5 Receipt of Radioactive Samples

The radioactive samples we receive are subject to the same monitoring identified in 9.4 when radioactivity levels do not exceed the level permitted by our license. Special procedures governing the receipt of radioactive samples are described in the GL-RAD-S-007 for the Receiving Radioactive Packages. These procedures prevent the inadvertent spread of radioactive contamination.

Because we cannot exceed the limits of our radioactive license, it is imperative that our clients notify us of impending shipments of radioactive samples. We reserve the right to refuse and return any radioactive sample where the radioactivity:

- Exceeds our permitted level by itself or in combination with other samples already on site; or
- Exceeds our administrative level of 25 mR/hr.

The following special requirements for receiving radioactive samples are applicable:

- Only designated staff trained in the proper handling of radioactive materials handle radioactive samples.
- If a sample is labeled as radioactive, the custodian will immediately inform the Radiation Safety Officer (RSO) before opening the sample.
- The radioactivity of the sample will be measured by scanning the exterior surface of the cooler using a survey meter calibrated in mR/hr. Refer to GL-RAD-S-001 for our Radiological Survey Procedures.
- If the radioactive level of the exterior of the cooler exceeds 0.5 mR/hr, the RSO will be notified before the cooler is opened.
- If the radioactivity level of a sample or group of samples is found to exceed 25 mR/hr, the RSO will be notified immediately. The client will be contacted and arrangements will be made to return the sample(s) or reduce the per sample exposure.
- If a chain of custody is not submitted with a sample, it will be placed on hold until a chain of custody is submitted.
- The inside of the cooler will be surveyed to ensure that no leakage or contamination has occurred.
- Each sample container will be surveyed and the highest reading will be documented on the Radioactive Shipment Inventory.

9.6 Sample Tracking

We track the samples we receive by a unique laboratory identification number that is automatically assigned when information pertaining to the sample is first entered into our database. Pursuant to GL-SR-E-001, the following information is entered for each sample received:

- client and/or project code
- client sample ID
- sample matrix
- equivalent laboratory sample matrix
- type of report format specified by client
- date and time of collection
- date received

- initials of person making entries
- number of containers submitted for the sample
- requested analyses
- pertinent observations or comments affecting the sample analysis or rejection

As soon as this information is entered, AlphaLIMS automatically assigns a unique number to the sample and its containers. We use the number to track the location of a sample container and to link to any subsamples and subsequent digestates and extracts.

The unique laboratory identification number is printed on a durable barcode label that contains the client identification, sample date and time. Once labeled, the sample container's identification number is uploaded into the database by scanning the barcode. Information included in the database at the time of sample scanning is the container's storage location, bottle type and volume, physical characteristics of the bottle, preservative, and the initials of the person entering this information. Entering of this information into the database is an important part of initiating our electronic internal chain of custody.

9.7 Internal Chain of Custody

Chain of custody procedures ensure traceability and sample integrity. Our legal and evidentiary chain of custody protocol establishes a continuous record of the physical possession, storage, and disposal of sample containers, collected samples and aliquots, and sample digestates or extracts.

The internal chain of custody starts with the scanning of a container's barcode label into an electronic database while identifying the location of the sample and the person having custody, or placing the sample in a secured storage area. If we supply the containers, the chain of custody may begin when the containers are provided to the client.

With regard to the internal chain of custody, a sample is defined as being in someone's custody if:

- It is in one's actual physical possession
- It is in one's view after being in one's physical possession
- It is in one's possession and then is locked up so that no tampering may occur
- It is kept in a secured area restricted to authorized personnel only

The protocol for ensuring sample integrity using the internal chain of custody is detailed in GL-LB-E-012 for Verifying the Maintenance of Sample Integrity. The electronic internal chain of custody works in conjunction with the chain of custody submitted by the client with a sample to:

- Account for all time associated with a sample, its subsamples, and extracts or digestates from the time the sample is received at GEL to its disposal
- Identify all individuals who physically handled the sample
- Provide evidence that the sample was stored in accordance with method and regulatory protocols

The electronic internal chain of custody is stored in AlphaLIMS so that information demonstrating the proper maintenance of custody can be provided to the client on the data reports or electronic data deliverables.

9.8 Sample Storage

In order to ensure the maintenance of sample integrity, all aliquots are stored in secured areas designated for sample storage. The storage location of each sample aliquot can be tracked using the internal chain of custody. Areas designated for sample storage include:

- Main cooler where most samples requiring maintenance at a temperature range of $0° \leq 6°$ C are stored.
- Volatile coolers for samples to be analyzed for volatile contaminants.
- Radioactive cooler for segregation of radioactive sample aliquots requiring refrigeration.
- Ambient storage for non-radioactive samples not requiring refrigeration.
- Ambient storage for radioactive samples.
- Refrigerators for the storage of samples requiring bacteriological analysis and temporary storage for those requiring the determination of biochemical oxygen demand.

The temperature of each refrigerated storage unit is monitored at least twice a workday and documented per GL-LB-E-004 for Temperature Monitoring and Documentation Requirements for Refrigerators Freezers, Ovens Incubators, and Other Similar Devices. In addition, the main and radioactive coolers are monitored twenty-four hours a day by temperature sensors that are

connected to our main security system. If the temperatures exceed the required range, an alarm is sounded and the security system notifies the facilities manager or his designee immediately. This allows corrective actions to be initiated promptly.

Prior to and immediately after analysis, samples and their digestates and extracts are stored in compliance with the requirements of the requested analytical methods and GL-SR-E-001 for Sample Receipt, Login, and Storage. If a single aliquot is supplied for analyses by several methods, the most stringent analytical storage requirements are applied to the sample.

If samples are to be analyzed for volatile organic compounds, they are stored in designated volatile coolers that are maintained at a temperature range of 0° ≤ 6° C. No sample aliquots are stored in these refrigerators unless they are to be analyzed for volatiles. These storage units are monitored on a weekly basis for contamination by the analysis of volatile cooler storage blanks.

At the beginning of each month, eight 40 mL vials are filled with treated deionized water, which is used for volatile method blanks and placed in each volatiles cooler. Each week, two vials are analyzed by EPA 8260B and the data are reported to the Quality Department. If the analysis reveals evidence of potential contamination, appropriate corrective actions are immediately implemented.

Sample aliquots for non-volatile analysis, which also should be maintained at 0° ≤ 6 ° C, are stored in the main cooler unless they are radioactive. In order to reduce the chance of contamination, radioactive samples are stored in a designated cooler.

Sample aliquots designated for the determination of total coliform bacteria, fecal coliform bacteria, or total plate count are delivered to the bacteriology laboratory and stored in the designated refrigerator at a temperature range of 0° ≤ 6° C. This allows easy access for the analyst ensuring that the short regulatory holding times are met. After analysis is complete, the remaining sample aliquot is disposed of in accordance with the Laboratory Waste Management Plan.

Sample aliquots to be analyzed for biochemical oxygen demand (BOD) are also delivered to the bacteriology laboratory and stored in the designated BOD cooler. This cooler is also maintained at 0° ≤ 6° C. After initiation of this analysis, the sample aliquots are returned to the main cooler.

After all analyses are complete and results are submitted to the client, sample aliquots are transferred to the sample archive area. They are stored in this area until they are disposed.

Radioactive and non-radioactive samples remain segregated in archive to reduce the risk of contamination.

9.9 Sample Disposal

Our policies concerning sample disposal are described in the Laboratory Waste Management Plan, GL-LB-G-001 and can be divided into two categories: those governing the disposal of sample laboratory waste, and those directing the disposal of remaining sample aliquots after the completion of all analyses.

9.9.1 Sample laboratory waste

Unless otherwise requested by contract, laboratory sample waste is collected throughout the laboratory in designated satellite containers found in sample collection and accumulation areas. Sample wastes are segregated based on the type of analysis by which they were generated, by matrix, and radioactivity. This contains certain process contaminants thus decreasing the amount of waste material that may be labeled hazardous. It also ensures that solid and aqueous wastes are not mixed.

We have separate radioactive and non-radioactive staging areas. The composited sample wastes then undergo hazardous waste characterization. The analyses allow GEL to properly characterize the waste according to EPA regulations.

Sample waste is disposed in accordance with the Laboratory Waste Management Plan, GL-LB-G-001.

9.9.2 Remaining Sample Aliquots

Samples not consumed during the sample preparation or analytical procedures are either returned to the client in accordance with GL-SR-E-002 for Transportation and Shipping of Samples and Pre-Preserved Sample Containers or disposed pursuant to the Laboratory Waste Management Plan. Non-radioactive samples are returned to a client under the conditions and terms agreed to by contract. A chain of custody listing the laboratory waste technician as the relinquishing party is enclosed with each set of samples being returned to a client. Unless otherwise specified by the client, all non-radioactive samples are

shipped by an approved package carrier. If the samples are radioactive, the procedure for shipment is delineated in GL-SR-E-002 for Transportation and Shipping of Samples and Pre-Preserved Sample Containers.

It is our policy to hold samples for a minimum of thirty days after invoicing and before disposal, unless otherwise specified by contract or if the sample is part of litigation. If the sample is part of litigation, disposal of the physical sample shall occur only with concurrence of the affected legal authority, sample data user, and/or client.

When sample analyses are complete and regulatory and/or contractual holding times have expired, samples are moved from their storage locations to the radioactive or non-radioactive archives. Samples that are to be returned to the client or held for an extended time period are segregated from the other samples. Radioactive and non-radioactive samples remain segregated.

When internal or client-specified storage time expires, samples with like matrices are composited into appropriate containers. The composites are then subject to the same treatment and disposal protocol as described in 9.9.1. Samples that are approved for disposal are scanned into our database and assigned the status of "Disposed."

SECTION 10
RECORDS

Section 10 - Records

Our quality records provide the documentation we need to support analytical results and conclusions. Documented evidence that quality assurance and quality control requirements have been met is critical to providing data that fulfill the specifications of applicable procedures, programs, and contracts.

As described in Section 3 of this Quality Assurance Plan (QAP), quality records include but are not limited to:

- Observations
- Calculations
- Calibration data
- Certificates of analysis
- Certification records
- Chains of custody
- External, supplier, and internal audits
- Run logs
- Instrument data and analytical logbooks
- Instrument, equipment and building maintenance logs
- Material requisition forms
- Monitoring logs
- Nonconformance reports
- Corrective actions
- Method development and start-up procedures including MDL studies
- Training records
- Waste management records
- Standard logs
- Software validation
- Standard operating procedures (SOPs)
- Sample collection and field data

Our procedures provide a legal and evidentiary chain of custody are described in Section 9 of this QAP. Described in this section are:

- Record keeping system and design
- Records management and storage
- Sample handling records
- Records of support activities
- Analytical records
- Administrative records

10.1 Recordkeeping System and Design

We manage, maintain and store our quality records according to GL-QS-E-008 for Quality Records Management and Disposition. The protocols established in this document work in conjunction with those for specific types of records addressed in other SOPs to govern our record keeping system. Our record keeping system allows the historical reconstruction of all laboratory activities that produced analytical data.

We facilitate historical reconstruction by maintaining the following records and information, from the time a sample is received until it is disposed.

- A master list of all employee signatures and initials is maintained in Human Resources. This allows the identification of any GEL personnel who accept, handle, analyze, prepare, review, store, or dispose of a sample, its subsamples, associated data and reports, and other related documentation.
- If we provide bottles and containers to a client or sampling personnel, these records are kept in accordance with GL-SR-E-002 Transportation and Shipping of Sample and Pre-preserved Sample Containers. These electronic and paper records include:
  - Supplier and lot numbers of containers and/or bottles provided
  - Certifications that the containers are free of contaminates that may bias the analyses
  - Addition of preservatives and identity of person responsible for this preservation.
  - Barcode of containers supplied to a particular client or for a specific field-sampling event.

The person or agency responsible for collecting a sample is documented on the chain of custody and entered into AlphaLIMS. Other records supporting the acceptance of a sample include:

- Date and time of sample receipt
- Person accepting sample
- Condition of sample upon receipt
- Client-confirmation letter and/or sample quote
- Client chain of custody

- Electronically generated sample ID numbers specific to each sample aliquot and linked to the client's sample description, sample collection and receipt information, and analyses to be performed.
- Identification of each person who has custody of a sample, its subsamples, extracts, or digestates. (This is provided through the internal chain of custody procedures described in Section 9.)

Documentation that materials purchased for use in the analysis or preparation of samples meet specifications is maintained in accordance with GL-RC-E-001 for Receipt and Inspection of Material and Services.

Records of equipment calibrations are maintained and traceable by date and ID number to a specific analysis. These records include certifications of calibration and service that have been initialed or signed.

Our thermometers are verified against the NIST traceable thermometer and records of this verification are maintained as described in GL-QS-E-007 for Thermometer Verification. Records of the daily and monthly calibration verifications of our analytical balances are kept in accordance with GL-LB-E-002 for Balances. The calibration records for our air-displacement pipets are maintained in pipet calibration logs specific to each pipet according to GL-LB-E-010 for Maintenance and Use of Air Displacement Pipets.

When methods and/or regulations specify that samples, subsamples, extracts, and/or digestates be stored at designated temperatures, or when the method, itself, has temperature sensitive steps, we document those temperatures on monitoring logs at the frequency defined in the corresponding SOPs. We can trace the specific storage location of a sample through the internal chain of custody.

We require that the initials of all personnel responsible for monitoring temperatures be recorded in the temperature monitoring logs pursuant to GL-LB-E-004 for Temperature Monitoring and Documentation Requirements for Refrigerators, Freezers, Ovens, Incubators and Other Similar Devices. The logs are reviewed for completeness in accordance with GL-QS-E-005 for Review of Monitoring Device Logs.

Documentation on the instruments and equipment used for the analysis of samples is recorded in run logs, laboratory logbooks, instrument data and/or sample preparation logs. Routine or corrective maintenance that is performed on equipment or instruments is recorded in the maintenance log specific to the instrument. We document these records in accordance with GL-LB-E-008 for Basic Requirements for the Use and Maintenance of Laboratory Notebooks, Logbooks, Forms and Other Recordkeeping Devices.

The standards containing known quantities of target analytes that we use in instrument calibration, calibration verification, and as quality control samples, such as matrix spikes and laboratory control samples, are documented according to GL-LB-E-007 for Laboratory Standards Documentation. These records contain the following information.

- Protocol by which each standard was prepared
- Traceability of each child standard to its parent
- Date each standard was prepared
- Initials of person preparing the standard
- Expiration dates
- Concentration of each standard

This information allows us to document that the standards used were prepared in accordance with the established protocol, produced using source standards that meet the method and regulatory criteria, and used prior to their expiration date.

If required, reagents used in the preparation, dilution, and analysis of samples are verified to be free of interferences or target analytes. We record these verifications in the reagent logs in accordance with GL-LB-E-008 for Basic Requirements for the Use and Maintenance of Laboratory Notebooks, Logbooks, Forms and Other Recordkeeping Devices.

Analytical and sample preparation methods applied to each sample aliquot are documented via the internal chain of custody, method information, and information recorded in lab notebooks, sample preparation logs, run logs, and instrument data. The laboratory protocol we employ during analysis is dictated by the SOP in effect at the time the sample was analyzed or prepared by a specific method.

Run logs, laboratory notebooks, instrument data and sample preparation logs are used to document the preparation and analysis of samples and the associated instrument calibrations. These logs and notebooks are governed by GL-LB-E-009 for Run Logs and GL-LB-E-008 for Basic Requirements for the Use and

Maintenance of Laboratory Notebooks, Logbooks, Forms, and Other Recordkeeping Devices. As stated in these SOPs, sample preparation and analytical records that are not electronically generated should be:

- Legible
- Recorded in permanent ink
- Corrected using one line marked through the error, initialed and dated
- Initialed by the responsible party

We maintain electronic records for each analytical batch. These records include the ID numbers of each client and quality control sample prepared and/or analyzed together, the method of preparation and analysis, and the matrix of the samples included in the batch.

Through our electronic statistical process control system (SPC), the acceptance criteria applied for all quality control (QC) samples are stored and maintained. The acceptance limits for target analytes are method, matrix, and time-period specific, which allow us to regenerate the criteria applied to QC samples associated with identified client samples.

Our Quality Systems Team maintains the records of nonconformances and corrective actions associated with specific samples, batches, and processes. We maintain these records according to GL-QS-E-004 for the Documentation of Nonconformance Reporting and Dispositioning and Control of Nonconforming Items; and GL-QS-E-002 for Conducting Corrective/Preventative Action and Identifying Opportunities for Improvement.

Electronic data records are maintained in a secured database designed to protect the integrity of the data. Data that are uploaded directly from instruments and that are manually entered are backed up by a second system.

Permanent records of electronic data deliverables are maintained along with the corresponding sample preparation and analytical data review records. This documentation includes the initials of the reviewer and date of the review.

Records of the data we report to our clients are maintained in a manner that protects client confidentiality, as well as any potential national security concerns. These records include copies of certificates of analysis, quality control summary reports, case narratives, CLP forms, and other information we provided to the client. The copies may be paper or electronic. The majority of the data packages submitted to Federal clients are stored electronically prior to being submitted to the client.

Records of samples being disposed or returned to the client are documented in accordance with GL-SR-E-002 for Transportation and Shipping of Samples and Pre-Preserved Sample Containers. Such records include the date samples are returned or disposed, the destination of the samples, and name of the person transferring the samples.

10.2 Record Storage

We store quality records in compliance with GL-QS-E-008 for Quality Records Management and Disposition. The records are:

- Stored in a secured area to maintain data integrity and protect client confidentiality, including any national security concerns.
- Kept in areas where they are protected from fire loss, environmental deterioration, and, in the case of electronic records, electronic or magnetic sources.
- Indexed and filed in a manner allowing for ready retrieval.
- Accessible to the client for whom the record was generated.
- Retained for an identified period of time that equals or exceeds five years as determined by applicable law and client contract requirements.

Electronic data records are stored on compact disks.

All of the hardware and software we need to reconstruct data is maintained according to GL-IT-E-003 for Requirements, Design, Operation, Validation and Removal of Hardware and Software Systems Used by the GEL Group, Inc. Records that are stored or generated by network or personal computers have either hard copy or write-protected backup.

10.3 Sample Handling Policy

Records of all procedures applicable to samples are maintained in our possession. These records include documents that pertain to:

- Preservation, including sample container and holding time
- Sample identification, receipt, acceptance or rejection, and login

- Sample storage and tracking including shipping receipts, transmittal forms, routing and assignment records
- Sample preparation (ID codes, cleanup and separation protocols, volumes, weights, instrument printouts, meter readings, calculations, reagents)
- Sample analysis
- Standard and reagent origin, receipt, preparation, and use
- Equipment receipt, use, specification, operating conditions and preventative maintenance
- Instrument calibration frequency and acceptance criteria
- Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions
- Method performance criteria including expected quality control requirements
- Quality control protocols
- Electronic data security, software documentation and verification, software and hardware audits, backups and records of any changes to automated data entries
- Automated sample handling systems
- Disposal of hazardous samples

10.4 Records of Laboratory Support Activities

In addition to sample handling records, we maintain the following:

- Original raw data for calibrations, samples and quality control measures, including worksheets and data output records (chromatograms, strip charts, and other instrument readout records)
- A written description of or reference to the specific method used, including the computational steps used to translate parameter observations into a reportable analytical value
- Copies of final reports
- Archived standard operating procedures
- Correspondence relating to project-specific laboratory activities
- Corrective action reports, audits and audit responses
- Proficiency test results

10.5 Analytical Records

We document and maintain analytical records, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs according to GL-LB-E-008 for Basic Requirements for the Use and Maintenance of Laboratory Notebooks, Logbooks, Forms, and Other Recordkeeping Devices, and GL-LB-E-009 for Run Logs.

The information that is documented in analytical records includes:

- Laboratory sample ID code
- Date and time of analysis
- Instrument ID and operating conditions/parameter (or reference to such data)
- Method of analysis
- All calculations
- Dilutions
- Initials of analyst or operator
- Units of measurement

Our policy is to produce and maintain analytical records that are:

- Accurate
- Reviewed and verified
- Legible and understandable
- Traceable and authentic to their source
- Grouped in a contemporary manner with data entered and information recorded as it is obtained

10.6 Administrative Records

A number of pertinent records are maintained by Human Resources or Quality Systems, including:

- Staff qualifications and experience.
- Training records, including initial demonstrations of proficiency. (Refer to procedure GL-HR-E-002 for Employee Training.)
- A log of names, initials and signatures for individuals having responsibility for initialing laboratory records.

We monitor continuing demonstrations of proficiency through AlphaLIMS per GL-HR-E-002 for Employee Training.

SECTION 11
LABORATORY REPORT FORMAT AND CONTENTS

Section 11 - Laboratory Report Format and Contents

Accurate data are of little benefit to a client unless they are reported in a format that is easy to interpret and provides all pertinent information relating to the analysis of a sample. At GEL, we have developed certificate of analysis report formats that meet the different needs of our clients, yet provide all of the information necessary to satisfy regulatory requirements while allowing for the interpretation of the data. Each format provides accurate, clear, unambiguous and objective data.

In addition to a certificate of analysis, a client can request and receive an extended data package. This package may include any of the following: certificates of analysis; summaries of quality control; case narratives; instrument data; sample preparation data; measurement traceability and calibration information; and electronic data deliverables. If clients require the reporting of data following the established contract laboratory protocol (CLP), we can provide a CLP-like data package that will meet their needs.

It is important that the certificate of analysis format and data package requirements be discussed with the client prior to our acceptance of the samples. Project Managers and contract staff are responsible for establishing an agreement with the client concerning data reporting and the potential cost to the client for data packages and/or specialized reporting. Our analytical data are reported to three significant figures unless otherwise required by client contract.

Laboratory reports and data packages are stored and transmitted in a manner that protects client confidentiality and potential matters of national security. No reports or data packages are released to persons or organizations outside GEL without the expressed consent of the client. If directed by a regulatory agency or subpoenaed to submit documents to a court of law, we will notify the client of the demand and the records being released.

The following elements of report formats and data packages are described in this section:

- Certificates of analysis (C of A)
- Quality control summary reports (QCSR)
- Analytical case narratives
- Electronic data deliverables (EDDs)
- Types of data packages and reporting formats
- Review of data packages and reports

11.1 Certificates of Analysis

We have two primary C of A report formats, Level 1 and Level 2. Both contain the following information when applicable:

- Title
- GEL address and phone number
- Name of PM or person serving as the primary client contact
- Barcode identification of the C of A
- Number of page and total number of pages
- Name and address of client, where appropriate
- Project name or code if applicable
- Client-provided sample description
- Unique laboratory ID number for the sample
- Sample matrix
- Characterization and condition of the sample where relevant
- Date of receipt of sample
- Date and time of sample collection, if provided
- Date and time of sample analysis, reanalysis, and/or sample preparation
- Initials of analyst and person responsible for sample prep
- Analytical batch number
- Sample analysis and preparation methods (or unambiguous description of any non-standard method used)
- Reference to sampling procedure
- Additions to or deviations or exclusions from the test method, and other information relevant to a specific test, such as environmental conditions and the use and meaning of data qualifiers
- Nonconformances that affect the data
- Whether data are calculated on a dry weight or wet weight basis
- Identification of the reporting units, such as µg/L or mg/kg

- Statement of the estimated uncertainty of the test result, if applicable
- Signature and title of the person(s) accepting responsibility for the content of the C of A
- Date C of A was issued
- Clear identification of data provided by outside sources, such as air temperature or ambient water temperature
- Identification of the reporting detection limit (RDL) or practical quantitation limit (PQL) for each analyte, if applicable.

If a portion of the sample analysis is subcontracted, the C of A will identify the subcontractor or applicable accreditation number, and the data that was determined by the subcontracting laboratory

Level 2 Certificates of analysis contain the following additional information:

- Dilution factors
- Method detection limits
- Surrogate recoveries and the acceptance criteria for all organic analyses
- Estimated concentrations determined for nondetects and appropriate "U" and "J" qualifiers for nondetects and concentrations that fall between the MDL and PQL respectively.

Once issued, a C of A is not altered unless a subsequent C of A is identified as a revised report.

11.2 Quality Control Summary Report (QCSR)

We prepare and analyze samples in groups of twenty or less. The quality control data that demonstrate the sample preparation and/or analytical efficiency of the batch are summarized on a QCSR. The data reported on the QCSR may be limited to a sample delivery group contained in the batch or may include all quality control for the batch. Information reported on QCSR includes:

- Quality control sample ID number
- Type of quality control sample
- Concentrations determined, where applicable, for method blanks, matrix spikes, matrix spike duplicates, matrix duplicates, laboratory control samples, serial dilutions, and laboratory control sample duplicates
- Acceptance criteria for matrix spikes, matrix spike duplicates, matrix duplicates, laboratory control samples, and laboratory control sample duplicates
- Nominal concentrations of matrix spikes, matrix spike duplicates, LCSs, and LCS duplicates
- Concentration of parent sample for the matrix spikes, matrix spike duplicates, or sample duplicates
- Percent recoveries for LCS and matrix spikes
- Relative percent differences for the matrix spike duplicates, matrix duplicates, and LCS duplicates
- Analytical batch number with which the quality control data is associated
- Parent sample numbers for matrix spikes, matrix duplicates, and matrix spike duplicates
- Sample or sample delivery group ID
- Project code
- Date issued, page numbers/total number of pages
- Identification of recoveries or relative percent differences that do not meet the acceptance criteria

11.3 Analytical Case Narratives

Analytical case narratives are written by an analyst or data validator to describe the overall conditions affecting the analysis of a batch or a specific sample in the batch. Case narratives usually include:

- Sample delivery group ID number
- Analytical batch number
- Methods of preparation and analysis
- Sample matrix
- Initial of person preparing and/or reviewing the narrative
- Specific sample ID numbers
- Identification and description of batch quality control samples including parent sample identification
- Affirmation that all sample preparation conditions specified by the method or regulatory agencies were met or identification of specific deviations
- Affirmation that all analysis criteria specified by the method or regulatory agencies were met or identification of specific deviations
- Instrumentation employed if applicable and verification of its calibration
- Summary of batch quality control as compared to acceptance criteria

- Identification of nonconformances
- Pertinent comments and observations of factors that affect sample data quality

11.4 Electronic Data Deliverables (EDDs)

Electronic data deliverables are generated according to client specifications. EDDs use programs supplied by the client or created internally by our EDD team. Internally generated EDDs are usually written in Perl and/or PL/SQL.

11.5 Types of Data Packages and Reports

We offer three levels of data reports and the ability to design packages to meet the needs of our clients. The levels of data reports are summarized in Table 1.

Table 1: Data Report Formats

Level	Contents
1	Level 1 C of A
2	Level 2 C of A plus QCSR
3	Level 2 plus Case Narrative

If a client so requests, the above reports can be accompanied by EDDs, case narratives, copies of associated nonconformance reports, and other support documentation. The client's specific requirements are communicated to the laboratory and data reviewers through AlphaLIMS.

GEL's SOP GL-CS-E-002 for The Internal Review of Contractually Required Quality Criteria for Client Package Delivery defines preparation and review of the package.

If a client requests a CLP-like data package, and we agree to provide one, it is compiled in accordance with GL-LB-E-013 for CLP-Like/DOE Data Package Assembly and Revision. If a client does not request a full CLP-like data package but asks for data to be provided on CLP forms generated from software, we follow the applicable procedures in GL-LB-E-013.

11.6 Review of Data Reports, EDDs, and Data Packages

Level 1 and Level 2 data reports are reviewed for accuracy and completeness by the PM or PMA. Level 3 and CLP-like data packages are reviewed in the laboratory by a data reviewer, who is responsible for reviewing specific fractions of the data package for accuracy, consistency, and completeness in accordance with the SOP for that lab area.

No data package fraction is to be provided to the data packaging team without the approval of the appropriate data reviewer.

CLP-like data packages are reviewed in compliance with the basic protocol. Specific requirements are described in GL-LB-E-013 for the CLP-Like/DOE Data Package Assembly and Revision.

SECTION 12
SUBCONTRACTING ANALYTICAL SAMPLES AND OUTSIDE SUPPORT SERVICES

Section 12 - Subcontracting Analytical Samples and Outside Support Services

We provide a full array of organic, inorganic, and radiochemical analyses. The subcontracting of samples to other facilities, while infrequent, may occur when:

- The client has requested analytical services for which we are not certified or do not offer as a routine product.
- The regulatory or method holding times and/or client due dates are in danger of not being met as the result of instrument malfunction or the unexpected influx of a large group of samples.

No samples are subcontracted without the client's consent. The laboratories selected to receive subcontracted samples are expected to meet the following criteria:

- Demonstrated technical capability to provide data that meet and conform to our quality standards.
- Established certification, if available, for the requested analyses.
- Successful proficiency evaluation results, if available.
- Commitment to meet time requirements for delivery of results to the client.
- Agreement to provide all documentation requested in conjunction with the analysis.
- NELAP or ISO/IEC 17025 accreditation for the analysis if required by the client.

We audit potential subcontractors for technical and administrative compliance as directed in GL-QS-E-001 for Conduct of Quality Audits. An audit may be in the form of a book audit or an on-site review.

If there is evidence of a technical, administrative, or quality deterioration, the laboratory is removed from our list of approved subcontractor laboratories pending further evaluation, which may include an on-site audit. Once the laboratory again demonstrates compliance with GEL's standards, it can be reclassified as an approved subcontractor laboratory.

At GEL, we have a multi-faceted and trained staff. There are occasions, however, when it may be necessary to obtain the services of professionals outside of GEL. This may be due to such things as sample workload, introduction of a new instrument or method requiring special knowledge, or employee leaves of absence.

Any outside support services or service personnel are subject to the same scrutiny as a subcontract laboratory. If a service fails to meet our standards for excellence, the appropriate parties are promptly notified. If immediate corrections are not implemented and services are not of adequate quality to maintain confidence, the contract is canceled.

SECTION 13
CLIENT SATISFACTION

Section 13 - Client Satisfaction

Meeting the needs and expectations of our clients is essential to meeting our commitment to be the environmental laboratory of first choice. An important part of meeting this commitment involves receiving and resolving client concerns and complaints.

Client complaints that question the quality of laboratory data or data deliverables are directed to Quality Systems. These concerns are responded to with input from the laboratory, EDD team or data packaging group as may be needed.

The types of complaints, area(s) affected, and any impacts on quality are trended on a quarterly basis. This information is available to members of the Leadership Team and other managers and group leaders.

We use AlphaLIMS to monitor client complaints, nonconformances and corrective actions. Every complaint is entered into the system upon receipt and assigned an internal and external due date. The external due date is often established by client contract. The internal due date allows time for the Quality Systems Team to review the response and transmit it to the client on or before the due date.

If we notice a trend that significantly affects the quality of our data, a corrective action is initiated following GL-QS-E-002 for Conducting Corrective/Preventive Action and Identifying Opportunities for Improvement. The implementation and verification of the corrective action affirms an effective and permanent solution.

The Quality Systems Team promptly audits those areas of activity or responsibility for which a complaint or concern has been stated.

APPENDIX A: REFERENCES

- National Environmental Laboratory Accreditation Program, NELAC, 2003.
- 10 CFR 50, Appendix B, US Code of Federal Regulations.
- 40 CFR Part 136, October 1984, Part VII, EPA 600 Series Methodologies for the Analysis of Organic Contaminants.
- DOE Orders 414.1B and 414.1C, Quality Assurance, U.S. Department of Energy.
- EPA Requirements for Quality Assurance Project Plans (QAPPs), US EPA QA/R5.
- Model Statement of Work for Analytical Laboratories, Prepared for Department of Energy Albuquerque Operations Office by AGRA Earth and Environmental, Rev 4, February 2002.
- Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs, American National Standard ANSI/ASQC E4-1994.
- Measurement Associated Instrument Quality Assurance for Radiobioassay Laboratories ANSI N42.23-1995.
- US Department of Defense Quality Systems Manual for Environmental Laboratories, Version 3, January 2006.
- US Department of Energy Quality Systems for Analytical Services, Revision 2.4, October 2008.
- MARLAP- Multi-Agency Radiological Laboratory Analytical Protocols
- 10 CFR Part 21- Reporting of Defects and Noncompliance
- 10 CFR Part 50 Appendix B -Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants
- 10 CFR Part 61- Licensing Requirements for Land Disposal and Radioactive Waste
- NRC REG Guide 4.15 and NRC REG Guide 4.8
- ANSI/ISO/IEC 17025-2005
- DOE G 414/1-3, 11-3-04, *Suspect/Counterfeit Items Guide for use with 10 CFR 830 Subpart A. Quality Assurance Requirements, and DOE O 414.B, Quality Assurance.*

APPENDIX B: DEFINITIONS

The following definitions are used throughout the text of our Quality Systems Plan. These definitions were reprinted from "Definitions for Quality Systems," NELAC, July 1, 1999.The original source of each definition is provided.

AlphaLIMS: GEL's Laboratory Information Management System.

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in the requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a program of study or an institution as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Aliquot: A discrete, measured, representative portion of sample taken for analysis. (DoD, EPA QAD Glossary)

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Analyte: The specific chemicals or components for which a sample is analyzed; may be a group of chemicals that belong to the same chemical family, and are analyzed together. (EPA Risk Assessment Guide for Superfund, OSHA Glossary)

Analytical Detection Limit: The smallest amount of an analyte that can be distinguished in a sample by a given measurement procedure throughout a given confidence interval. (NELAC Quality Systems Committee)

Analytical Reagent (AR) Grade: Designation for the high purity of certain chemical reagents and solvents given by the American Chemical Society. (NELAC Quality Systems Committee)

ANSI: American National Standards Institute--this consensus standards body approves standards as a guide to aid the manufacturer, the consumer and the general public who may be concerned with its scope and provisions.

Audit: A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch: Environmental samples prepared and/or analyzed together with the same process and personnel using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) that are analyzed together as a group using the same calibration curve or factor. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subject to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Blind Sample: A subsample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process. (NELAC)

Calibrate: To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration: The set of operations that establish, under specified conditions, the relationship between values indicated by a measuring device, or the correct value of each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Curve: The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response. (NELAC)

Calibration Standard: A substance or reference material used to calibrate an instrument. (QAMS)

Certified Reference Material (CRM): A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation that is issued by a certifying body. (ISO Guide 30 - 2.2)

Chain of Custody: A record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number of and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses. (NELAC Quality Systems Committee)

Confirmation: Verification of the presence of a component through the use of an analytical technique that differs from the original test method. These may include: (NELAC)

Second column confirmation
Alternate wavelength
Derivatization
Mass spectral interpretation
Alternative detectors or
Additional cleanup procedures

Corrective Action: Action taken to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction: The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useful form. (EPA-QAD)

Detection Limit: The lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated degree of confidence. Refer to Method Detection Limit. (NELAC)

Document Control: The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity is performed. (ASQC)

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Environmental Detection Limit (EDL): The smallest level at which a radionuclide in an environmental medium can be unambiguously distinguished for a given confidence interval using a particular combination of sampling and measurement procedures, sample size, analytical detection limit, and processing procedure. The EDL shall be specified for the 0.95 or greater confidence interval. The EDL shall be established initially and verified annually for each test method and sample matrix. (NELAC, Radioanalysis Subcommittee)

Holding Times (Maximum Allowable Holding Times): The maximum times that samples may be held prior to analysis and still be considered valid. (40 CFR Part 136)

Initial and Continuing Demonstrations of Capability: Procedures to establish the ability of the laboratory to generate acceptable accuracy and precision which is included in many of the EPA's analytical test methods. In general, the procedure includes the addition of a specified concentration of each analyte in each of four separate aliquots of laboratory pure water or authentic samples. These are carried through the analytical procedure and the percentage recovery and the standard deviation are compared to specified limits. (40 CFR Part 136, 2003 NELAC)

Internal Standard: A known amount of standard added to a test portion of a sample and carried through the entire measurement process as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (NELAC)

ISO/IEC 17025: The International Organization for Standardization and International Electrotechnical Commission form this specialized system for worldwide standardization. Members of ISO or IEC participate in the development of International Standards through technical committees established by their organization to deal with particular fields of activity. Other international organizations, government and non-government, also take part in development of these standards. The ANSI/ISO/IEC 17025-2005 is approved as an American National Standard and covers general requirements for the competence of testing and calibration laboratories.

Laboratory: A body that calibrates and/or tests.

1. In cases where a laboratory forms part of an organization that carries out other activities besides calibration and testing, the term "laboratory" refers only to those parts of that organization that are involved in the calibration and testing process.
2. As used herein, the term "laboratory" refers to a body that carries out calibration or testing at or from a permanent location, from a temporary facility, or a mobile facility. (ISO 25)

Laboratory Control Sample (LCS): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes from a source independent of the calibration standards or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias to assess the performance of all or a portion of the measurement system. (NELAC)

Laboratory Duplicate: Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC Quality Systems)

Limit of Detection (LOD): The lowest concentration level that can be determined by a single analysis and with a defined level of confidence to be statistically different from a blank. See also Method Detection Limit. (Analytical Chemistry, 55, p.2217, Dec. 1983, modified)

Limit of Quantitation (LOQ): The lowest concentration level of the initial calibration curve used to quantitate an analyte. (DoD clarification) The LOQ must be $\geq$ 3X the LOD, and is usually not more than 10X the LOD.

Matrix: The component or substrate that contains the analyte of interest. For purposes of batch determination, the following matrix types shall be used:

- ◊ Aqueous: Any aqueous sample excluded from the definition of a drinking water matrix or saline/estuarine source. Includes surface water, groundwater, and effluents.
- ◊ Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.
- ◊ Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt-water source.
- ◊ Non-aqueous liquid: Any organic liquid with <15% settleable solids.
- ◊ Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
- ◊ Solids: Includes soils, sediments, sludges and other matrices with >15% settleable solids.
- ◊ Chemical Waste: A product or by-product of an industrial process.

◊ Air Samples: Media used to retain the analyte of interest from an air sample such as sorbent tubes or summa canisters. Each medium shall be considered as a distinct matrix. (Quality Systems)

Matrix Spike (MS): Prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Matrix Spike Duplicate (spiked sample/fortified sample duplicate): A second replicate matrix spike is prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

May: Denotes permitted action, but not required action. (NELAC)

Method Blank (MB): A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples containing an analyte of interest through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit (MDL): The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater that zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136 Appendix B)

Must: Denotes a requirement that is required to be met. (Random House College Dictionary)

Negative Control: Measures taken to ensure that a test, its components, or the environment does not cause undesired effects, or produce incorrect test results. (NELAC)

NELAC: National Environmental Laboratory Accreditation Conference. A voluntary organization of state and federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of National Environmental Laboratory Accreditation Program (NELAP).

Performance Audit: the routine comparison of independently obtained quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS): A set of processes wherein the data quality needs, mandates, or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance, or range, in either absolute or relative terms. (NELAC)

Preservation: Refrigeration and or reagents added at the time of sample collection to maintain the chemical and or biological integrity of the sample. (NELAC)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an extermal source. (NELAC, Section 2.1)

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results in comparison to peer laboratories and the collective demographics and results summary of all participating laboratories. (NELAC)

Protocol: A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) that must be strictly followed. (EPA-QAD)

Pure Reagent Water: Shall be water in which no target analytes or interferences are present at a concentration that would impact the results when using a particular analytical test method. (NELAC)

Quality Assurance: An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality within a stated level of confidence. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Quality Control: The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the need of users. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Quality Manual: A document stating the quality policy, quality system and quality practices of an organization. This may also be called a Quality Assurance Plan or a Quality Plan. **NOTE:** The quality manual may call up other documentation relating to the laboratory's quality arrangements. (Quality Systems Committee)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. (ANSI/ASQC E-41994)

Quantitation Limits: The value at which an instrument can accurately measure an analyte at a specific concentration that includes the maximum or minimum levels, concentrations, or quantities of a target that can be quantified with the accuracy required by the data user. These values establish the upper and lower limits of the calibration range. (NELAC with DoD clarification)

Range: The difference between the minimum and the maximum set of values. (EPA_QAD)

Raw Data: Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes that have been transcribed verbatim, dated and verified accurate by signature), the exact copy or exact transcript may be submitted. (EPA-QAD)

Reagent Blank (method reagent blank): A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Reference Material: A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30 -2.1)

Reference Standard: A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM - 6.08)

Requirement: Denotes mandatory specification; often designated by the term "shall." (NELAC)

Sample: Portion of material collected for chemical analysis, identified by a single, unique term. A sample may consist of portions in multiple containers, if a single sample is submitted for multiple or repetitive analysis. (DoD)

Selectivity: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. (NELAC Quality Systems)

Sensitivity: The capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC Quality Systems)

Shall: Denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there will be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled. (ANSI)

Should: Denotes a guideline or recommendation whenever noncompliance with the specification is permissible. (ANSI)

Spike: A known mass of target analyte added to a blank sample or subsample; used to determine recovery efficiency or for other quality control purposes.

Standard Operating Procedure (SOP): A written document that details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and is accepted as the method for performing certain routine or repetitive tasks. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Standard Reference Material (SRM): A certified reference material produced by the U.S. National Institute of Standards and Technology and characterized for absolute content, independent of analytical test method. (NELAC)

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them for quality control purposes. (Glossary of Quality Assurance Terms, QAMS, 8/31/92)

Test: A technical operation that consists of the determination of one or more characteristics or performance of a given product, material equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2 - 12.4)

Test Method: An adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP. (NELAC)

Tolerance Chart: A chart in which the plotted quality control data is assessed via a tolerance level (e.g. ± 10% of a mean) based on the precision level judged acceptable to meet overall quality/data use requirements instead of a statistical acceptance criteria (e.g. ± 3 sigma). (ANSI N42.23-1995, Measurement and Associated Instrument Quality Assurance for Radiochemistry Laboratories)

Traceability: The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM-6.12)

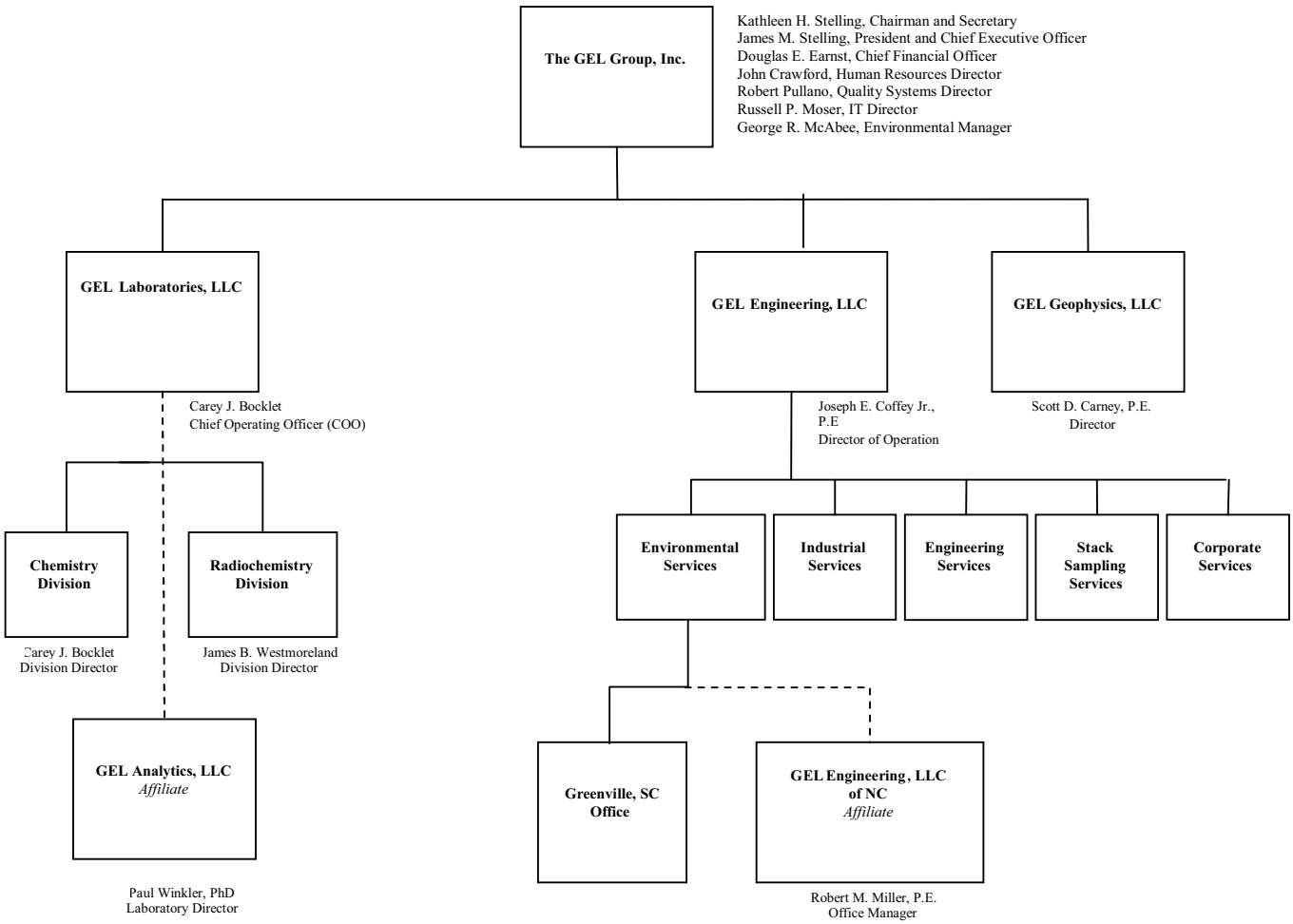
Validation: The process of substantiating specified performance criteria.

Verification: confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

NOTE: Verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation, or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustments, or to repair, or to downgrade, or to declare obsolete. In all cases it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

APPENDIX C: CORPORATE ORGANIZATION CHART



APPENDIX D: CERTIFICATIONS

GEL Laboratories, LLC maintains environmental laboratory certification in many states, including primary NELAP in Florida and secondary in California, Illinois, Kansas, Louisiana, New Jersey, New York, Pennsylvania, Texas and Utah. We expand our list of certification as needed.

Original Scope of Accreditations is maintained in the Quality Assurance work area. Electronic copies are available in .pdf form on the GEL intranet. *Please call to confirm the status of any certification of interest to you.*

- **U.S. Department of Energy (DOE) -** Established Basic Ordering Agreement (BOA) in support of ICPT, for use by DOE and its eligible subcontractors. Audited by DOE's Office of Environmental Management under the Department of Energy Consolidated Audit Program (DOECAP)
- **U.S. Army Corps of Engineers (USACE) -** Validation by the Hazardous, Toxic and Radioactive Waste (HTRW) Center of Expertise
- **U.S. Navy -** Approval for Naval Facilities Command Southern Division Remedial Action Contract
- **U.S. Department of Agriculture -** Foreign soil importation permit # S-52597
- **National Environmental Laboratory Accreditation Program (NELAP) -** Primary issued through the State of Florida, Department of Health, Bureau of Laboratories; Secondary issued through the States of California, New York, New Jersey and Utah
- **Clinical Laboratory Improvement Amendments (CLIA) -** U.S. Department of Health and Human Services, Certificate of Compliance for Acceptance of Human Specimens (GEL ID: 42D0904046)
- **USEPA** Office of Ground Water and Drinking Water, Perchlorate under UCMR
- **USEPA Region 5** Radiochemical Parameters for the Safe Drinking Water Act (SDWA)
- **Alaska** Department of Environmental Conservation, Contaminated Sites Program (UST-062)
- **Arkansas** Department of Environmental Quality Laboratory Certification Program for Wastewater, Groundwater, Solid Waste Reciprocal Certification to SC DHEC
- **Arizona** Division of Public Health Services (GEL ID: AZ 0668)
- **California** Environmental Laboratory Accreditation Program Certification (GEL ID: 01151CA)
- **Colorado** Department of Public Health and Environment, Reciprocal Certification to SC DHEC Environmental Laboratory Certification Program for Safe Drinking Water Chemistry and Radiochemistry
- **Connecticut** Department of Public Health - Potable Water, Waste Water and/or Trade Waste, Sewage and/or Effluent, Soil and Radiochemistry Reciprocal Certification (GEL ID: PH-0169)
- **Florida** Department of Health - Office of Laboratory Services, Safe Drinking Water, Clean Water Act and RCRA Certification (Lab ID: E87156)

- **Georgia** Department of Natural Resources, Reciprocal Certification to SC DHEC Environmental Laboratory Certification Program for Safe Drinking Water (inorganics) (GEL ID: 938)
- **Illinois** EPA Environmental Laboratory Accreditation for Drinking Water, Wastewater, and Hazardous and Solid Waste (GEL ID: 200029)
- **Kansas** Department of Health and Environmental Laboratory, Non-potable Water and Solid and Hazardous Waste (GEL ID: E-10332)
- **Kentucky** Department of Environmental Protection for Drinking Water (GEL ID: 90129)
- **Maryland** Department of Health and Mental Hygiene, Laboratories Administration, Reciprocal Certification to SC DHEC Environmental Laboratory Certification Program for Safe Drinking Water -Radiochemistry (GEL ID: 270)
- **Massachusetts** Department of Environmental Protection, Division of Environmental Analysis – Potable Water, Radiochemistry (GEL ID: M-SC-012)
- **Nevada** Department of Human Resources, Health Division, Bureau of Licensure and Certification, Radiologicals and Non-Radiologicals (GEL ID: SC-12-2002-57)
- **New Jersey** Department of Environmental Protection, Safe Drinking Water, Solid and Hazardous Waste, and Water Pollution Certification (GEL ID: SC002)
- **New York** Department of Health, Environmental Laboratory Approval Program Certification, Potable Water, Non-potable Waters and Solids/Hazardous Wastes (GEL ID: 11501)
- **North Carolina** Division of Environmental Management Lab Certification Program, Waste Waters/Ground Waters. (GEL ID: 233)
- **North Carolina** Department of Health and Human Services, North Carolina State Laboratory Public Health Environmental Sciences, Safe Drinking Water. (GEL ID: 45709)
- **North Dakota** State Department of Health for Drinking Water, Wastewater, and Hazardous and Solid Waste (GEL ID: R-158)
- **Oklahoma** Department of Environmental Quality, General Water Quality/Sludge Testing Laboratory Dual Certification (GEL ID: 9904)
- **Pennsylvania** Department of Environmental Protection - Bureau of Laboratories, Safe Drinking Water Certification (GEL ID: 68-485)
- **South Carolina** Department of Health and Environmental Control - Environmental Laboratory Certification Program, Clean Water, Safe Drinking Water and Solid/Hazardous Wastes (GEL ID: 10120)
- **South Carolina** Department of Health and Environmental Control (DHEC) Radioactive Material License (License #362)
- **Tennessee** Department of Health - Division of Laboratory Services, Reciprocal Certification to SC DHEC Environmental Laboratory Certification Program, Safe Drinking Water-Radiochemistry and Non-radiochemistry (GEL ID: 02934)

- **Texas** Department of Health - Bureau of Laboratories, Reciprocal Certification to SC DHEC Environmental Laboratory Certification Program, Safe Drinking Water, including Radiochemistry (GEL ID: TX 213)
- **Utah** Department of Health, Division of Epidemiology and Laboratory Services, Safe Drinking Water, Clean Water and Resource and Conservation and Recovery Act Certifications (Customer ID: GEL)
- **Vermont** Department of Environmental Conservation, Water Supply Division Reciprocal Certification
- **Virginia** Department of General Services - Division of Consolidated Laboratory Services, Safe Drinking Water Reciprocal Certification (Radiologicals and Non-Radiologicals) (GEL ID: 00151)
- **Washington** State Department of Ecology, Safe Drinking Water, Clean Water and Resource and Conservation and Recovery Act Certifications (GEL ID: C1641)

APPENDIX E: ESSENTIAL QUALITY CONTROL REQUIREMENTS

At GEL, we enforce strict adherence to quality control measures. Quality control measures for each type of analysis are delineated in the associated standard operating procedure and include those specified in the identified analytical method. Client requests for additional quality control agreed to by us will be communicated to the laboratory by the Project Manager and performed accordingly.

All quality control measures are assessed and evaluated on an ongoing basis. We use these measures to establish statistically derived quality control acceptance criteria. The acceptance criteria are used to evaluate whether the analytical process is in control and to assist us in establishing the validity of the data. Our procedures for handling out-of-control situations are written in the analytical standard operating procedure.

Method-specific quality measures are described in the appropriate standard operating procedure. Essential but general quality control requirements are summarized in the sections below for chemical testing, including inorganic and organic analyses, microbiological analyses, and radiochemical testing.

E1 Chemical Testing

This section includes our quality control requirements for inorganic and organic analyses, and discusses:

- Negative controls
- Positive controls
- Analytical variability and reproducibility
- Method evaluation
- Method detection limits
- Data reduction
- Quality of standards and reagents
- Selectivity
- Constant and consistent test condition

E1.1 Negative controls

We implement a negative control at least once per analytical batch of samples having the same matrix, and where, if applicable, the same extraction or preparation method is employed. The negative control is a method blank that we use to determine the presence of contamination. If discovered, we must investigate the source of contamination and take measures to correct, minimize, or eliminate the source if:

1. The concentration of target analyte exceeds the established practical quantitation limit and exceeds a concentration greater than 1/10 of the measured concentration of any sample in the analytical batch;
2. The concentration of a target analyte in the method blank exceeds that present in the samples and is greater than 1/10 of the specified regulatory limit.

If a method blank is indicative of contamination, we must assess each sample in that batch against the above criteria to determine if the data are acceptable. Any sample associated with a contaminated method blank shall be reprocessed for analysis, as needed, or we will report the results with appropriate data qualifiers.

E1.2 Positive Control - Method Performance

E1.2.1 Laboratory Control Sample (LCS)

Purpose: The LCS is used to evaluate the performance of the total analytical system, including all preparation and analysis steps. Results of the LCS are compared to established criteria and, if found to be outside of these criteria, indicates that the analytical system is “out of control.” Any affected samples associated with an out-of-control LCS shall be reprocessed for re-analysis or the results reported with appropriate data qualifying codes, as necessary.

Frequency: The LCS is analyzed at a minimum of 1 per preparation batch. Exceptions would be for those analytes for which no spiking solutions are available such as total suspended solids, total

dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. In those instances for which no separate preparation method is used (example: volatiles in water) the batch shall be defined as environmental samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

Composition: The LCS is a controlled matrix, known to be free of analytes of interest, spiked with known and verified concentrations of analytes. **NOTE:** The matrix spike may be used in place of this control as long as the acceptance criteria are as stringent as for the LCS. Alternatively the LCS may consist of a medium containing known and verified concentrations of analytes or as Certified Reference Material (CRM). All analyte concentrations shall be within the calibration range of the methods. The following shall be used in choosing components for the spike mixtures:

The components to be spiked shall be as specified by the mandated test method or other regulatory requirement or as requested by the client. In the absence of specified spiking components the laboratory shall spike per the following:

For those components that interfere with an accurate assessment such as spiking simultaneously with technical chlordane, toxaphene, and PCBs, the spike should be chosen that represents the chemistries and elution patterns of the components to be reported.

For those test methods that have extremely long lists of analytes, a representative number may be chosen. The analytes selected should be representative of all analytes reported. The following criteria shall be used for determining the minimum number of analytes to be spiked.

a) For methods that include 1-10 targets, spike all components;
b) For methods that include 11-20 targets, spike at least 10 or 80%, whichever is greater;
c) For methods with more than 20 targets, spike at least 16 components.

NOTE: Unless otherwise noted in project quality assurance plans or if components interfere with an accurate assessment, all Department of Defense projects will have LCS, MS, and MSD that contain all target analytes.

Evaluation Criteria and Corrective Action: The results of the individual batch LCS are calculated in percent recovery. The laboratory shall document the calculation for percent recovery. The individual LCS is compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory determines internal criteria or utilizes client specified assessment criteria.

An LCS that is determined to be within the criteria effectively establishes that the analytical system is in control and validates system performance for the samples in the associated batch. Samples analyzed along with a LCS determined to be "out of control" should be considered suspect and the samples reprocessed and re-analyzed or the data reported with appropriate data qualifying codes as necessary.

E1.2.2 Sample Specific Controls

The laboratory must document procedures for determining the effect of the sample matrix on method performance. These procedures relate to the analyses of matrix specific Quality Control (QC) samples and are designed as data quality indicators for a specific sample using the designated test method. These controls alone are not used to judge laboratory performance. Examples of matrix specific QC include: Matrix Spike (MS); Matrix Spike Duplicate (MSD); Post Spike (PS) and Post Spike Duplicate (PSD) sample duplicates; and surrogate spikes.

E1.2.3 Matrix Spike; Matrix Spike Duplicates, Post Spike ; Post Spike Duplicates:

Purpose: Matrix specific QC samples indicate the effect of the sample matrix on the precision and accuracy of the results generated using the selected method. The information from these controls is sample/matrix specific and would not normally be used to determine the validity of the entire batch.

Frequency: The frequency of the analysis of matrix specific samples shall be determined as part of a systematic planning process (e. g. Data Quality Objectives) or as specified by the required mandated test method.

Composition: The components to be spiked shall be as specified by the mandated test method. Any permit specified analytes, as specified by regulation or client requested analytes shall also be included. If there are no specified components, the laboratory shall spike per the following:

For those components that interfere with an accurate assessment such as spiking simultaneously with technical chlordane, toxaphene and PCBs, the spike should be chosen that represents the chemistries and elution patterns of the components to be reported.

For those test methods that have extremely long lists of analytes, a representative number may be chosen using the following criteria for choosing the number of analytes to be spiked. However, the laboratory shall insure that all targeted components are included in the spike mixture over a 2-year period.

a) For methods that include 1-10 targets, spike all components;
b) For methods that include 11-20 targets, spike at least 10 or 80%, whichever is greater;
c) For methods with more than 20 targets, spike at least 16 components.

Evaluation Criteria and Corrective Action: The results from matrix spike/matrix spike duplicate and post spike/post spike duplicate are primarily designed to assess the precision and accuracy of analytical results in a given matrix and are expressed as percent recovery (%R) and relative percent difference (RPD).

Results are compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory should determine internal criteria and document the method used to establish the limits. For matrix spike or post spike results outside established criteria, corrective action shall be documented or the data reported with appropriate data qualifying codes.

E1.2.4 Matrix Duplicates:

Purpose: Matrix duplicates are defined as replicate aliquots of the same sample taken through the entire analytical procedure. The results from this analysis indicate the precision of the results for the specific sample using the selected method. The matrix duplicate provides a usable measure of precision only when target analytes are found in the sample chosen for duplication.

Frequency: The frequency of the analysis of matrix duplicates may be determined as part of a systematic planning process (e. g. Data Quality Objectives) or as specified by the mandated test method.

Composition: Matrix duplicates are performed on replicate aliquots of actual samples. The composition is usually not known.

Evaluation Criteria and Corrective Action: The results from matrix duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD) or another statistical treatment (e. g., absolute differences). The laboratory shall document the calculation for relative percent difference or other statistical treatments.

Results are compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory shall determine internal criteria and document the method used to establish the limits. For matrix duplicates results outside established criteria corrective action shall be documented or the data reported with appropriate data qualifying codes.

E1.2.5 Surrogate Spikes:

Purpose: Surrogates are used most often in organic chromatography test methods and are chosen to reflect the chemistries of the targeted components of the method. Added prior to sample

	preparation/extraction, they provide a measure of recovery for every sample matrix.
Frequency	Except where the matrix precludes its use or when not available, or is not a method requirement, surrogate compounds are added to all samples, standards, and blanks for all appropriate test methods.
Composition:	Surrogate compounds are chosen to represent the various chemistries of the target analytes in the method. They are often specified by the mandated method and are deliberately chosen for their being unlikely to occur as an environmental contaminant. Often this is accomplished by using deuterated analogs of select compounds.
Evaluation Criteria and Corrective Action:	The results are compared to the acceptance criteria as published in the mandated test method or determined using statistical process controls (SPC). Where there are no established criteria, the laboratory determines internal criteria and documents the method used to establish the limits. Surrogates outside the acceptance criteria must be evaluated for the effect indicated for the individual sample results. The appropriate corrective action may be guided by the data quality objectives or other site specific requirements. Results reported from analyses with surrogate recoveries outside the acceptance criteria include appropriate data qualifiers.

E1.3 Method Evaluation

The following procedures, as described in the other sections of the QAP, are in place in order to ensure the accuracy of the reported result:

- Procedure for initial demonstration of analytical capability performed initially (prior to the analysis of any samples) and if there is a significant change in instrument type, personnel, matrix or test method. Refer to Section 8.
- Procedures for initial and continuing calibration protocols as specified in Section 7.
- Procedures for utilizing proficiency test samples to evaluate the ability of a procedure and/or analyst laboratory to produce accurate data as specified in Section 3.

E1.4 Method Detection Limits

Method detection limits (MDLs) are determined as described in GL-LB-E-001 for The Determination of Method Detection Limits. This procedure is based on that established in 40 CFR Part 136, Appendix B.

Where possible, MDL studies are conducted for both aqueous and solid matrices and biological tissues using a clean matrix appropriate to the test method (such as laboratory pure reagent water or Ottawa sand). MDL studies for the majority of routine parameters are conducted by:

- analyzing a minimum of seven replicates of the lowest calibration standard
- determining the standard deviation of the seven replicates
- multiplying the standard deviation by 3.143 (based on six degrees of freedom and representing a 99% confidence level) to obtain the calculated MDL.

If the MDL study is being conducted for a new method or target analyte, the following steps are taken:

- the MDL is estimated based on information provided in the method or analytical experience
- a standard with a concentration three to five times the estimated MDL is prepared and analyzed a minimum of seven times
- the MDL is calculated as above based on the standard deviation and degrees of freedom
- the MDL is evaluated for reasonableness by verification through analysis of a prepared standard solution two to three times the calculated MDL.

MDL studies are not performed for any target analyte for which spiking solutions are not available such as total volatile solids, pH, color, odor, temperature, dissolved oxygen, or turbidity.

Practical quantitation limits (PQLs) are determined by either multiplying the MDL by approximately 2 to 10 or are equal to that of the lowest calibration standard. Concentrations of a target analyte determined to be greater that its PQL are defined as quantitative results. All quantitative reported results are bracketed by calibration or calibration verification standards.

All MDL studies conducted by the laboratory are submitted to the Quality Group for an independent review. Upon acceptance of the MDL study, the MDLs reported to clients via our computer system are updated unless otherwise specified by contract. PQLs are also updated as directed by the new MDLs or changes to procedures.

All data pertaining to the study and the calculation of MDLs is stored on the production file system for data packages for four years and then archived to DVD.

E1.5 Data Reduction

The procedures for data reduction, such as use of linear regression, are documented in the individual analytical standard operating procedures. GEL's policy governing the manual integration of chromatographic data is detailed in GL-LB-E-017, Procedure and Policy for Manual Integration. Manual integrations of chromatographic peaks can only be performed in accordance with GL-LB-E-017. This ensures that the integrations are done in a consistent and technically justifiable manner while meeting the requirements set forth under the Good Automated Laboratory Practices.

SOP GL-QS-E-014, Quality Assurance Measurement Calculations and Processes, discusses the use of laboratory data in statistical determinations and includes discussion of Estimation of Total Analytical Uncertainty, Statistical Process Control (SPC) Limits, and Calibration of Instrumentation. Understanding of the procedures used for data generation and reduction is an important part of an analyst demonstrating proficiency in an analytical procedure. All analysts and technicians responsible for generating curves and using curve-generated data are trained to this SOP per GEL annual and interim training requirements.

E1.6 Quality of Standards and Reagents

The quality of standards used in instrument calibration or quality control samples and reagents used in sample preparation and/or analysis must meet the criteria described in Section 7. In methods where the purity is not specified, analytical grade reagents are used. Reagents of lesser purity than those specified by the test method are never used. Upon receipt and prior to use, the labels on the container are checked to verify that the purity of the reagents meets the documented requirements of the particular test method.

The quality of water sources is monitored and documented as described in Section 4. The quality of water used in sample preparation or analysis meets the method-specified requirements. The type of water available in the laboratory is described in Section 4.

E1.7 Selectivity

Absolute and relative retention times aid in the identification of components in chromatographic analyses and in evaluation of the effectiveness of a column in separating constituents. The procedures governing retention time widows are documented in the applicable analytical SOP and meet all regulatory and method requirements.

In addition to retention time windows, the acceptance criterion for mass spectral training is also documented in the appropriate analytical SOP. In all cases, the acceptance criteria meet or exceed those specified in the analytical methods.

Unless stipulated in writing by the client, confirmations are performed to verify the compound identification of positive results detected on a sample from a location that has not been previously tested by our laboratory. Such confirmations are performed on a second column for organic tests such as pesticides, herbicides, or acid extractable or when recommended by the analytical test method except when the analysis involves the use of a mass spectrometer. All conformation is documented.

E1.8 Constant and Consistent Test Conditions

GEL's implementation of standard operating procedures that specify quality criteria including initial and continuing calibrations assures that our test instruments consistently operate within the specifications required of the application for which the equipment is used.

In addition to the specifications applied to instrumentation, glassware used for sample preparation or analysis is cleaned in a manner that reduces the potential for positive or negative interferences. Glassware is prepared in accordance with GL-LB-E-003 for Glassware Preparation.

This SOP details the procedures used to clean the following groups of glassware:

- That used for the determination of metals
- Reusable bottles and plasticware
- Bottles sued for the determination of biochemical oxygen demand (BOD)
- Glassware used in the determination of organic compounds
- That used for the determination of methylene blue active substances (MBAS)
- Glassware used in the determination of total organic halides (TOX)
- Glassware used in the analyses of samples for total Kjeldahl nitrogen (TKN) and total phosphorous
- Generic glassware used in all other analyses

If the method specifies that the glassware be stored in a particular manner, this requirement is documented in the appropriate analytical SOP.

Section E2 Microbiology

The quality control elements included in this section apply to microbiological analyses performed at GEL. The analyses include the determination of both total and fecal coliforms and standard plate counts.

Discussed in this section are:

- Negative controls
- Positive controls
- Test variability and reproducibility
- Method evaluation
- Test performance
- Data reduction
- Quality of standards, reagents, and media
- Selectivity
- Test conditions

E2.1 Negative Controls

We demonstrate that the cultured samples have not been contaminated during sampling handling and analysis or environmental exposure by the use of negative controls. These negative controls include both sterility checks of media and method blanks.

All blanks and non-inoculated controls specified by the test methods are prepared and analyzed at the frequency stated in the method and in the corresponding standard operating procedure.

A minimum of one non-inoculated control is prepared and analyzed with analytical batches containing only one sample. If the analytical batch contains multiple samples, a series of method blanks is prepared. This series includes least one beginning and ending negative control with additional controls inserted after every 10 samples.

If the method blanks show evidence of contamination, the data obtained for the associated samples are not reported and the client is advised that resampling will be necessary.

Prior to initial use, each lot of medium is subjected to a sterility check by analyzing an aliquot of sterile buffer water. If there is any evidence of contamination, the medium is not utilized for the analysis of samples and is either returned to the supplier or disposed of in accordance with the Laboratory Waste Management Plan.

E2.2 Positive Controls

Positive controls are used to demonstrate that the medium can support the growth of the target organism and that it produces the specified or expected reaction to that organism. Prior to initial use and then on a monthly basis, each lot of medium is tested using least one pure culture of with a known positive reaction. If the positive reaction does not

occur, the medium is not used for sample analysis and is either returned to the supplier or disposed of according to the Laboratory Waste Management Plan.

E2.3 Test Variability and Reproducibility

We demonstrate reproducibility of our data by analyzing sample duplicates for least 5% of the suspected positive samples. Each analyst performing microbiological analyses makes parallel analyses on at least one positive sample per month.

For analysis requiring sample volumes of less than 100 mL or where the clients submit duplicate sample aliquots, a sample duplicate is analyzed with each analytical batch.

E2.4 Method Evaluation

Our ability to perform a specified analysis successfully for its intended purpose is demonstrated and documented in meeting at a minimum the acceptance criteria specified by the method, by the EPA, and by state programs under which we are certified. The acceptance criteria demonstrate that the test method as performed at GEL provides correct and expected results with respect to specified detection capabilities, selectivity, and reproducibility.

Proficiency of the analysis is demonstrated prior to the test method through the use of positive and negative controls. The validation of microbiological test methods is conducted under the same conditions as those for routine analysis.

All validation data are recorded in a logbook specified by the appropriate SOP. We maintain the data as long as the analysis is being conducted and for a minimum of five years after the retirement of an analytical method.

E2.5 Test Performance

Test performance is demonstrated for all growth and recovery media used by the appropriate growth and reaction of target organisms to the test media through the use of positive controls as discussed in E2.2.

E2.6 Data Reduction

All data are calculated and subjected to data reduction and statistical interpretations as specified by the method's SOP. These specifications incorporate those found in the associated analytical method.

For test methods specifying colony counts, such as membrane filter or colony counting, the ability of individual analysts to count colonies is verified at least once per month. This verification includes having two or more analysts count colonies from the same plate.

E2.7 Quality of Standards, Reagents and Media

In addition to the performance of positive and negative controls, we ensure that the quality of the reagents and media meets or exceeds the requirements specified in the analytical methods. The commercially dehydrated powders used to prepare certain culture media as well as the media that are purchased ready for use are both subjected to positive and negative controls. In addition, all reagents, commercial dehydrated powders, and media are used within the shelf life of the product as documented in Section 8.

We retain all manufacturer supplied "quality specification statements" which may contain such information as shelf life of the product, storage conditions, sampling regimen/rate, sterility check including acceptability criteria, performance checks including the organism used, their culture collection reference and acceptability criteria, date of issue of specification, or statements assuring that the relevant product batch meets the product specifications.

All media and buffers are prepared using deionized water that has been demonstrated to be free from bacterial contamination. The deionized water used for microbiological analyses and the monitoring of the deionized water is discussed in Section 4.

Media, solutions and reagents are prepared, used and stored in accordance with the appropriate SOP. As described in 2.2, all laboratory media are evaluated at least monthly to ensure they support the growth of specific microbial cultures. In addition, selective media are checked to ensure they suppress the growth of non-target organisms.

The laboratory detergent is be checked by use of the inhibitory residue test to ensure that its residues do not inhibit or promote growth of microorganisms.

E2.8 Selectivity

We perform all confirmation and verifications tests specified by the test method according to the procedures outlined in our SOPs.

In order to demonstrate traceability and selectivity, we use reference cultures of microorganisms obtained from a recognized national collection. We do not subculture bacterial working stocks. The storage and maintenance of all working and reference stocks are specified in the applicable analytical SOP.

E2.9 Test Conditions

We monitor background levels by the use of method blanks and other negative controls. The acceptable background counts for each analysis and how to deal with situations in which these levels are exceeded are specified in the applicable SOP.

Walls, floors, ceilings, and work surfaces of our microbiological laboratory are non-absorbent and easy to clean and disinfect. Measures are taken to avoid accumulation of dust by the provision of sufficient storage space and daily cleaning of exposed surfaces.

The temperature measuring devices such as liquid-in-glass thermometers used in incubators, autoclaves, and other equipment are of the appropriate quality to achieve the specification in the test method.

The graduation of the temperature measuring devices is appropriate for the required accuracy of measurement. Each device is verified at least annually to national or international standards for temperature in accordance with GL-QS-E-007 for Thermometer Verification.

The temperatures of incubators, refrigerators, autoclaves, and water baths are monitored and documented in accordance with GL-LB-E-004 for Temperature Monitoring and Documentation Requirements for Refrigerators, Freezers, Ovens, Incubators, and Other Similar Devices. While in use, each piece of equipment is maintained in the temperature range specified by the applicable SOP and test method.

Records of autoclave operations including temperature and time are maintained for every cycle.

Volumetric equipment such as automatic dispensers, air displacement pipets and disposal pipets are all used in the microbiology laboratory. This equipment is routinely checked for accuracy as discussed in Section 7.

Conductivity meters, pH meters, and other similar measurement instruments are calibrated according to the methods specified requirements detailed in the SOP.

Mechanical timers are checked regularly against electronic timing devices to ensure accuracy.

Section E3 Radiochemical Analysis

This section describes the general quality control applied to radiochemical analysis. The specific quality control criteria applied to each analysis are delineated in the corresponding SOP. Detector Capabilities, Relative Bias, Relative Precision, and methods of calculating results for periodic Quality Control Determinations are discussed in the appropriate SOPs.

Discussed in this section are:

- Negative controls
- Positive controls
- Test variability/reproducibility
- Tracers and carriers
- Method evaluation
- Radiation measurement system calibration
- Data reduction
- Quality of standards and reagents
- Test conditions

E3.1 Negative Controls

Method blanks serve as the primary negative controls providing a means of assessing the existence and magnitude of contamination introduced via the analytical scheme. A method blank is analyzed at a frequency of one per preparation or analytical batch and is one of the quality control measures used to assess batch acceptance.

The activity level determined for each target in the method blank is assessed against the specific acceptance criteria specified in the applicable SOP. These criteria are based on a designated sample aliquot size and include appropriate calculations to compare the blank to activity levels determined for different sizes of sample aliquots.

The activity level of any target analyte in the method blank should be less than or equal to the contract required detection limit. The method blank may exceed this limit if the activity is less than 5% that of the lowest sample activity in the batch.

If the method blank acceptance criteria are not met, the specified corrective action and contingencies delineated in the SOPs are followed. Any failures of method blanks to meet the acceptance criteria are documented in the laboratory report and through GEL's nonconformance reporting system specified in GL-QS-E-004 for the Documentation of Nonconformance Reporting and Dispositioning and Control of Nonconforming Items.

The activity levels determined for method blanks are not subtracted from those obtained for the samples in the associated preparation or analytical batch. Correction factors such as instrument background and analyte presence in the tracer may, however, be applied to all analyzed samples including both client samples and internal quality control samples.

E3.2 Positive Controls

Positive controls routinely employed in radiochemical analyses include both laboratory control samples (LCS) and matrix spikes (MS).

The laboratory standards used to prepare LCS and MS are from a different source than those used in instrument calibration, except when the calibration has been verified with a different source. This requirement may be superseded by client specific contract requirements. The activity levels of target analytes in the LCS and MS exceed ten times the prior detection limit and are less than one hundred times this detection limit. If a radiochemical method, however, has more than one reportable analyte isotope, the LCS and MS need to only include one of the analyte isotopes.

Gamma spectroscopy is the exception to this guideline requiring the LCS and MS to contain isotopes representing the low, medium, and high-energy range of the analyzed gamma spectra.

E3.2.1 Laboratory Control Sample (LCS)

Laboratory control samples are analyzed at a minimum of once per preparation or analytical batch containing twenty or less samples.

The recovery of target analytes in the LCS is compared to the acceptance criteria specified in the applicable analytical SOP. If the recovery of the LCS does not fall within the acceptance range, the corrective actions and contingency steps specified in the SOP are implemented. These steps include the completion of an internal nonconformance report in accordance with GL-QS-E-004 and noting the failure on the laboratory report.

E3.2.2 Matrix Spike (MS)

Matrix spikes are analyzed at a minimum of once per preparation or analytical batch containing twenty samples or less under the following conditions:

- The analytical method does not utilize an internal standard or carrier
- There is a physical or chemical separation process
- There is sufficient sample volume provided for the analysis.

The target analyte recoveries are one of the quality control measures used to assess batch acceptance. The recovery of target analytes in the MS is compared to the acceptance criteria specified in the applicable analytical SOP. If the recovery of the MS does not fall within the acceptance range, the data associated with that matrix spike are qualified accordingly.

E3.3 Test Variability/Reproducibility

The reproducibility of measurements is evaluated by the use of matrix duplicates. Matrix duplicates are analyzed once per preparation or analytical batch of twenty samples. The relative percent difference (RPD) obtained between the activity levels obtained for the sample and its duplicate is evaluated against the range in the SOP.

E3.4 Tracers and Carriers

Two additional quality control measures specific to radiochemical analysis are tracers and carriers. If the analytical method requires a tracer or carrier, each sample result will be associated with a tracer recovery that is calculated and reported. For radiochemistry procedures requiring gravimetric or radiometric recovery (tracer yields), the acceptable limits are 15% - 125%. These limits may vary for specific clients and/or projects. If the applicable limits are not met, the corrective actions delineated in the SOP are implemented.

E3.5 Method Evaluation

GEL evaluates the radiochemical preparation and analytical methods to ensure the accuracy of the reported result. This evaluation includes initial demonstrations of capability as described in Section 8 and the analysis of proficiency test samples as described in Section 3. The suppliers of proficiency test samples conform to the requirements of ANSI N42.22 and ISO/IEC 17025-2005.

E3.6 Radiation Measurement System Calibration

It is not generally necessary or practical to calibrate radiochemical instrumentation each day of use due to its stability and the time-consuming nature of some of the measurements. There are, therefore, significant differences in the calibration requirements for radiochemical instrumentation from that used for chemical analyses.

Calibration differences include but are not limited to the following:

- The requirement in Section 7 for the determination of the appropriate number of standards for initial calibration is not applicable to radiochemical methods. If the radiochemical method requires multiple standards for initial calibration, the number of standards is included in the applicable SOP.
- If linear regression or non-linear regression is used to fit standard response or calibration standard results to a calibration curve, the correlation coefficient is determined. This differs from Section 7.
- The requirement identified in Section 7 for the bracketing of quantitative results by calibration or calibration verification standards is not applicable to radiochemical analyses due to the non-correlated event nature of decay counting instrumentation.
- As indicated in Section 7, the LCS may fill the requirements for the performance of an initial calibration and continuing calibration verification standard. The calibration verification acceptance criteria are the same as specified for the LCS (75 -125%).
- Background calibration measurements are made on a regular basis and monitored using control charts. These values are subtracted from the total measured activity in the determination of the sample activity. The frequency of these measurements is indicated in the SOP GL-RAD-I-010.
- Instrument calibration shall be performed with reference standards as defined in Section E3.8.
- The frequency of calibration shall be addressed in the governing SOPs.

E3.7 Data Reduction

All sources of method uncertainties and their propagation must be traceable to reported results. This is performed under the guidance of the ISO “Guide to the Expression of Uncertainty in Measurement” and the NIST Technical Note 1297 on “Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results.” Details of calculations and equations used in reporting Radiochemistry analytical results may be found in GL-RAD-D-003 for Data Review, Validation , and Data Package Assembly.

E3.8 Quality of Standards and Reagents

The reference standards we use are obtained from the National Institute of Standards and Technology (NIST), EPA, or suppliers providing NIST standards. Reference standards should be accompanied by a certificate of calibration whose

content is described in ANSI N42.22 - 1995, Section 8, Certificates. All reagents used shall be analytical reagent grade or better.

E3.9 Test Conditions

GEL adheres to written procedures that minimize the possibility of cross contamination between samples. This prevents incorrect analysis results from the cross contamination. Procedures are in place, for example, to separate known radioactive and nonradioactive samples from the time of sample receipt to analysis and sample disposal.

Instrument performance checks are performed on a regular basis and monitored with control charts. This ensures that the instrument is operating properly and that the calibration has not changed. The same check source used in the preparation of the control chart at the time of calibration is used in the performance checks of the instrument. The sources must provide adequate counting statistics for a relatively short count time and should be sealed or encapsulated to provide loss of activity and contamination of the instrument and laboratory personnel.

Instrument performance checks include checks on the counting efficiency and the relationship between channel number and alpha or gamma ray energy.

THE GEL GROUP INC.

ETHICS and DATA INTEGRITY AGREEMENT

I. I, _____, state that I understand the high standards of integrity required of me with regard to the duties I perform and the data I report in connection with my employment at The GEL Group Inc.

II. I agree that in the performance of my duties at The GEL Group Inc.:

A. I shall not intentionally report data values that are not the actual values obtained;

B. I shall not intentionally report dates and times of data analyses that are not the actual dates and times of data analyses; and,

C. I shall not intentionally represent another individual's work as my own.

III. I agree to inform The GEL Group Inc. of any accidental or intentional reporting of non-authentic data by myself in a timely manner.

IV. I agree to inform The GEL Group Inc. of any accidental or intentional reporting of non-authentic data by other employees.

_____ _____
(Signature) (Date)

APPENDIX G: EQUIPMENT LIST

SEMIVOLATILE ANALYSIS

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
1	Hewlett Packard 6890N Gas Chromatograph/5973 Mass Spectrometer w/7683 Autosampler Tower	5973	May-97	US00023050/US82311233 MSD5
1	Hewlett Packard 6890N Gas Chromatograph/5973 Mass Spectrometer w/7683 Autosampler Tower	5973	May-97	CN10521005/US52440275 MSD1
1	Hewlett Packard 6890 Gas Chromatograph/5973 Mass Spectrometer w/7673 Autosampler Tower	5973	September-05	US00009213/US72010604 MSD2
1	Hewlett Packard 6890 Gas Chromatograph/5973 Mass Spectrometer w/7673 Autosampler Tower	5973	May-97	US00007297/US70810371 MSD7
1	Hewlett Packard 6890N Gas Chromatograph/5975 Mass Spectrometer w/7683 Autosampler Tower	5975	November-07	CN10727001/US90704000 MSD4
1	Hewlett Packard 6890 Gas Chromatograph/5973 Mass Spectrometer w/7683 Autosampler Tower	5973	May-97	US00025502/US82311417 MSD6
1	Hewlett Packard 6890 Gas Chromatograph/5973 Mass Spectrometer w/7683 Autosampler Tower	5973	May-97	US00028102/US82311610 MSD8
1	Hewlett Packard 5890 Gas Chromatograph-FID w/CTCA200S Autosampler	5890	February-91	3203A41418 FIDA
1	Hewlett Packard 6890N Gas Chromatograph-FID w/CTCH5500 Headspace Autosampler	6890	July-08	CN10805007 FID8 126292
1	Hewlett Packard 6890N Gas Chromatograph-FID w/7683B Autosampler	6890	March-08	CN10805005 FID6
1	Hewlett Packard 6890N Gas Chromatograph-FID w/7683B Autosampler	6890	June-08	CN10811015 FID7

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
1	Hewlett Packard 6890N Gas Chromatograph-FID w/7683B Autosampler	6890	July-08	US10604037 FID5
1	Hewlett Packard 6890 Gas Chromatograph-Dual ECD w/7673 Autosampler	6890	Nov-97	US00009591 ECD5
1	Hewlett Packard 6890 Gas Chromatograph-Dual ECD w/7673 Autosampler	6890	Nov-97	US00010134 ECD7
1	Hewlett Packard 6890 Gas Chromatograph-Dual ECD w/7683 Autosampler	6890	Nov-97	US00023068 ECD3
1	Hewlett Packard 6890 Gas Chromatograph-Dual ECD w/7683 Autosampler	6890	Mar-98	US00023402 ECD1
1	Hewlett Packard 6890 Gas Chromatograph-Dual ECD w/7683 Autosampler	6890	Mar-98	US00028911 ECD2
1	Hewlett Packard 6890 Gas Chromatograph-Dual ECD w/7683 Autosampler	6890	Nov-97	US00023343 ECD6
1	Hewlett Packard 6890 Gas Chromatograph-Dual ECD w/7683 Autosampler	6890	Jul-98	US10133016 ECD8

VOLATILE ORGANIC ANALYSIS

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
1	Hewlett Packard Gas Chromatograph/Mass Spectrometer with OI 4560 Purge and Arcon Autosampler	5973	Oct-99	US91911845/US00030386 VOA1
1	Hewlett Packard Gas Chromatograph/Mass Spectrometer with OI 4560/Arcon Autosampler	5973	Nov-98	US71191097/US00023264 VOA9
1	Hewlett Packard Gas Chromatograph/Mass Spectrometer Chemstation with OI 4560/Arcon Autosampler	5973	Nov-07	US00026073/US82311481 VOA4

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
1	Hewlett Packard Gas Chromatograph/Mass Spectrometer Chemstation with OI 4560/Arcon Autosampler	5972	Jun-93	3336A51009/3251A00145 VOA5
1	Hewlett Packard Gas Chromatograph/Mass Spectrometer Chemstation with 014560/Arcon Autosampler	5973	Jan-98	US72010562/US00010331 VOA8
1	Hewlett Packard Gas Chromatograph/Mass Spectrometer Chemstation with OI 4560/Arcon Autosampler	5973	Mar-99	US82311536/US00026725 VOA2
1	Hewlett Packard Gas Chromatograph/Mass Spectrometer Chemstation with OI 4560/Arcon Autosampler	5973	Jul-04	US82311616/US00028288 VOA3
1	Hewlett Packard Gas Chromatograph/Mass Spectrometer Chemstation with OI 4560/Arcon Autosampler	5973	Jul-05	US10442045/US10150081 VOA7
1	Hewlett Packard Gas Chromatograph/Mass Spectrometer Chemstation with OI 4560/Arcon Autosampler	5973	Sep-05	US52430466/CN10525054 VOA6
1	Flame IonizationDetector and Tekmar LCS 200 with Acron Autosampler	6890N	Jul-08	CN10813002
1	Hewlett Packard Gas Chromatograph/Mass Spectrometer with OI 4560/Arcon Autosampler	5975	Jun-06	USG1332879/CN10606080 VOA5

METALS ANALYSIS

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
2	Perkin Elmer Mercury Analyzer	Fims 400 Fims 100	Nov-97 Jul-01	4179 1538
2	AA WINLAB (Software)		Nov-97 Jul-01	
1	PS Analytical Atomic Fluorescence Mercury Analyzer	10.035	Aug-02	024
1	Millennium (software)		Aug-02	
2	Perkin Elmer Inductively Coupled Plasma Mass Spectrometer	ELAN 6100	Jun-03 Dec-01	187000 G2730107

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
2	Perkin Elmer Inductively Coupled Plasma Mass Spectrometer	ELAN 9000	Apr-02 Jan-06	P1160304 AJ0100590602
2	Perkin Elmer Inductively Coupled Plasma Spectrometer	4300DV	Apr-02	077N1030502 077N2061001
1	Perkin Elmer Inductively Coupled Plasma Spectrometer	5300DV	Dec-07	077C7090601
4	ELAN (software)	2.4 SP3	Jun-03 Dec-01 Apr-02 Jan-06	
3	Winlab 32 (software)	Ver. 3.1.0	Apr-02 Jan-06	
1	Leeman Low Level Hg Analyzer	Hydra AFG+	Jan-08	5021 112-00067-1
1	WinHGRunner (software)		Jan-08	
4	TCLP Tumblers			T101, T104, T105, T106
1	Sartorius Balance	U6100+		39010019
1	Sartorius Balance	CP323S		15750050
1	Sartorius Balance	I8100P		14509268
1	Sartorius Balance	TE133S		16107662
1	Sartorius Balance	TE313S		16107665
1	Mettler Toledo pH meter	Seven Easy		1226126036
1	Thermo Orion pH meter	420		65576
2	Environmental Express HotBlock	SC100		
9	Environmental Express HotBlock	SC154		
1	Barnstead Hotplate	HPA2248 M		1065050570393
1	U.S. Filter Modulab Water System	M00100		LW2264
1	Barnstead NANOpure Diamond	D11901	Aug-02	1190030186870
1	Thermo Centrifuge	CL30	Apr-08	307070484
2	OHAUS Balance	AV313	Feb-08	8029041071 8029041076

GENERAL CHEMISTRY

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
1	Dohrman Total Organic Carbon Analyzer	DC190	May-93	9302211
1	OI Analytical, TOC 1010	1010	Jul-99	18935710267
1	WinTOC (software)		Jul-99	
2	Horizon Speed Vap II	9000	Oct-01 April-02	01-337 01-340

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
4	Environmental Express Midi Still	MC-100	Mar-02	2022 2023 2017 0102
2	Lachat QuikChem 8000	8000 Series	Jul-01 Jul-02	A83000-1910 A83000-2077
1	Lachat QuikChem 8500	8500 Series	Jan-06	60900000344
2	Ominion (software)	3.0.218	Jul-01 Jul-02	
1	Ominion (software)	3.0.219	Jan-06	
2	ThermoSpectronic	20D+	Nov-03 Aug-06	3DUD255001 3DUJ199004
2	Mitsubishi Total Organic Halogen Analyzers	TOX-10-C TOX-10-C	Jul-84 Jan-90	43R00334 43R31429
1	Dionex Ion Chromatograph	DX 500	Oct-99	99040041
1	PeakNet (software)	5.21	Oct-99	
2	Dionex Ion Chromatograph	DX300	Jun-89 Mar-93	891603 930519
2	AI450 (software)		Jun-89 Mar-93	
1	Dionex Ion Chromatograph	ICS-3000	Feb-08	7120836
1	Chromeleon (software)	6.80 SP2	Feb-08	
1	Turbidimeter	VWR555	Mar-08	200803105
1	Dohrman DX 2000 TOX/EOX	DX2000	Feb-94	9309876
1	Titroline Karl Fischer Moisture Analyzer	D55122	Feb-07	635172
2	TKN Block Digestor	AIM500	Feb-06	4540A10265 4540A10266
2	NH3 Distillation Unit	100	Feb-08	342930103 498810510
2	Lab-Line Pyro Multi-Magnestire	59380		0300-0171 0300-0170
1	YSI Dissolved Oxygen Meter	5000	Nov-05	05L1915 AE
2	IEC Clinical Centrifuge	Clinical		428-17189
1	Pensky Martin Flashpoint Tester	HFP 380		23800146
1	Rapid Tester Setaflash	RT-00001		22012
2	Baxter TDS Ovens	DN63		DN63
1	VWR TSS Oven	1370FM		101399
1	Muffle Furnace			
2	Precision Water Baths		Nov-03	R7U-1 602101333

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
2	HACH COD Reactor	COD Reactor	Jan-94	911005731C 9807000017919
1	Orion Conductivity Meter	160	Jan-94	32241041
1	Parr 1261 Calorimeter	Parr 1261	Jan-89	289
1	Sartorius Balance	L2200S		3410156
1	Sartorius Balance	1872		3410156
1	Sartorius Balance	BP2100S		90710197
1	Sartorius Balance	BA210S		40245216
1	Sartorius Balance	BA221S		90606741
1	OHAUS Balance	OHAUS	Jul-08	8029271076
1	Brookfield Viscometer	LVDVE	Apr-05	E6515383
1	Fisher Accumet pH Meter	805MP		471
1	PerpHect pH Meter Orion	370		19496
1	Beckman Centrifuge	TJ-6		4359
1	Olympus Stereo Zoom Microscope		Jan-92	SZ4045
1	National Autoclave	704-8000-DES		

RADIOCHEMISTRY/BIOASSAY

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
2	Tennelec LB-4100 Proportional Counter with 32 detectors	LB4100	Jun-93 Dec-98	18483 21938
1	OSUM (software), Canberra	v1.11	Feb-08	
3	Beckman Liquid Scintillation Counters	LS6000	Jun-93 Mar-03 Dec-98	7065155 7060655 7060656
4	Beckman Liquid Scintillation Counters	LS6500	Jun-93 Apr-94 Oct-03 Dec-98	7067083 7067404 7070506 7069123
3	LS Winconnection Suite	Software		
1	Wallac Liquid Scintillation Counter	1414	Mar-97	4040127
1	Quantallus Liquid Scintillation Counter	1220	Dec-98	220082
1	Win Spectral (software)	v2.00.02		
1	WinQ (software)	v1.2		
1	Gamma Spectrometer	GC3018	1993	5933088
1	Gamma Spectrometer	GEM-35190	2004	CV-P122204CA
1	Gamma Spectrometer	GC3520	1992	12922955
1	Gamma Spectrometer	GC3519	1991	9912854
1	Gamma Spectrometer	GR3520	1993	8932581
1	Gamma Spectrometer	GC3519	1991	11912876

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
1	Gamma Spectrometer	GC4019	2007	10079344
1	Gamma Spectrometer	GC3519	1994	1943234
1	Gamma Spectrometer	GC4019	2001	10017452
1	Gamma Spectrometer	IGC3919	1993	2605
1	Gamma Spectrometer	GC4019	2006	9069163
1	Gamma Spectrometer	GC4019	2001	10017444
1	Gamma Spectrometer	GMX 45225-P-S	1990	37-TN11260A
1	Gamma Spectrometer	GC4020	2005	10059017
1	Gamma Spectrometer	GEM35P4 -83	2008	CV-TP001608CA
1	Gamma Spectrometer	GC4019	2006	9069175
1	Gamma Spectrometer	GMX302 00-P	1990	30-TN10348
1	Gamma Spectrometer	GEM9021 0-P	1990	30-TP30546-A
1	Gamma Spectrometer	GC4020	2005	10059015
1	Gamma Spectrometer	GC4020	2006	4069118
1	Gamma Spectrometer	BE3825	2006	3068173
1	Gamma Spectrometer	GC8021	1994	8943324
1	Gamma Spectrometer	GEM35	2007	CV-PO42407CA
1	Gamma Spectrometer	GC3519	1994	1943199
1	Gamma Spectrometer	NIC3019	1991	PGT2461
1	Gamma Spectrometer	GC6020	2006	12069216
1	Gamma Spectrometer	GCW352 3	1994	3941466
1	Gamma Spectrometer	GL2020-S	1992	12922782
1	Gamma Spectrometer	GL2820R	1995	1954119
1	Gamma Spectrometer	GL2820R	1998	3984452
1	Gamma Spectrometer	GL2820R	2007	9078304
1	Gamma Spectroscopy Software		Jan-94	
1	Alpha Personal Workstation	500au	Nov-98	N188806229
1	Alpha Personal Workstation	500au	Nov-98	N183806280
1	APEX Alpha		Mar-08	
4	Protean Multi-Detector Proportional Counter	MDS-16	Apr-02	10751, 10752, 10753, 10754
4	Protean Multi-Detector Proportional Counter	MDS-16	Jul-05	0525768, 0525767, 0531474, 0531475
2	Protean Multi-Detector Proportional Counter	MDS-16	Oct-05	311438 311437
1	Protean Multi-Detector System Control Panel (software)	PIC MDS Control Panel v1.22	Apr-02	
1	Perkin Elmer Automatic Gamma Counter	1480	Jun-05	4800440

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
1	Protean Automatic Gas Proportional Counter	WPC 9550		329438
1	Ludlum Radon Flask Counter	182	Dec-00	86494
1	Ludlum Radon Flask Counter	182	May-92	86493
1	Ludlum Radon Flask Counter	182	Jun-93	84406
1	Ludlum Radon Flask Counter	182	Oct-93	140731
1	Ludlum Radon Flask Counter	182	Dec-98	78964
1	Ludlum Radon Flask Counter	182	Dec-00	134331
1	Ludlum Radon Flask Counter	182	Aug-08	125015
21	Alpha Spectrometer, Canberra	7401	1990	
18	Alpha Spectrometer, Canberra	7401	1991	
18	Alpha Spectrometer, Canberra	7401	1992	
12	Alpha Spectrometer, Canberra	7401	1993	
6	Alpha Spectrometer, Canberra	7401	1994	
12	Alpha Spectrometer, Canberra	7401	1995	
6	Alpha Spectrometer, Canberra	7401	2000	
2	Alpha Spectrometer, Canberra	7401	2003	
12	Alpha Analyst Spectrometer Canberra Industries	7200	Mar-06	12055889, 11055017, 11055019, 11055020, 11055021, 11055022, 11055023, 11055024, 11055025, 11055026, 5062243
12	Alpha Analyst Spectrometer Canberra Industries	7200	Jul-06	08021107, 07050165, 12055898, 10255899, 12056204, 08051501, 04061317, 08051113, 05062240, 12073580,
12	Alpha Analyst Spectrometer Canberra Industries	7200	Jul-08	12073509, 12073519, 12073520, 12073521, 12073522, 12073590, 12073524, 12073525, 12073526, 12073571, 12073572, 12073573,
6	Alpha Analyst Spectrometer Canberra Industries	7200	Sep-08	10079972, 10079973, 10079974, 10079971, 10079982, 10079983
1	Alpha Spectroscopy Software	Canberra	Jan-94	
1	Coaxial Germanium Detector for Gamma Spectroscopy	GC3519	Dec-06	1943199
1	Wallac Liquid Scintillation Counter	Guardian	Mar-97	4140299
1	Canberra Alpha/Gamma Data Management System (software)	XG3100B	Feb-92	G-4470
1	ChemChek Instruments Kinetic Phosphorescence Analyzer (software)	KPAWin Ver 1.2.8	1998	GEL
1	Laser Kinetic Phosphorimeter with Sample Changer	KPA-11	May-05	05-45050162
1	Sartorius Balance	EB6DCE-L	Pre-2001	22610879

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
1	Sartorius Balance	LC3201D	Pre-2001	60108592
1	Sartorius Balance	BP210S	Pre-2001	70104421
1	Sartorius Balance	EB6DCE-L	Pre-2001	15701734
1	Sartorius Balance	LC6200S	Pre-2001	30503785
1	Mettler Balance	AT261	2001	M64061
2	Thermo IEC Centrifuge	Centra CL3	pre-2001	37500869 37501045
1	Thermo IEC Centrifuge	Centra CL3	2005	37502501
1	Muffle Furnace	BF51841C-1	Pre-2001	BF51841C-1
1	Muffle Furnace	BF51828C	Pre-2001	BF51828C
1	Muffle Furnace	BF51842C	Pre-2001	BF51842C
1	Muffle Furnace	BF51842PC-1	Pre-2001	BF51842PC-1
1	Muffle Furnace	BF51841C-1	Pre-2001	BF51841C-1
3	Yamato Drying Oven	DX600	2001	A9300029
132	Canberra Alpha Analyst Spectrometer with PIRS Detectors	7200	1988-2002	585-716
1	Drying Oven	1300U	pre-2001	904002

LABORATORY INFORMATION MANAGEMENT SYSTEMS

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
1	SUN Ultra Enterprise 3000, Solaris 2.5.1, 6 CPUs, (new carlos) 512 MB RAM, 50 GB Disk (mirrored, 100 Mbps Eth card, Oracle 7)	N/A	Apr-98	SUN-E3-167
1	SUN Ultra Enterprise 3000, Solaris 2.6, 6 CPUs, (prodsvr01) 512 MB RAM, 25 GB Disk (mirrored, 100 Mbps Eth card, Oracle 8I, Rad Tower)	N/A	Apr-98	SUN-E3-167
1	Windows NT Server, NT4, 2 CPU 256 MB RAM 10 GB Disk (rad_server), 100 Mbps Eth card, ORACLE 7	N/A	Aug-98	PC Server Class

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
1	HP9000 Dclass, HP-UX 10.20, 2 cpu, 256 MB RAM, (hpclp1) 50GB Disk (mirrored and RAID%), Raid tower, 100 Mbps Eth card, Target Software	N/A	Nov-97	A3480A
1	HP9000 Dclass, HP-UX 10.20, 2 cpu, 256 MB RAM, (kilroy) 50GB Disk (mirrored and RAID5), Raid tower, 100 Mbps Eth card, Target Software	N/A	Nov-97	A3480A
1	SUN Ultra Enterprise 4500, Salaris 9 20 CMUs, 6 GB RAM, 720 GB Disk (mirrored RAID 5), Oracle 9, 100 Mbps Ethernet card	E4500	Feb-03	941H35EF
1	Rave - Ultra AX-MP 2 CPU's, 1024 MB RAM, 60 GB Disk (mirrored)	E450	Oct-99	257703
1	Rave - Ultra AX-MP 2 CPU's, 1024 MB RAM, 60 GB Disk (mirrored)	E250	Mar-00	302971
1	Aberdeen Sterling S38i 4x1.8 GHz, 1.5GB RAM, 168 GB (RAID5)	Sterling S38i		F14102A3420394
1	Aberdeen Sterling S38i 4x1.8 GHz, 1.5GB RAM, 168 GB (RAID5)	Sterling S38i		F14102A3470669
1	Apple- Xserve G% 2x2.5 GHzCPU's, 1.0 GB RAM, 3x400 GB Disks (mirrored)	Xserve G5		QP5020HKRTS
1	Apple-Xserv RAID 14x400 GB Disks (RAID5)	Xserve RAID		QP503007R56
1	SUN Sparc-5 225 MB, 5 GB	N/A		521F00XX
1	SUN Sparc-5 225 MB, 10 GB	N/A		434F2457

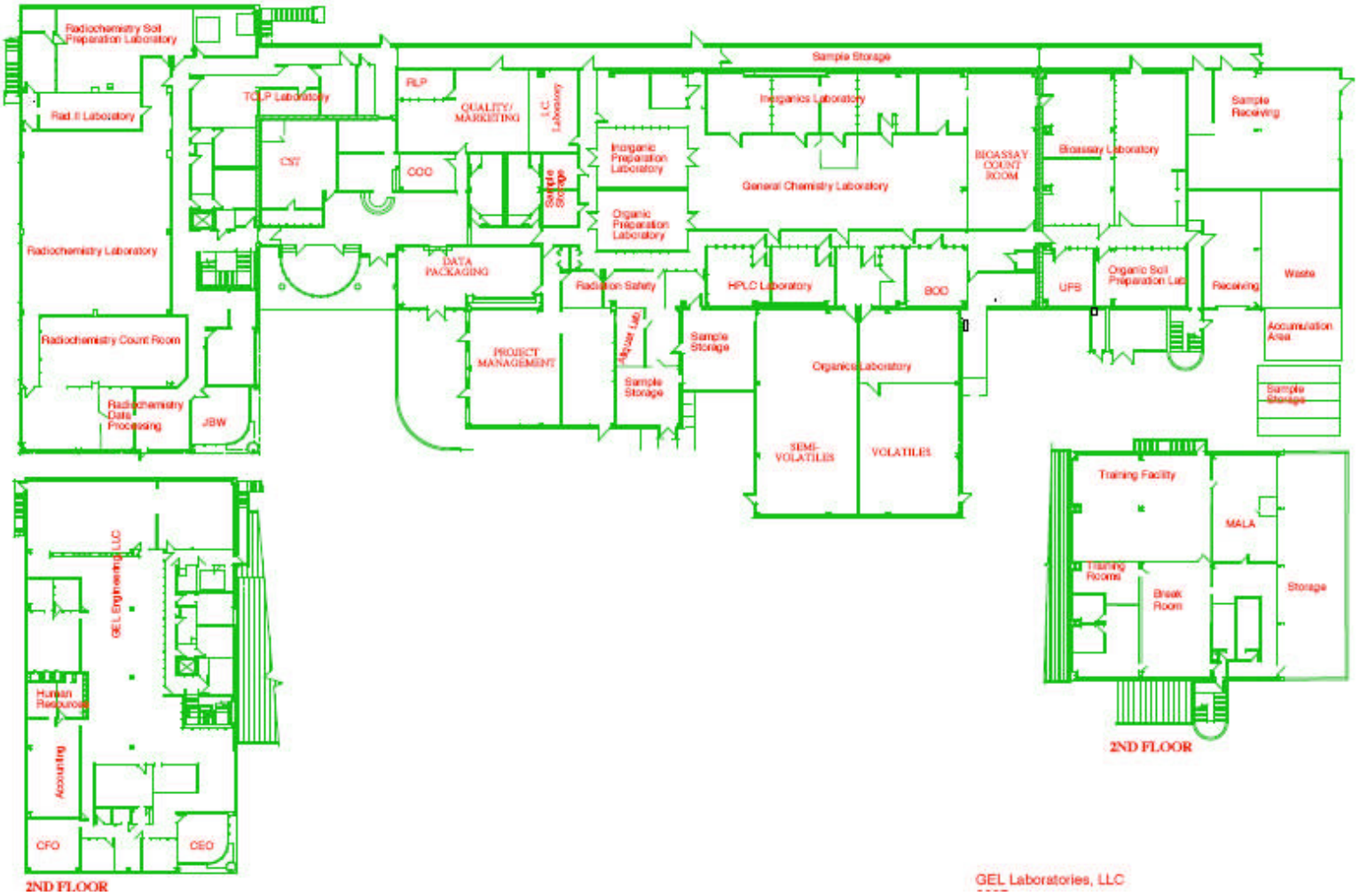
UNIVERSAL POWER SUPPLY

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
1	Power ware9315	9315	Jul-05	ES443ZXX57

AREA 51 STORAGE

# of Units	Equipment	Model #	Purchase Date	ID/Serial #
1	Ohaus Balance	Adventurer	Feb-08	8029041076
1	Ohaus Balance	Adventurer	Feb-08	8029041072

APPENDIX H: FACILITIES WITH EVACUATION ROUTES



APPENDIX I: STANDARD OPERATING PROCEDURES AND ANALYTICAL METHODS

Standard Operating Procedures and Analytical Methods

SOP #	SOP Title	Methods
GL-ADM-E-001	Preparation, Authorization, Advance Change, Revision, Release, and Retirement of SOPs	N/A
GL-AP-E-001	Invoicing Analytical Lab Numbers	N/A
GL-CO-E-001	Revising GEL Laboratories Catalog of Analytical Services	N/A
GL-CO-E-002	Delegated Authority to Commit the Company	N/A
GL-CO-E-003	Request for Proposal (RFP) and Contract Review	N/A
GL-CS-E-002	Internal Review of Contractually Required Quality Criteria for Client Package Delivery	N/A
GL-CS-E-005	Electronic Data Deliverables	N/A
GL-CS-E-006	Subcontracting Analytical Services	N/A
GL-CS-E-008	Prelogin, Login, and Login Review	N/A
GL-CS-M-001	Project Management AlphaLIMS Manual	N/A
GL-DC-E-001	Document Control	N/A
GL-FC-E-001	Facility Security	N/A
GL-FC-E-002	Testing Emergency Eyewash and Shower Equipment	N/A
GL-FC-E-003	Fume Hood Face Velocity Performance Checks	N/A
GL-FC-E-004	Inspection of Fire Extinguishers	N/A
GL-FS-E-001	Field pH	**EPA 150.1, 4500-H+ B**
GL-FS-E-002	Field Specific Conductance	**EPA 120.0, 2510B**
GL-FS-E-003	Field Dissolved Oxygen	**EPA 360.1, 4500-O G**
GL-FS-E-004	Field Total and Free Residual Chlorine	**EPA 330.5, 4500-Cl G, HACH 8021 and 8167**
GL-FS-E-005	CME-45 B Drilling Rig	**N/A**
GL-FS-E-006	Hydrolab DataSonde 4a Operation	**N/A**
GL-FS-E-007	Low Level Mercury Sampling by EPA Method 1669	**1631, 1669**
GL-GC-E-001	Total Dissolved Solids	**EPA 160.1, 2540C**
GL-GC-E-004	General Chemistry Standards, Definitions, and Preparation	N/A
GL-GC-E-007	Total Organic Halogen (TOX) and Adsorbable Organic Halides on Liquid Samples Using the Mitsubishi TOX-10 Analyzer	**1650C, 9020B**
GL-GC-E-008	pH	**EPA 150.1, 9040B/9040C, 9041A, 9045C/9045D, 4500-H^+, OLMO 4.2**
GL-GC-E-009	Conductivity and Salinity	**EPA 120.1, 9050A, SM 2510B, SM 2520B**
GL-GC-E-010	Paint Filter Test	**EPA 9095A, 9095B**
GL-GC-E-011	Total Solids	**EPA 160.3, 2540B, 2540G**
GL-GC-E-012	Total Suspended Solids	**EPA 160.2, 2540D**
GL-GC-E-027	Pensky-Martens Closed Cup Flashpoint	**1010, 1010A, ASTMD93-80**

Standard Operating Procedures and Analytical Methods

SOP #	SOP Title	Methods
GL-GC-E-028	Carbonaceous Biochemical Oxygen Demand (CBOD)	**EPA 405.1, 5210B**
GL-GC-E-029	Corrosivity Toward Steel	**1110(M), 1110A(M)**
GL-GC-E-031	Fecal Coliform by Membrane Filter	**9222D**
GL-GC-E-032	Carbon Dioxide (Total and Free) by Calculation	**4500-CO_2 D**
GL-GC-E-033	Alkalinity: Total, Bicarbonate, Carbonate, Hydroxide, and Phenolphthalein	**EPA 310.1(M), 2320B**
GL-GC-E-034	Fecal Coliform Most Probable Number (5 Tube Dilution)	**9221E1, EPA 600/8-78-017**
GL-GC-E-035	Volatile Suspended Solids	**EPA 160.2, 160.4, 2540E**
GL-GC-E-036	Color by Visual Comparison	**EPA 110.2, 2120B**
GL-GC-E-037	Turbidity	**2310, EPA 180.1**
GL-GC-E-040	Pretreatment of Cyanide Amenable to Chlorination	**EPA 335.1, 9010B, 9010C, 9012A, 9012B, 4500-CN^- G**
GL-GC-E-044	Colorimetric Determination of Hexavalent Chromium	**7196A, 3500-Cr D, 3060A**
GL-GC-E-045	Biochemical Oxygen Demand (BOD)	**EPA 405.1, 5210B**
GL-GC-E-047	Methylene Blue Active Substance	**EPA 425.1, 5540C**
GL-GC-E-048	Heating Value Determination by Bomb Calorimeter	**ASTM D 240-00, 4809-00, E 711-87 (M)**
GL-GC-E-050	Threshold Odor	**EPA 140.1**
GL-GC-E-052	Sulfide (Methylene Blue Method)	**EPA 376.2(M), HACH 8131, 4500 S^{2-} D**
GL-GC-E-053	Heterotrophic Plate Count (Standard Plate Count)	**9215B**
GL-GC-E-054	Total Coliform by Membrane Filter	**9222B**
GL-GC-E-056	Sulfite	**4500-SO_3^{2-} B, EPA 377.1**
GL-GC-E-057	Volatile Solids and % Ash Procedure for Water Samples	**EPA 160.4, 2540E**
GL-GC-E-058	Volatile Solids and % Ash Procedure for Solid and Semisolid Samples	**2540G**
GL-GC-E-059	Dissolved Oxygen Analysis by Membrane Electrode Method	**4500-O^- G, EPA 360.1**
GL-GC-E-061	Chemical Oxygen Demand (COD) Digestion Reactor Method	**EPA 410.4, HACH 8000**
GL-GC-E-062	Total Carbon and Total Organic Carbon Analysis Using the Dohrmann DC-190 Boat Sampler	**9060 (M), 9060A(M), EPA 415.1, Lloyd Kahn**
GL-GC-E-063	Total Coliform by Most Probable Number (5 Tube Dilution)	**9221B**
GL-GC-E-064	Density	**ASTM D5057**
GL-GC-E-065	Specific Gravity	**ASTM D5057**
GL-GC-E-066	Flashpoint by Setaflash	**1020A, 1020B, ASTM D 3278-78**
GL-GC-E-067	Cyanide Sample Distillation	**9012A, 9012B, 9010B, 9010C, 335.1, 335.3, 335.4, 335.2 CLP-M, 4500-CN^- C**
GL-GC-E-068	Viscosity	**Manufacturer's Method**
GL-GC-E-069	Reactive Cyanide and Sulfide	**SW-846 Chap 7.3.3, Chap 7.3.4**

Standard Operating Procedures and Analytical Methods		
SOP #	**SOP Title**	**Methods**
GL-GC-E-071	Total Phosphorous and Total Kjeldahl Nitrogen Sample Preparation	**EPA 365.4, 351.2**
GL-GC-E-072	Ammonia-Nitrogen Sample Preparation	**EPA 350.1, 350.2, 4500-NH_3^- B**
GL-GC-E-073	Free Cyanide Analysis by Microdiffusion	**ASTM D 4282**
GL-GC-E-074	Extractable Organic Halides (EOX) Using the Dohrmann DX-2000 Analyzer	**SW-846 9023**
GL-GC-E-076	Total Residue Chlorine	**4500-Cl G, EPA 330.5**
GL-GC-E-077	Cyanide Weak Acid Dissociable Sample Preparation and Analysis	**EPA 335.4, 4500-CN I**
GL-GC-E-079	Bomb Preparation Method for Solid Waste	**5050**
GL-GC-E-082	Acid-Soluble Sulfides	**9030B, 9034**
GL-GC-E-086	Ion Chromatography (IC)	**EPA 300.0, 4110B, 9056A**
GL-GC-E-087	Percent Water by Karl Fischer Titration	**ASTM E203-96**
GL-GC-E-090	Acidity	**EPA 305.1, 305.2, 2310B**
GL-GC-E-091	Wavelength Calibration Verification of Thermospectronic Spectrophotometers	N/A
GL-GC-E-092	General Chemistry Data Review and Packaging	N/A
GL-GC-E-093	Total, Total Inorganic and Total Organic Carbon (TOC) using the OI Analytical Model 1010 TOC Analyzer	**EPA 415.1, 9060, 9060A, 5310D**
GL-GC-E-094	N-Hexane Extractable Material (HEM; Oil and Grease) and Silica GEL Treated N-Hexane Extractable Material (SGT-HEM Non-Polar Material) in Aqueous Matrices	**1664A**
GL-GC-E-095	Cyanide Analysis by Lachat QuikChem 8000 FIA	**CLP 335.2-M, 335.1, 335.3. 335.4, 9010B, 9010C, 9012A, 9012B, 4500-CN^- C**
GL-GC-E-096	Perchlorate by Ion Chromatography (IC)	**EPA 314.0**
GL-GC-E-097	Boiling Point	**ASTM D1120 (M)**
GL-GC-E-098	Total Halogens	**ASTM D 808-00**
GL-GC-E-099	Ferrous Iron (Phenanthroline Method)	**SM 3500-Fe D, 3500-Fe B**
GL-GC-E-100	Total Hardness by Titration	**EPA 130.2, 2340C**
GL-GC-E-101	Hydrazine	**ASTM D 1385-01**
GL-GC-E-102	Total Recoverable Phenol by the Lachat QuikChem FIA+ 8000 Series	**EPA 420.4, 9066**
GL-GC-E-103	Total Phosphorus by the Lachat Quickchem FIA+ 8000 Series Instrument	**EPA 365.4**
GL-GC-E-104	Total Kjeldahl Nitrogen (TKN) Using the Lachat QuikChem FIA+ 8000 Series Instrument	**EPA 351.2, 4500 N_{org} B or C**
GL-GC-E-105	The Volumetric Determination of Settleable Solids	**EPA 160.5, 2540F**
GL-GC-E-106	Ammonia Determination by the Lachat Quickchem FIA + 8000 Series	**EPA 350.1 Rev 2**
GL-GC-E-107	Inorganic Calculations	N/A

Standard Operating Procedures and Analytical Methods		
SOP #	**SOP Title**	**Methods**
GL-GC-E-127	Modified Elutriate Test	N/A
GL-GC-E-128	Nitrate/Nitrite (NO_3+NO_2) Analysis Using The Lachat QuickChem FIA + 8000 Series Instrument	**EPA 353.2, 4500-NO_3^- F**
GL-GC-E-129	Air Filter Particulates	N/A
GL-GC-E-130	Percent Ash Determined at 775 C Procedure for Solid and Semisolid Samples	**ASTM D 482-03 (M)**
GL-HR-E-002	Employee Training	N/A
GL-IT-E-001	Information Technology Program for Good Laboratory and Good Manufacturing Practices	N/A
GL-IT-E-002	Computer Systems Team Roles and Responsibilities	N/A
GL-IT-E-003	Requirements, Design, Operation, Validation and Removal of Hardware and Software Systems Used by the GEL Group, Inc.	N/A
GL-IT-E-004	Change Control Requirements for Hardware and Software	N/A
GL-IT-E-005	Requirements, Design, Operation, Validation and Removal of Applications Used by The GEL Group, Inc.	N/A
GL-IT-E-006	Change Control Requirements for Applications	N/A
GL-IT-E-007	User Roles and Responsibilities for Personnel Using Computer Services	N/A
GL-IT-E-008	Server Backup for GEL Analytics, LLC	N/A
GL-IT-E-009	Archive and Retrieval of Systems Information	N/A
GL-IT-E-010	Backup of Computer Controlled Instrumentation	N/A
GL-IT-E-011	System Security and Virus Protection	N/A
GL-IT-E-012	Application Tools used by Computer Services Personnel	N/A
GL-IT-E-013	Creation and Maintenance of the LIMS Audit System	N/A
GL-IT-E-014	Disaster Recovery	N/A
GL-IT-E-015	Operation of LIMS Database Primary and Failover Servers	N/A
GL-LB-E-001	The Determination of Method Detection Limits	N/A
GL-LB-E-002	Balances	N/A
GL-LB-E-003	Glassware Preparation	N/A
GL-LB-E-004	Temperature Monitoring and Documentation Requirements for Refrigerators, Ovens, Incubators, and Other Similar Devices	N/A
GL-LB-E-005	Data Review and Validation	N/A
GL-LB-E-006	Toxicity Characteristic Leaching Procedure Preparation	**SW-846 1311**
GL-LB-E-007	Laboratory Standards Documentation	N/A
GL-LB-E-008	Basic Requirements for the Use and Maintenance of Laboratory Notebooks, Logbooks, Forms and Other Recordkeeping Devices	N/A
GL-LB-E-009	Run Logs	N/A
GL-LB-E-010	Maintenance and Use of Air Displacement Pipets	N/A
GL-LB-E-012	Verifying the Maintenance of Sample Integrity	N/A
GL-LB-E-013	CLP-Like/DOE Data Package Assembly and Revision	N/A
GL-LB-E-015	Control of Laboratory Standards	N/A

Standard Operating Procedures and Analytical Methods		
SOP #	**SOP Title**	**Methods**
GL-LB-E-016	The Collection and Monitoring of the DI Water Systems	N/A
GL-LB-E-017	Procedure and Policy for Manual Integration	N/A
GL-LB-E-018	Instrument Clock Verification	N/A
GL-LB-E-020	Tuning of High Intensity Ultrasonic Processor	N/A
GL-LB-E-022	Generation of Swipe Data	N/A
GL-LB-E-023	Waste Extraction Test (WET)	N/A
GL-LB-E-024	Synthetic Precipitation Leaching Preparation	**EPA 1312**
GL-LB-E-026	Container Suitability Testing	N/A
GL-LB-E-027	Bioassay Kit Delivery and Retrieval	N/A
GL-LB-E-028	Creation and Maintenance of Case Narratives	N/A
GL-LB-E-029	Laboratory Sub-Sampling	N/A
GL-LB-E-030	Silica Gel and Air Filter Removal and Replacement	N/A
GL-LB-E-031	Sample Compositing	N/A
GL-LB-E-033	Proper Peak Identification for Organics	N/A
GL-LB-G-001	Laboratory Waste Management Plan	N/A
GL-LB-N-001	Safety, Health and Chemical Hygiene Plan	N/A
GL-MA-E-006	Acid Digestion of Total Recoverable or Dissolved Metals in Surface and Groundwater Samples for Analysis by ICP or ICP-MS	**3005A**
GL-MA-E-008	Acid Digestion of Total Metals in Aqueous Samples and Extracts for Analysis by ICP and ICP-MS	**3010A,** 7760
GL-MA-E-009	Acid Digestion of Sediments, Sludges, and Soils	**3050B**, 6010B, 6020
GL-MA-E-010	Mercury Analysis Using the Perkin Elmer Automated Mercury Analyzer	**245.1, 245.2, 245.5**, **245.1 CLP-M, 245.2 CLP-M, 245.5 CLP-M**, **7470A**, **7471B**, **3112B**
GL-MA-E-012	Inorganic CLP Sample Digestions	**ILMO 4.0**
GL-MA-E-013	Determination of Metals by ICP	**EPA 200.7, 6010C, and 200.7 CLP-M, 6010B**
GL-MA-E-014	Determination of Metals by ICP-MS	**6020, 6020A, EPA 200.8, ASTM D4698-92,** 3005, 3010, 3050, 200.2
GL-MA-E-016	Sample Preparation for Total Recoverable Elements by EPA Method 200.2	**EPA 200.2**
GL-MA-E-017	Metals Data Validation	N/A
GL-MA-E-018	Mercury Analysis using the PS Analytical Millennium Automated Mercury Analyzer	**EPA 1631 Rev E**
GL-MA-E-019	NIOSH 7300 Filter Digestion	**NIOSH 7300**
GL-MA-E-021	Total Digestion of Sediment Samples for Analysis by ICP or ICP-MS	**ASTM D 4698-92**
GL-OA-E-001	Establishing Retention Time Windows for GC and HPLC Analysis	**SW-846 8000**
GL-OA-E-002	Organic Standards Preparation and Traceability	N/A

Standard Operating Procedures and Analytical Methods

SOP #	SOP Title	Methods
GL-OA-E-003	Non-Volatile Total Petroleum Hydrocarbons by Flame Ionization Detector	**8000B, 8000C, 8015B, 8015C,** 3510C, 3510B, 3550C, 3580A
GL-OA-E-004	Volatile Total Petroleum Hydrocarbons by Flame Ionization Detector	**5030A, 5030B, 5030C, 5035A, 5035, 8000B, 8015, 8015A, 8015B, 8015C, 8015D**
GL-OA-E-009	Analysis of Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry	**8270C, 8270D, EPA 625**
GL-OA-E-010	Extraction of Semivolatile and Nonvolatile Organic Compounds from Soil, Sludge, and Other Miscellaneous Solid Samples	**3500C, 3550C**, 8270C, 8270D, 8081, 8081A, 8081B, 8082, 8015A, 8310, FL-PRO, CT-ETPH, AK 102, AK 103
GL-OA-E-011	Analysis of Chlorophenoxy Acid Herbicides by ECD	**8151A**, 8150B, 8150
GL-OA-E-013	Extraction of Semivolatile and Nonvolatile Organic Compounds from Groundwater, Wastewater, and Other Aqueous Samples	**3510C**, 8270B, 8270D, 8081, 8081A, 8081B, 8082, 8082A, 8015A, 8015B, 8015C, 8310, 608, 625, FL-PRO, AK102, 103, CT-ETPH
GL-OA-E-015	The Extraction of Herbicides from Groundwater, Wastewater, and Other Aqueous Samples	**8151A**
GL-OA-E-020	Percent Moisture	**ASTM D2216-98 (M)**
GL-OA-E-022	Volatile Organic Compounds by Gas Chromatograph/Mass Spectrometer Applicable to EPA Method 524.2	**EPA 524.2**
GL-OA-E-026	Volatile Organic Compounds (VOC) by Gas Chromatograph/Mass Spectrometer	**EPA 624**
GL-OA-E-027	The Extraction of Herbicides from Soil and Sludge Samples	**8151A**
GL-OA-E-030	Polynuclear Aromatic Hydrocarbons	**8000B, 8310**
GL-OA-E-033	Nitroaromatics and Nitramines by High Performance Liquid Chromatography (HPLC)	**8330, 8000B**
GL-OA-E-036	Florisil Cleanup of Organochlorine Pesticide Solvent Extracts	**3620B**, 3510C, 3550B, 8081A, 3620B
GL-OA-E-037	Sulfuric Acid/Permanganate Cleanup of PCB Solvent Extract	**3550C, 3665A, 8082, 8082A**
GL-OA-E-038	Volatile Organic Compounds (VOC) by Gas Chromatograph/Mass Spectrometer	**8260A, 8260B, 8260C, 5030A, 5030B, 5030C, 5035, 5035A**
GL-OA-E-039	Closed-System Purge-and-Trap Collection and Extraction Volatile Organics in Soil and Waste Samples	**EPA 5035, 5035A**
GL-OA-E-040	Polychlorinated Biphenyls	**8000B, 8000C, 8082, 8082A, 608**
GL-OA-E-041	Organochlorine Pesticides and Chlorinated Hydrocarbons	**8000B, 8000C, 8081A, 8081B, 608**
GL-OA-E-045	Sulfur Clean-up	**3660B**

Standard Operating Procedures and Analytical Methods		
SOP #	**SOP Title**	**Methods**
GL-OA-E-046	Common Industrial Solvents, Glycols, and Various Organic Compounds by Flame Ionization Detector	**8000A, 8000B, 8000C, 8015A, 8015B, 8015C**, 8020A,CA Method
GL-OA-E-047	Gel Permeation Cleanup of Solvent Extracts	**3640A, 3510C, 3550C,** 8270D, 8081B, 8082A
GL-OA-E-048	Determination of Petroleum Range Organics by GC-FID (FL-PRO and CT-ETPH)	**3510C, 3550B, 8000B, 8015B, FL-PRO, CT-ETPH**
GL-OA-E-049	Silica Gel Cleanup Using Solid Phase Silica Gel Extraction Cartridges	**3550C, 3510C, 3630C**
GL-OA-E-050	The Extraction of Semivolatile and Nonvolatile Organic Compounds from Oil	**3580A,** 8270B, 8180A, 8015A, 8082
GL-OA-E-056	Definitive Low Level Analysis of Nitroaromatic Explosives Utilizing Liquid Chromatography/Mass Spectrometry/Mass Sepctrometry (LC/MS/MS) by SW-846 Method 8321 Modified (8321M)	**8321(M), 8000B, 8330**
GL-OA-E-058	Volatile Storage Blanks	N/A
GL-OA-E-059	Analysis of 1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-Chloropropane (DBCP) in Water by GC/ECD Using Methods 504 or 8011	**EPA 504, 8011**
GL-OA-E-061	Haloacetic Acids in Water	**EPA 552.2**
GL-OA-E-062	Preparation of Samples for Massachusetts Extractable Petroleum Hydrocarbons (EPH)	**Massachusetts Method,** 3510C, 3541
GL-OA-E-063	Massachusetts Method for the Determination of Extractable Petroleum Hydrocarbons (EPH)	**Massachusetts Method,** 8015B, 3510C, 3541
GL-OA-E-064	Dissolved Gases in Water by Flame Ionization Detector (FID)	**RSK-175**
GL-OA-E-065	Reagent/Solvent/Standards Screening for Organic Prep	N/A
GL-OA-E-066	Automated Soxhlet Extraction	**EPA 3541,** 3600
GL-OA-E-067	Definitive Low Level Perchlorate Analysis Utilizing Liquid Chromatography/Mass Spectrometry/Mass Spectrometry (LC/MS/MS) by EPA Method 6850 Modified (6850M)	**6850, 6850(M), 8000B**
GL-OA-E-068	The Processing, Extraction, and Analysis of Nitroaromatics, Nitroamines, and Nitrate Esters by SW-846 8330B	**8330B,** 3535
GL-QS-B-001	Quality Assurance Plan	N/A
GL-QS-E-001	Conduct of Quality Audits	N/A
GL-QS-E-002	Conducting Corrective/Preventive Action	N/A
GL-QS-E-003	Training and Qualifying Quality Assurance Audit Personnel	N/A
GL-QS-E-004	Documentation of Nonconformance Reporting and Dispositioning and Control of Nonconforming Items	N/A
GL-QS-E-005	Review of Monitoring Device Logs	N/A
GL-QS-E-007	Thermometer Verification	N/A
GL-QS-E-008	Quality Records Management and Disposition	N/A
GL-QS-E-011	Method Validation and Initial and Continuing Demonstrations of Capability	N/A
GL-QS-E-012	NCR Database Operation	N/A

Standard Operating Procedures and Analytical Methods		
SOP #	**SOP Title**	**Methods**
GL-QS-E-013	Handling of Proficiency Evaluation Samples	N/A
GL-QS-E-014	Quality Assurance Measurement Calculations and Processes	N/A
GL-QS-E-015	Use of Logos and Describing Accredited Status	N/A
GL-QS-E-016	Identification and Implementation of New and Revised Methods	N/A
GL-QS-E-017	Maintaining Technical Training Records	N/A
GL-RAD-A-001	The Determination of Gross Alpha And Gross Non-Volatile Beta in Water	**900.0, 9310**
GL-RAD-A-001B	The Determination of Gross Alpha And Gross Non-Volatile Beta in Soil, Filters, Solid Matrices and Direct Count Air Filters	**900.0(M), 9310**
GL-RAD-A-001C	The Determination of Gross Alpha in Water by Co-precipitation	**520/5-84-006 Method 00-02**
GL-RAD-A-002	The Determination of Tritium	**600/4-80-032, 906.0(M)**
GL-RAD-A-003	The Determination of Carbon-14 in Water, Soil, Vegetation and Other Solid Matrices	N/A
GL-RAD-A-004	The Determination of Strontium 89/90 in Water, Soil, Milk, Filters, Vegetation and Tissues	**905.0(M), DOE RP501 Rev1(M), HASL 300(M)**
GL-RAD-A-005	The Determination of Technitium-99	**HASL 300(M) TC-02-RC, DOE RP550(M)**
GL-RAD-A-006	The Determination of Radiometric Iodine	**901.1(M), HASL 300(M) I-01**
GL-RAD-A-007	The Determination of Radon-222 in Water	**SM 7500 Rn-B**
GL-RAD-A-008	The Determination of Radium-226	**903.1(M), HASL 300(M) Ra-04-RC**
GL-RAD-A-009	The Determination of Radium-228 in Water and Solids	**904.0(M)**
GL-RAD-A-010	Total Alpha Radium Isotopes in Soil and Water	**900.1(M)**
GL-RAD-A-011	The Isotopic Determination of Americium, Curium, Plutonium, and Uranium	**DOE RP800 1997(M), HASL-300 U-02-RC(M)**
GL-RAD-A-013	The Determination of Gamma Isotopes	**901.1 (M), HASL-300 (M) Sec. 4.5.2.3**
GL-RAD-A-015	Digestion for Soil	N/A
GL-RAD-A-016	The Determination of Radiometric Polonium	**HASL-300, Po-01-RC**
GL-RAD-A-017	The Determination of Iodine-131 in Water	**902.0, 7500 I^- B**
GL-RAD-A-018	The Determination of Lead-210 in Liquid and Solid Matrices	N/A
GL-RAD-A-019	Determination of Phosphorus-32 in Soil and Water	N/A
GL-RAD-A-020	The Determination of Promethium-147 in Soil and Water	N/A
GL-RAD-A-021	Soil Sample Preparation for the Determination of Radionuclides	N/A
GL-RAD-A-021B	Soil Sample Ashing for the Determination of Radionuclides	N/A
GL-RAD-A-022	Determination of Ni-59 and Ni-63	N/A
GL-RAD-A-023	Total Uranium in Environmental Samples by Kinetic Phosphorescence	**ASTM D 5174-91, 5174-97, 5174-02**

Standard Operating Procedures and Analytical Methods		
SOP #	**SOP Title**	**Methods**
GL-RAD-A-026	The Preparation of Special Matrices for the Determination of Radionuclides	N/A
GL-RAD-A-028	Radium-226 in Drinking Water by EPA Method 903.1	**EPA 903.1**
GL-RAD-A-029	The Determination of Strontium-89/90 in Drinking Water by EPA Method 905.0	**EPA 905.0**
GL-RAD-A-030	Determination of Radium-228 in Aqueous Samples	**904.0, 9320**
GL-RAD-A-031	The Determination of Selenium and Tellurium	N/A
GL-RAD-A-032	The Isotopic Determination of Neptunium/Thorium	N/A
GL-RAD-A-033	Determination of Chlorine-36 in Soil and Water Samples	N/A
GL-RAD-A-035	The Isotopic Determination of Plutonium-241	**HASL-300 Pu-11-RC (M)**
GL-RAD-A-036	The Isotopic Determination of Americium, Curium, and Plutonium in Large Soil Samples	**DOE RP800(M), HASL 300 E-U-04**
GL-RAD-A-037	Radium-226 and Radium-228 in Drinking Water by Sulfate Precipitation and Gamma-Ray Spectrometry	N/A
GL-RAD-A-038	The Isotopic Determination of Thorium/Uranium	**DOE RP800(M), HASL-300(M) Pu-02-RC, Pu-03-RC**
GL-RAD-A-040	The Determination of Fe-55 in Liquid and Solid Matrices by Liquid Scintillation Counter	N/A
GL-RAD-A-041	The Determination of Total Activity in Solids and Liquids	N/A
GL-RAD-A-043	The Determination of Plutonium, Uranium and Thorium	**HASL 300**
GL-RAD-A-044	Total Alpha Radium Isotopes In Drinking Water	**903.0, 9315, HASL 300(M)**
GL-RAD-A-045	The Isotopic Determination of Plutonium, Uranium, Americium, Curium and Thorium	**HASL-300 (M)**
GL-RAD-A-046	The Determination of Radium-224 and Radium-226 by Alpha Spectroscopy	N/A
GL-RAD-A-047	48 Hour Rapid Gross Alpha Test	**N.J.A.C. 7:18, EPA 600/4-80-032, 900.0(M)**
GL-RAD-A-048	The Determination of Calcium-45 in Soils and Waters	N/A
GL-RAD-A-049	The Determination of Sulfur-35 in Liquid Matrices	**NAS-NS-3054**
GL-RAD-A-050	The Determination of Tritium in Drinking Water Samples	**600/4-80-032, 906.0**
GL-RAD-A-051	The Rapid Determination of Strontium 89/90 by Cerenkov Counting	N/A
GL-RAD-A-052	The Determination of Organically Bound Tritium	**600\4-80-032, 906.0**
GL-RAD-A-053	Isotopic Determination of Plutonium in Large Water Resin Samples	**HASL 300 Pu-11-RC**
GL-RAD-B-001	The Sequential Determination of Isotopic Americium, Curium, Californium, Plutonium, Strontium and Uranium in Urine	N/A
GL-RAD-B-002	The Determination of Polonium-210 or Radium-226 in Bioassay Samples	N/A
GL-RAD-B-003	The Determination of Isotopic Thorium and Uranium in Urine Samples	N/A
GL-RAD-B-005	Management of Blank Populations	N/A

Standard Operating Procedures and Analytical Methods

SOP #	SOP Title	Methods
GL-RAD-B-008	The Determination of Gross Alpha Activity in Nasal Swipes	N/A
GL-RAD-B-009	Bioassay Countroom Alpha Spectroscopy System	N/A
GL-RAD-B-010	The Determination of Thorium in Fecal Samples	N/A
GL-RAD-B-011	The Determination of Tritium in Urine	**EPA 906**
GL-RAD-B-012	The Ashing of Fecal, Bone, and Tissue Samples	N/A
GL-RAD-B-013	Sequential Determination of Americium, Plutonium, Strontium, Plutonium-241, and Uranium in Fecal, Bone, and Tissue Samples	N/A
GL-RAD-B-014	The Preparation of Synthetic Urine and Fecal Material	N/A
GL-RAD-B-016	The Determination of Technetium-99 in Urine	N/A
GL-RAD-B-017	The Determination of Neptunium in Urine	N/A
GL-RAD-B-018	Operation of the Chemchek Automatic KPA	N/A
GL-RAD-B-019	Total Uranium in Bioassay Samples by Kinetic Phosphorescence	**ASTM D 5174-02**
GL-RAD-B-020	The Determination of Ni-59 and Ni-63 in Urine	N/A
GL-RAD-B-022	The Determination of Gross Alpha and Gross Non-volatile Beta in Urine	**EPA 900.0, 9310, EERF 00-01, USGS R-1120-76**
GL-RAD-B-023	The Determination of Carbon-14 in Urine	**EERF C-01(M)**
GL-RAD-B-024	Managing Statistical Data in the Bioassay Laboratory	N/A
GL-RAD-B-025	The Combination and Preservation of Urine Samples	N/A
GL-RAD-B-026	Bioassay Data Review, Validation and Data Package Assembly	N/A
GL-RAD-B-027	Specific Gravity in Urine	**ASTM D5057**
GL-RAD-B-029	The Determination of Radiometric Iodine in Urine	N/A
GL-RAD-B-030	The Preparation and Determination of Gamma Isotopes in Urine and Fecal Samples	**EPA 901.1, HASL 300**
GL-RAD-B-031	Bioassay/REMP Quality Control Package Assembly	N/A
GL-RAD-B-032	Concentration of Tritium by Electrolysis	**HASL H-02-RC, EML-95-110 Rev 2**
GL-RAD-B-033	Bioassay Count Room Alpha Spectrometry Instrument Calibration	N/A
GL-RAD-B-034	The Determination of Metals in Urine by ICP-MS	N/A
GL-RAD-B-035	The Preparation of Urine Samples for Total Uranium Analysis by ICP-MS	N/A
GL-RAD-B-036	Initial Installation and Returning to Service of Repaired Instrumentation	N/A
GL-RAD-D-002	Analytical Methods Validation for Radiochemistry	N/A
GL-RAD-D-003	Data Review, Validation, and Data Package Assembly	N/A
GL-RAD-I-001	Gamma Spectroscopy System Operation	N/A
GL-RAD-I-004	Beckman LS-6000/6500	N/A
GL-RAD-I-006	LB4100 Gross Alpha/Beta Counter Operating Instructions	N/A
GL-RAD-I-007	Ludlum Lucas Cell Counter	N/A

Standard Operating Procedures and Analytical Methods		
SOP #	**SOP Title**	**Methods**
GL-RAD-I-008	VAX/VMS Quality Control Software Program	N/A
GL-RAD-I-009	Alpha Spectroscopy System	N/A
GL-RAD-I-010	Counting Room Instrumentation Maintenance	N/A
GL-RAD-I-012	Managing Statistical Data in the Radiochemistry Laboratory	N/A
GL-RAD-I-013	Column Preparation	N/A
GL-RAD-I-014	WALLAC Guardian Model 1414	N/A
GL-RAD-I-015	WPC 9550 Gross Alpha/Beta Counter: Operating Instructions	N/A
GL-RAD-I-016	Multi-Detector Counter: Operating Instructions	N/A
GL-RAD-I-017	Wallac 1220 Quantalus Liquid Scintillation Counter	N/A
GL-RAD-I-018	Operation of Wallac 1480 Gamma Wizard	N/A
GL-RAD-I-019	Management of Blank Populations	N/A
GL-RAD-I-020	Operation of the Gamma Analyst	
GL-RAD-M-001	Preparation and Verification of Radioactive Standards	N/A
GL-RAD-M-003	Magnetic Backup of Hard Drives for Bioassay Alpha Spectroscopy	N/A
GL-RAD-S-000	Radiation Safety Plan	
GL-RAD-S-001	Radiological Surveys	N/A
GL-RAD-S-002	Radiation Related Emergencies	N/A
GL-RAD-S-003	Administration of the Radioactive Material License Inventory	N/A
GL-RAD-S-004	Radioactive Material Handling	N/A
GL-RAD-S-006	Radiation Worker Training	N/A
GL-RAD-S-007	Receiving Radioactive Packages	N/A
GL-RAD-S-009	Personnel Dosimetry	N/A
GL-RAD-S-010	The Handling of Biological Materials	N/A
GL-RAD-S-013	Air Sampling for Radioactivity	**Guide 825**
GL-RAD-S-014	Release of Laboratory Coats	N/A
GL-RAD-S-015	The Acceptance and Classification of Radioactive Material	N/A
GL-RAD-S-016	Radiation Work Permits	N/A
GL-RAD-S-017	Maintaining the SC DEHC Radiological Materials License	N/A
GL-RC-E-001	Receipt and Inspection of Material and Services	N/A
GL-RC-E-002	Material Requisition	N/A
GL-SR-E-001	Sample Receipt, Login, and Storage	N/A
GL-SR-E-002	Transportation and Shipping of Samples and Pre-Preserved Sample Containers	N/A
GL-SR-E-003	The Inspection, Cleaning and Screening of Sample Coolers	N/A
GL-SR-E-004	Control of Foreign Soils	N/A
GL-SR-E-005	Wipe Test	N/A
GL-SVR-D-001	Design Specifications for the Network Infrastructure	N/A
GL-SVR-D-002	Design Specifications for the Mail Server	N/A
GL-SVR-D-003	Design Specifications for Sansvr	N/A

Standard Operating Procedures and Analytical Methods		
SOP #	**SOP Title**	**Methods**
GL-SVR-D-004	Design Specifications for Pharmsvr01	N/A
GL-SVR-D-005	Design Specifications for Backupsvr01	N/A
GL-SVR-D-006	Design Specifications for Pharmsvr02	N/A
GL-SVR-E-001	Network Infrastructure	N/A
GL-SVR-E-002	The Mail Server	N/A
GL-SVR-E-003	Sansvr	N/A
GL-SVR-E-004	Pharmsvr01	N/A
GL-SVR-E-005	Backupsvr01	N/A
GL-SVR-R-001	System Requirements for Network Infrastructure	N/A
GL-SVR-R-002	System Requirements for The Mail Server	N/A
GL-SVR-R-003	System Requirements for Sansvr	N/A
GL-SVR-R-004	System Requirements for Phamrsvr01	N/A
GL-SVR-R-005	System Requirements for Backupsvr01	N/A

APPENDIX J: SAMPLE STORAGE AND PRESERVATION REQUIREMENTS

Parameter	Container[1]	Preservation	Holding Time[2]	Min. Volume
Inorganics				
Acidity	P,G	0 ≤ 6° C	14 days	25 mL/ NA
Alkalinity	P,G	0 ≤ 6° C	14 days	50 mL/ NA
Demand (BOD)	P,G	0 ≤ 6° C	48 hours	500 mL / NA
Bromide	P,G	None	28 days	10 mL/ 4 g
Chemical Oxygen Demand (COD)	P,G	0 ≤ 6° C, H_2SO_4 to pH ≤ 2	28 days	2 mL/ NA
Chlorine by Bomb	P,G	None	None	NA/ 0.5 g
Chloride	P,G	0 ≤ 6° C	28 days	10 mL / 4 g
Color	P,G	0 ≤ 6° C	48 hours	50 mL / NA
Conductivity	P,G	0 ≤ 6° C	28 days	25 mL / NA
Corrosivity by pH	**P**	**None**	**Immediate**	**25 mL / 5 g**
Corrosivity to Steel	P	None	None	1000 mL / NA
Cyanide amenable to chlorination	P,G	0 ≤ 6° C, NaOH to pH ≥ 12, 0.6 g ascorbic acid [3]	14 days [4]	50 mL / NA
Cyanide, total	P,G	0 ≤ 6° C, NaOH to pH ≥ 12, 0.6 g ascorbic acid [3]	14 days [4]	50 mL / 1 g
Dissolved Oxygen	**G (bottle and tap)**	**None**	**Immediate**	**25 mL / NA**
Fixed and Volatile Solids	P,G	0 ≤ 6° C	7 days	100 mL / NA
Flashpoint	P,G	None	None	Call
Fluoride	P	0 ≤ 6° C	28 days	25 mL / 4 g
Hardness	P,G	HNO_3 to pH ≤ 2, H_2SO_4 to pH ≤ 2	6 months	50 mL / NA
Heating Value	P	None	None	NA / 0.5 g
Hydrazine	**G**	**HC1 to pH≤2**	**Immediate**	**50 mL / NA**
Percent (%) Moisture	P	0 ≤ 6° C	None	2 mL / 2 g
Ammonia Nitrogen	P,G	0 ≤ 6° C, H_2SO_4 to pH ≤ 2	28 days	100 mL / 5 g
Nitrate	**P,G**	**0 ≤ 6° C**	**48 hours**	**10 mL / 4 g**
Nitrite	**P,G**	**0 ≤ 6° C**	**48 hours**	**10 mL / 4 g**
Nitrate/Nitrite	P,G	0 ≤ 6° C, H_2SO_4 to pH ≤ 2	28 days	4 mL/ 4 g
Total Kjeldahl and Organic Nitrogen	P,G	0 ≤ 6° C, H_2SO_4 to pH ≤ 2	28 days	100 mL / 5 g
Odor	**G**	**0 ≤ 6° C, Zero headspace**	**Immediate**	**50 mL**
Oil and Grease	G	0 ≤ 6° C, HCl or H_2SO_4 to pH ≤ 2	28 days	1000 mL
Orthophosphate	**P,G**	**Filter immediately, 0 ≤ 6° C**	**48 hours**	**25 mL / 4 g**
Total Phenols	G	0 ≤ 6° C, H_2SO_4 to pH ≤ 2	28 days	50 mL / 1 g
pH	**P,G**	**None**	**Immediate**	**25 mL / 5 g**
Total Phosphorus	P,G	0 ≤ 6° C, H_2SO_4 to pH ≤ 2	28 days	20 mL / 1 g
Residual Chlorine	**P,G**	**None**	**Immediate**	**25 mL / NA**
Salinity	P	None	28 days	25 mL / NA
Specific Gravity	P	0 ≤ 6° C	7 days	50 mL / NA
Sulfate	P,G	0 ≤ 6° C	28 days	10 mL / 4 g
Sulfide	P,G	0 ≤ 6° C, add ZnAc and NaOH to pH ≥ 9	7 days	200 mL/ 20 g
Sulfite	**P,G**	**EDTA**	**Immediate**	**50 mL / NA**
Sulfur by Bomb	G	None	None	NA / 0.5 g
Surfactants	**P,G**	**0 ≤ 6° C**	**48 hours**	**100 mL / NA**
Settleable Solid	P,G	0 ≤ 6° C	7 days	1000 mL / NA
Total Dissolved Solid	P,G	0 ≤ 6° C	7 days	25 mL / NA
Total Solid	P,G	0 ≤ 6° C	7 days	25 mL
Total Suspended Solid	P,G	0 ≤ 6° C	7 days	1000 mL
Volatile Solid	P,G	0 ≤ 6° C	7 days	25 mL / 1 g
Total Organic Carbon	P,G	0 ≤ 6° C, HCl or H_2SO_4 to pH ≤ 2	28 days	50 mL/ 5 g
Total Organic Halides	G	0 ≤ 6° C, H_2SO_4 to pH ≤ 2	28 days	50 mL/ 1 g

Parameter	Container[1]	Preservation	Holding Time[2]	Min. Volume
Total Petroleum Hydrocarbons	G	0 ≤ 6° C, H_2SO_4 to pH ≤ 2	28 days	1000 mL / 20 g
Turbidity	**P,G**	**0 ≤ 6° C**	**48 hours**	**50 mL / NA**
Metals (except chromium VI and mercury)	P	0 ≤ 6° C ,HNO_3 to pH ≤ 2	6 months	50 mL / 2 g
Chromium VI - Aqueous	**P**	**0 ≤ 6° C**	**24 hours**	**25 mL / 4 g**
Chromium VI - Solids	P	0 ≤ 6° C	7 days for extraction	4 g
Mercury - Wastewater and Drinking water	P,G	0 ≤ 6° C ,HNO_3 to pH ≤ 2	28 days	50 mL / 2 g
Mercury - Others	G	0 ≤ 6° C, HNO_3 to pH ≤ 2	28 days	50 mL / 2 g
Bacteriology				
Coliform, fecal	P,G	0 ≤ 6° C, 0.008% $Na_2S_2O_3$ [3]	6 hours	100 mL / NA
Standard Plate Count	P,G	0 ≤ 6° C, 0.008% $Na_2S_2O_3$	24 hours	100 mL / NA
Coliform, total - Wastewater	P,G	0 ≤ 6° C, 0.008% $Na_2S_2O_3$	6 hours	100 mLl / NA
Coliform, total - Groundwater	P,G	0 ≤ 6° C, 0.008% $Na_2S_2O_3$	24 hours	100 mL / NA
Coliform, total - Drinking water	P,G	0 ≤ 6° C, 0.008% $Na_2S_2O_3$	30 hours	100 mL / NA
Organics				
Base/Neutral and Acid Extractables - Water	Amber G, teflon-lined cap	0 ≤ 6° C 0.008% sodium thiosulfate solution	7 days for extraction 40 days after extraction for analysis	1000 mL / 50 g
Base/Neutral and Acid Extractables - Solid and Waste	G, teflon-lined cap	0 ≤ 6° C	14 days for extraction 40 days after extraction for analysis	1000 mL / 50 g
Base/Neutral and Acid Extractables - Concentrated Waste	G, teflon-lined cap	None	7 days for extraction 40 days after extraction for analysis	1000 mL / 50 g
BTEX - Solid and sludge	G, teflon-lined septum	0 ≤ 6° C	14 days	3x5 g EnCores or 2 low and 1 high level vials
BTEX - Water	G, teflon-lined septum	0 ≤ 6° C, zero headspace	14 days	3x40 mL
TPH-GRO	G, teflon-lined cap	0 ≤ 6° C, HCl to pH 2, zero headspace	14 days	3x40 mL
TPH-DRO	G, teflon-lined cap	0 ≤ 6° C	14 days	1000 mL / 50 g
Volatiles – Groundwater/wastewater	G, teflon-lined cap	0 ≤ 6° C, HCl to pH 2, zero headspace	14 days	3x40 mL
Chlorinated Herbicides - Water	Amber G, teflon-lined cap	0 ≤ 6° C 0.008% sodium thiosulfate solution	7 days for extraction 40 days after extraction for analysis	1000 mL
Chlorinated Herbicides - Solid and Waste	G, teflon-lined cap	0 ≤ 6° C	14 days for extraction 40 days after extraction	50 g
Volatiles - Drinking Water	G, teflon-lined cap	0 ≤ 6° C, zero headspace, HCl	14 days	3x40 mL
Volatiles (including 2 chloroethylvinylether) - Wastewater	G, teflon-lined cap	0 ≤ 6° C, zero headspace, unpreserved	7 days	3x40 mL
Volatiles - Wastewater/groundwater	G, teflon-lined cap	0 ≤ 6° C, zero headspace, unpreserved	7 days	3x40 mL
Volatiles - Solid and Sludge -	EnCore Sampler	0 ≤ 6° C	48 hours	3x5 g EnCores

Parameter	Container[1]	Preservation	Holding Time[2]	Min. Volume
Volatiles - Concentrated Waste	G, teflon-lined septum	None	14 days	1x40 mL
Industrial Solvents	G, teflon-lined septum	0 ≤6° C	None	1x40 mL
Organochlorine Pesticides and PCBs	Amber G, teflon-lined cap	0 ≤6° C, 0.008% sodium thiosulfate solution	7 days for extraction 40 days after extraction for analysis	1000 mL / 50 g
PCBs in Oil	G, teflon-lined cap	None	7 days for extraction 40 days after extraction for analysis	1x40 mL
Dioxin	G, teflon-lined cap	0 ≤6° C	7 days for extraction 40 days after extraction for analysis	1000 mL / 50 g
Total Petroleum Hydrocarbon	G, teflon-lined septum	0 ≤6° C	14 days	1000 mL / 50 g
EDB and DBCP	G, teflon-lined septum	0 ≤6° C, HCl to pH 2 0.4% sodium thiosulfate solution	7 or 14 days	3x40 mL
Radiochemistry/Bioassay				
Carbon-14 - Water and Soil	P	None	6 months	500 mL / 20 g
Gamma Isotopes - Water	P	HNO_3 or HCl to pH 2	6 months	2000 mL
Gamma Isotopes - Soil	P	None	6 months	200 g
Gross Alpha and Beta - Water	P	HNO_3 or HCl to pH 2	6 months	500 g
Gross Alpha and Beta - Soil	P	None	6 months	20 g
Iodine-129 - Water and Soil	P	None	6 months	1000 mL / 50 g
Iodine -131 - Water	P	None	8 days	1000 mL
Neptunium - Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Neptunium - Soil, Vegetation, and Air Filters	P	None	6 months	20 g
Plutonium - Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Plutonium - Soil, Vegetation, and Air Filters	P	None	6 months	20 g
Thorium - Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Thorium - Soil, Vegetation, and Air Filters	P	None	6 months	20 g
Uranium - Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Uranium - Soil, Vegetation, and Air Filters	P	None	6 months	20 g
Americium - Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Americium - Soil, Vegetation, and Air Filters	P	None	6 months	20 g
Curium - Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Curium - Soil, Vegetation, and Air Filters	P	None	6 months	20 g
Lead-210 – Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Lead-210- Soil	P	None	6 months	200 g
Nickel-59 – Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Nickel-59 – Soil	P	None	6 months	20 g
Nickel-63 - Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Nickel-63 - Soil	P	None	6 months	20 g

Parameter	Container[1]	Preservation	Holding Time[2]	Min. Volume
Phosphorus-32 -Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Phosphorus-32 -Soil	P	None	6 months	20 g
Polonium -Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Polonium -Soil	P	None	6 months	20 g
Promethium-147 -Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Promethium-147 -Soil	P	None	6 months	20 g
Radium-223 - Water	P	None	6 months	1000 mL
Radium-224 - Water	P	None	6 months	1000 mL
Radium-226 - Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Radium-228 - Water	P	HNO_3 or HCl to pH 2	6 months	1000 mL
Radon-222 - Water	**40 mL volatile bottle**	**None, Zero headspace**	**4 days**	**2x40 mL**
Strontium-89/90 -Water	P	HNO_3 to or HCl pH 2	6 months	1000 mL
Strontium-89/90 -Soil	P	None	6 months	20 g
Technetium-99 -Water	P	HNO_3 to or HCl pH 2	6 months	1000 mL
Technetium-99 -Soil	P	None	6 months	20 g
Total Alpha Radium -Water	P	HNO_3 to or HCl pH 2	6 months	500 mL
Total Alpha Radium -Soil	P	None	6 months	20 g
Total Uranium -Water	P	HNO_3 to or HCl pH 2	6 months	100 mL
Total Uranium- Soil	P	None	6 months	20 g
Tritium - Water, Soil, Vegetation, and Air Filters	P	None	6 months	250 mL / 20 g
Iron 55 -Water	P	HNO_3 to or HCl pH 2	6 months	500 mL
Iron 55 -Soil	P	None	6 months	20 g

[1] P = Polyethylene; G = Glass
[2] Samples should be analyzed as soon as possible after collection. The holding times listed are maximum times that samples may be held before analysis and be considered valid.
[3] Used only in the presence of residual chlorine.
[4] Maximum holding time is 24 hours when sulfide is present. All samples may be tested with lead acetate paper before pH adjustments in order to determine if sulfide is present. If present, remove by adding cadmium nitrate powder until a negative spot test is obtained. Filter sample and add NaOH to pH 12.

PTS Laboratories, Inc.

Santa Fe Springs, CA

QUALITY ASSURANCE
QUALITY CONTROL
MANUAL

PTS Laboratories, Inc.

November 2002 v02.01

PTS Laboratories
ENVIRONMENTAL SERVICES

Table of Contents

1.0 Introduction

Quality Assurance/Quality Control (QA/QC) is an integral component of the Testing process. This component is the foundation of all laboratory technique and management. QA/QC impacts all technical decisions, i.e., selection of personnel and test equipment, use of instruments, standards, and reagents, calibration and maintenance of instruments and equipment, and adherence to defined standard and quality control methodologies. In addition, operational procedures i.e., regular procedural checks, documentation control, and quality control verifications are also impacted. A high standard of QA/QC is also dependent upon management and laboratory personnel's commitment to quality production in strict accordance to protocols.

PTS Laboratories, Inc. (PTS) is unique in the commercial core analysis industry. This company has made a commitment to providing a quality product and has established a Quality Assurance Plan created by Petroleum Engineers with laboratory experience. It is the responsibility of the District Manager to implement, and monitor formal quality control programs throughout PTS.

This manual describes the Quality Assurance/Quality Control protocols that are followed by PTS personnel. These protocols impact laboratory technique, sample requisition and sample physical property testing. PTS has developed a Quality Assurance program that regulates all laboratory and sampling operations.

2.0 Organization and Responsibility

2.1 Analyst's Responsibilities

2.1.1 Ensure the procedure is appropriate with sample type and Supervisor's instruction.

2.1.2 Assume custody for all or portions of the samples.

2.1.3 Set up instrument/apparatus consistent with the specified protocol.

2.1.4 Perform analyses according to the specified protocol.

2.1.5 Derive data from tests and ensure that data is within established limits.

2.1.6 Maintain all results, instrument control, calibration checks, and documentation in accordance with PTS documentation requirements.

2.1.7 Maintain all applicable QA/QC data.

2.2 Supervisor's Responsibilities

2.2.1 Ensure that correct procedure was followed.

2.2.2 Review all data generated. Inspect calculations.

2.2 Supervisor's Responsibilities cont.

2.2.3 Review QA/QC criteria.

2.2.4 Evaluate results for reanalysis if QA/QC criteria is not within acceptable limits. Note in report when established limits have been exceeded.

2.2.5 Prepare a final report. Submit the report to the district manager.

2.3 District Manager's Responsibilities

2.3.1 Review final report data. Compare each new set of data with previously completed data for reasonability.

2.3.2 Verify that the data is within acceptable QA/QC criteria limits.

2.3.3 Order reanalysis of sample when necessary.

2.3.4 Review final report for analytical, quality, and custodial documentation completeness. Confirm that all laboratory procedures and documentation satisfy requirements.

2.4 Project\QC Manager's Responsibilities

2.4.1 Perform completeness checks of selected final reports. These checks include document verification, data reduction, and report narrative evaluations where required.

2.4.2 Review final reports for testing and documentary completeness, client or contractual requirements, and timeliness.

2.4.3 Report to PTS district manager.

3.0 Sampling Protocols

3.1 Representative Sampling

To collect a subsample that is representative of the total sample, certain factors and techniques must be considered. Factors commonly considered are site selection, number of samples, measured parameters, and sampling frequency. Also, incorrect or inaccurate sampling techniques will alter the subsample.

Careful consideration of these factors and sampling techniques will result in useful, qualitative test results. A good sampling plan that documents the sample's representation will insure useful results.

Due to the physical and chemical diversity of materials, a variety of sampling techniques may be utilized. Soil sampling techniques are given in *The American Petroleum Institute, RP40* and *American Society for Testing and Materials D-18* manuals.

3.2 Sample Collection

A variety of techniques are used for sampling. The sample type, sample container, and sample location all dictate the type of technique employed. In addition, possible contamination or cross contamination, an uncommon measured parameter, or sampling methodology will effect the sampling technique choice.

3.3 Sample Preservation

Samples generally require some form of preservation. The preservation type is dictated by the sample type and the measured parameter. The techniques employed for sample preservation are agreed to with the client for physical properties, and where applicable, EPA SW846.

3.4 Sample Containers

Sample disturbance, and thereby representativeness, is minimized or reduced by container selection and preparation.

3.5 Chain of Custody

3.5.1 Documentation

Documentation is an essential component in the testing process. Documentation traces the possession and handling of samples from the time of collection through analyses and final disposition. In addition, this sample history may be used in court litigation.

3.5.2 Field Log Book

The field log book records the field sample collection, treatment, transport, measurement, and other miscellaneous information necessary to reconstruct the sample collection process. PTS maintains a separate, bound field log book which minimally contains the following information:

- sequentially numbered pages
- date, time, and location of sample collection
- project identification number
- sample identification
- field contact name and address
- sampling methodology description
- type of sample analysis
- field measurements
- field observations
- collector and client signatures

3.5.3 Sample Labels

Sample labels prevent misidentification of samples. Information is written on the sample container.
3.5.3 Sample Labels cont.

The label contains the following information:

- sample identification
- sample collection date and time
- place of collection
- project identification number

3.5.4 Sample Seals

Sample seals eliminate tampering. When applicable, these seals are affixed to the sample container upon sample collection and remain sealed until the time of analysis. The seal shall be affixed so that opening the sample container will break the seal. The sample seal shall contain the same information as the sample label.

3.5.5 Incoming Sample Log Sheet

The incoming sample log sheet shall accompany each sample. This form is completed by laboratory or receiving personnel and contains the following information:

- name of person receiving sample
- date of sample receipt
- number of samples
- customer identification
- special handling requirements
- contact name
- project identification

3.5.6 Chain-of-Custody Record

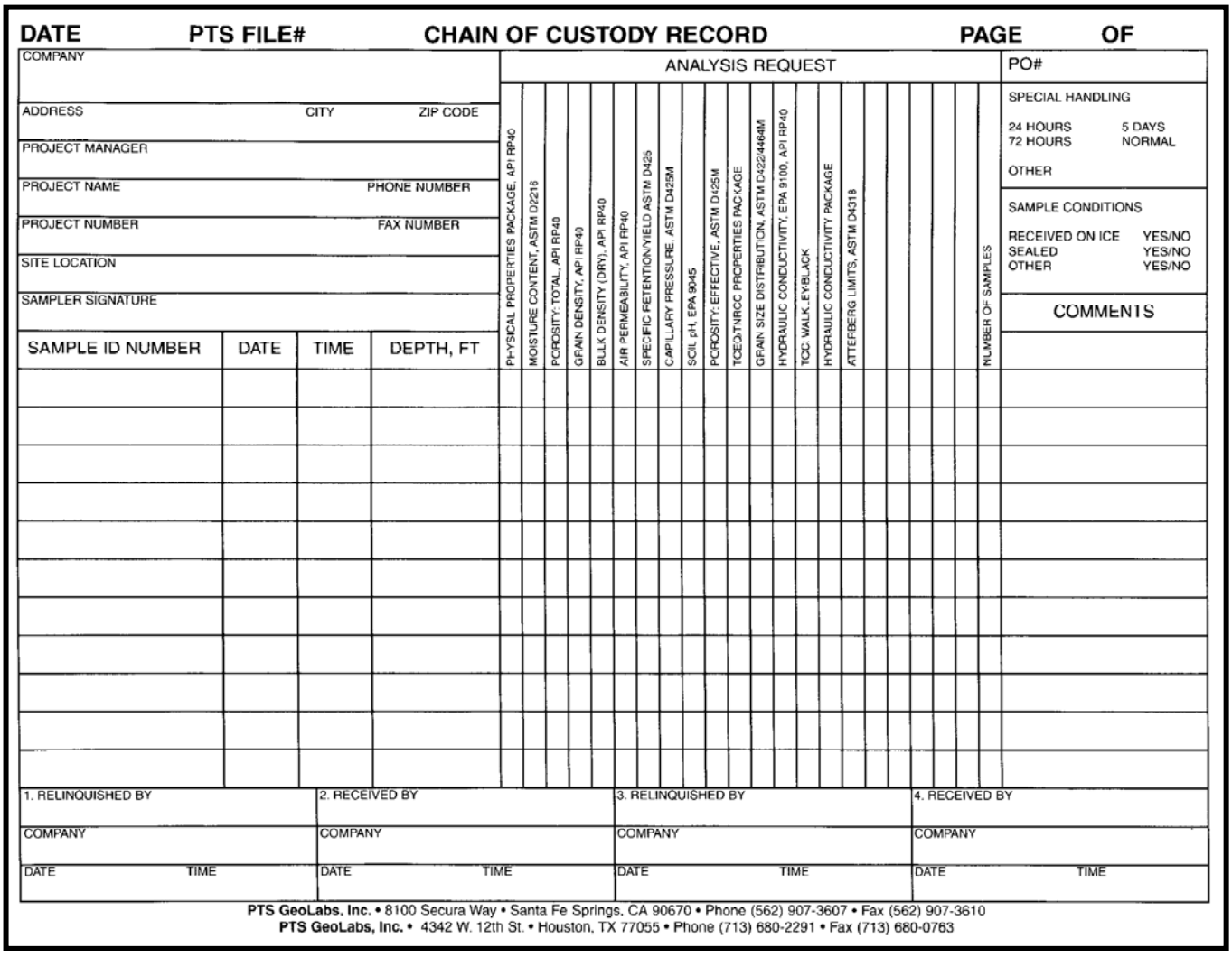
A chain-of-custody record established the documentation necessary to trace sample possession from the time of collection. A chain-of-custody record shall accompany each sample. The chain-of-custody record shall contain the following information:

- sample numbers
- date, time, and location of collection
- project identification
- type of analysis
- number of containers
- analysis requested
- inclusive dates of possession

Figure 1 illustrates PTS's chain-of-custody record.

Figure 1

Chain Of Custody Form



DATE **PTS FILE#** **CHAIN OF CUSTODY RECORD** **PAGE** **OF**

COMPANY

ADDRESS CITY ZIP CODE

PROJECT MANAGER

PROJECT NAME PHONE NUMBER

PROJECT NUMBER FAX NUMBER

SITE LOCATION

SAMPLER SIGNATURE

ANALYSIS REQUEST

PO#

SPECIAL HANDLING

24 HOURS 5 DAYS
72 HOURS NORMAL

OTHER

SAMPLE CONDITIONS

RECEIVED ON ICE YES/NO
SEALED YES/NO
OTHER YES/NO

COMMENTS

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY: TOTAL, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY (DRY), API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	POROSITY: EFFECTIVE, ASTM D425M	TCEQ/TNRCC PROPERTIES PACKAGE	GRAIN SIZE DISTRIBUTION, ASTM D422/4464M	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TCC WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	NUMBER OF SAMPLES	

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY	COMPANY	COMPANY	COMPANY
DATE TIME	DATE TIME	DATE TIME	DATE TIME

PTS GeoLabs, Inc. • 8100 Secura Way • Santa Fe Springs, CA 90670 • Phone (562) 907-3607 • Fax (562) 907-3610
PTS GeoLabs, Inc. • 4342 W. 12th St. • Houston, TX 77055 • Phone (713) 680-2291 • Fax (713) 680-0763

3.5.7 Sample Delivery

The field sample collector shall be responsible for packaging and delivery of samples to the laboratory for analysis. The chain-of-custody record (Figure 1) shall accompany the sample(s). Sample(s) must be packaged in shipping containers to avoid breakage, leakage, or contamination. Sample(s) sent by common carrier must have a bill of lading. All receipts and bill of lading shall be retained as permanent chain-of-custody documentation.

3.6 Sample Receipt and Control

Sample(s) shall be received by laboratory personnel. The chain-of-custody record shall accompany the sample(s). Upon receipt of the sample(s), the laboratory technician shall reconcile sample label and seal information against the chain-of-custody record and assign a PTS file number to the project.

The sample(s) shall be inspected for leakage, damage, and broken seals. A container that is leaking or has a broken seal shall be noted. Any discrepancies between the sample label and seal and the information on the chain-of-custody documentation shall be communicated to the client prior to testing.

The sample(s) shall be stored as specified by the client in the Sample Receiving and Storage Room until analysis.

Sample(s) or sample splits (one or more aliquots representing a single sample) may be assigned to other laboratories to complete the requested analysis. In that case, chain-of-custody records shall accompany the sample(s) or sample splits.

After sample testing, a raw data package is assembled. Then a report is constructed, edited and approved. After approval the original is sent to the client. A copy of the report, the raw data package, and the chain-of-custody or sample transfer sheet is retained in Data Processing.

The unused sample(s), identifying labels, and other documentation are returned to the sample storage room. Upon request, the samples(s) shall be returned to the client. Otherwise, the sample(s) shall be destroyed when requested by the client, when information is no longer required, or when the sample(s) have deteriorated. Sample(s) shall be destroyed by approved disposal methods.

4.0 Testing Protocols

All testing performed at PTS Laboratories, Inc. is in accordance with API RP40, ASTM, EPA SW846 or client approved protocols.

4.1 Calibration QA/QC Procedure

Standards materials of known physical parameters are tested along with the subject samples to insure proper calibration and correct operation of the test equipment.

4.2 Data Management

All routine data and miscellaneous procedures and observations are recorded on laboratory bench sheets, serialized pages of permanently bound notebooks, computer printout sheets, or strip chart recorder paper. The following are a list of laboratory documents and their uses:

4.2.1 Data Sheet

Data sheets record accumulated test data. These sheets are permanently stored with the project file. The data sheets shall contain the following:

- Analysis date
- Job order number
- Client information (well name, field name, region name)
- Method of analysis
- Instrument type (when applicable)
- Sample numbers
- Data generated from samples and QC samples
- All calculations
- Observations and variations
- Analyst's identification

4.2.2 Client File Folder

Contains a copy of all information collected for a specific job order number.

4.3 Precision and Accuracy Assessment

Monitoring accuracy and precision is accomplished by the use of calibration standards, reference materials and/or duplicates. PTS policy dictates that QC samples must be run at a minimum of one for each run date. Control limits are established for each property or group properties measured to ensure data acceptability with respect to the test type. Data, that does not conform to the established control limits, are checked by the Supervisor. If applicable, corrective action is implemented. Corrective action includes calculation, calibration, instrument setting review, instrument repair, and alternate method selection.

Table 1

PTS Sample Containers, Preservation Methods, and Maximum Holding Times

Parameter	Container[1]	Preservation	Maximum Holding Time
pH, non-aqueous	P, G	Cool, 4°C	28 days
TOC	P, G	Cool, 4°C	28 days
Geotechnical Tests	S	Cool, 4°C	Test Dependant
Physical Properties	S	Cool, 4°C	Test Dependant

[1] P = Polyethylene
G = Glass
S = Sleeve (undisturbed)

Table 2

PTS Analysis Control Ranges

Parameter Range	Control
pH	±0.35 pH units
Bulk Density	±0.5 of 1 porosity %
Grain Density	±0.5 of 1 porosity %
Bulk Volume	±0.15cc
Porosity	±0.02% pore volume
Air Permeability	±2.0% permeability units
Hydraulic Conductivity	±2.0% permeability units
Total Organic Carbon, standard	±30% Certified Value
Total Organic Carbon, blank	±3.0% Method Response Factor
Total Organic Carbon, duplicate sample	±30% Initial Value
Water Saturation, Dean-Stark	±0.20% pore volume
Hydrocarbon Saturation, Dean-Stark	±0.20% pore volume

Table 3

Test Methodology

Test Description	Methodology
Air Permeability	API RP40, ASTM D4525
Atterberg Limits	ASTM D4318
Capillary Pressure by Mercury Injection	ASTM D4404 (modified)
Capillary Pressure, centrifugal	ASTM D425 (modified)
Capillary Pressure, porous plate	ASTM D3152/2325
Cation Exchange Capacity	EPA 9081
Column Leaching	ASTM D4874
Core Photography; color/UV	non-standard test method
CT Scanning of Soil Samples	ASTM D4452 (modified)
Fluid Saturations	API RP40 (Dean-Stark)
Grain/Bulk Density	API RP40, ASTM D2937
Grain Size Distribution	ASTM D422 (modified)
Grain Size Distribution, Laser	ASTM D4464 (modified)
Hydraulic Conductivity	ASTM D5084, EPA 9100
Interfacial/Surface Tension	DuNuoy, ASTM D971
Intrinsic Permeability	non-standard test method
Minimum Resistivity	Cal Trans 532
Moisture Content	ASTM D2216
Moisture, Ash & Organic Content	ASTM D2974
pH, non-aqueous	EPA 9045
Porosity	API RP40
Relative Permeability	non-standard test method
Minimum Resistivity	Cal Trans 532
Moisture, Ash & Organic Content	ASTM D2974
pH, non-aqueous	EPA 9045
Porosity	API RP40
Relative Permeability	non-standard test method
Reid Vapor Pressure	ASTM D323
Simulated Distillation by GC	ASTM D2887
Soil Moisture	ASTM D3152/2325
Specific Gravity of soils	ASTM D854
Specific Retention, Specific Yield	ASTM D425
Total Organic Carbon	Walkley-Black
Unconfined Compressive Strength	ASTM D2166
Viscosity and Density	ASTM D445
Wettability	USBM

Quality Assurance Manual Approvals:

District Manager:	Project/QC Manager:
Date:	Date:

Appendix A

Core Analysis QA/QC Applicability General Statement

PTS Laboratories provides our customers with high quality data and services. Our goal is to provide the most accurate and defensible site-specific suite of data available. We accomplish this by following specific standard operating procedures (SOP's) relating to all laboratory operations including proper core preservation and handling, sample log-in, chain of custody, sample tracking, sample analysis, data review (QA/QC), and report generation. The combination of an experienced staff of scientists, project management team, state-of-the-art instrumentation, and technical innovation enables PTS to provide the most representative data set available. As part of our commitment to providing the highest quality core analysis and analytical services, PTS also recognizes the need to inform our clients of the inherent limitations involved in measuring the physical properties of rocks and soil.

Core analysis consists of physical properties analyses conducted upon soil and rock cores or samples. Not only does each core or sub-sample have unique geologic and chemical properties, but also depending upon lithological variations, those properties may vary widely. In addition, certain properties such as moisture content, fluid saturation, or wettability are dynamic and may only be measured once per sample or core. Some analyses involve heating or disaggregation resulting in destruction or alteration of the original material. Due to the uniqueness of each sample the practice of running confirmation analyses through duplicates or matrix spike samples may not be applicable.

Due to the variation in geological materials, control standards are ran in conjunction with the test samples during appropriate analyses. These control standards consist of inert materials of known physical parameters and are tested along with the subject samples to insure proper calibration and correct operation of the test equipment. Control standards are used in conjunction with the following types of analyses:

Flow tests – permeability standards (air and water)
Grain density standards
Bulk density standards
Porosity standards
Particle size standards

Monitoring accuracy and precision is accomplished by the use of control (calibration) standards, reference materials and/or split duplicates. PTS policy dictates that control QC samples must be run at a minimum of one for each run date. Control limits are established for each property or group properties measured to ensure data acceptability with respect to the test type.

Due to the wide range of factors that can affect the outcome of special core analyses, duplicate or duplicate split samples may be analyzed and are often recommended to bracket the range of data results. Please note that all duplicate analyses are charged as full additional tests.

Appendix B

PTS Laboratories Data Integrity Statement

It is the goal of PTS Laboratories to provide our customers with the highest quality data and service. We stand behind the quality of all testing and measurements made by our laboratory, partners, or subcontractors including the generation, recording, and retention of such data. We accomplish these goals through use of the following actions, methodologies and procedures:

(a) Measurement activities and information reported from measurement shall be complete, accurate, and timely.

(b) PTS Laboratories follows specified industry standard test methods and instrument calibration procedures without modification, unless that modification has been approved by industry standard and/or by our client(s).

(c) A quality assurance system is in place for all of our laboratory facilities. Our quality assurance system serves to deter, detect, and correct the generation and communication of incorrect data and also includes the maintenance and calibration of measurement instruments.

(d) All personnel involved in testing and measuring are trained in the necessary skills involved in data generation and data management. This includes initial and ongoing personnel training, testing, and verification of knowledge transfer.

(e) PTS Laboratories utilizes a self-monitoring and assessment system to determine the extent to which the requirements above are being met. This system includes the resolution of all problems found in the assessments, with plans and responsibilities for appropriate follow-up.

SAMPLE SUBMISSION

Typically samples are collected by Client in the field. These samples range from cores to bulk or grab samples to fluids (water or liquid hydrocarbons) or even other non-standard sample types. When samples are delivered or shipped to the Laboratory (or picked up by Laboratory) a four step sample acceptance process is initiated. This process consists of 1) document condition of all received samples on a Cooler Receipt Form, 2) sign Chain of Custody (COC) form indicating receipt of samples, 3) Log-In samples into Laboratory Information Management System (LIMS), and 4) generate Laboratory Work Order.

Cooler Receipt
All core/sample containers whether received in person from Client, via U.S. Mail, overnight courier, commercial carrier, or picked up by Laboratory are treated the same. If there is a container shipping label and/or airbill, the tag is saved and attached to the COOLER RECEIPT FORM (Figure X). When more than one cooler or box is received at a time, they are opened one at a time and all of the cores or samples are properly logged and secured before the next cooler is opened. This ensures that there is no opportunity for mixing of samples from different sites/locations. If it is clear that multiple coolers are from the same site/location, they may be opened at the same time. Figure 2 illustrates a Cooler Receipt form.

Coolers or sample shipments are received in the Sample Receiving Area through a designated entrance at each PTS Laboratories facility and receiving personnel are responsible for following the Laboratory Sample Receiving SOP. Upon arrival of a cooler at the Laboratory, the designated laboratory sample custodian or trained receiving personnel signs for the cooler and begins the sample acceptance process. The sample custodian locates the COC and checks samples received against samples listed on COC. The sample custodian or receiving personnel then signs the COC indicating receipt of the incoming cores or samples. Sample receiving personnel properly document the receipt of all incoming cores or samples and record on the COOLER RECEIPT FORM any damage to the shipping container(s) or custody seals, the internal temperature of cooler, problems or discrepancies between samples, broken or disturbed samples, or incomplete COC forms and report them to the designated Laboratory Project Manager. The designated Laboratory Project Manager then informs Client of any sample or document discrepancies. Completed cooler receipt forms are electronically converted to PDF file and the original copy is submitted to designated Laboratory Project Manager for inclusion in the central project file.

The Laboratory is open for cooler/sample receiving from 7:00AM to 4:30 PM Monday through Friday, excluding company holidays. Late night, weekend, or holiday sample receipt can be arranged.

Chain of Custody
A chain-of-custody (COC) record establishes the documentation necessary to trace sample possession from the time of collection. A chain-of-custody record shall accompany each sample. If an external COC does not accompany an incoming sample, an internal PTS Laboratories Chain of Custody will be created for that sample. The chain-of-custody record shall contain the following minimum information:

- Sample Numbers or ID
- Date, Time, and Location of Collection
- Project Identification
- Type of Analysis
- Number of Cores or Samples
- Analyses Requested
- Inclusive Dates of Possession

Figure Y illustrates a PTS Laboratories chain-of-custody record.

Upon signing of the COC, responsibility for custody of received cores and samples passes to the Laboratory sample custodian. The Laboratory sample custodian or trained receiving personnel are then responsible for releasing cores or samples to the assigned laboratory technicians for analyses. COC forms are electronically converted to PDF file and the original copy is submitted to the designated Laboratory Project Manager for inclusion in the central project file.

Sample Log-In
Upon completion of the Cooler Receipt Form and secure storage of the cores or samples, electronic sample log-in is conducted using the Laboratory Information Management System (LIMS). Samples are logged within 24 hours or one business day of receipt of samples. At log-in, each job or project is entered into the LIMS using a Job Information Form/Work Request that requires the following information:

- Client/Company Name
- Client Address
- Telephone Number
- Facsimile Number
- Email Address
- Log-In Date (automatically assigned)
- Date Received
- Received By
- Report Due Date
- Project Name
- Project Number
- Laboratory Project Manager
- Custody Seal Condition
- Sample Preservation & Temperature
- Client Sample ID or Description
- Number/Type of Samples
- Analytical request
- Cooler/Shipping Container
- Sample Disposition or Storage upon Project Completion
- Current or Existing Job/Project (PTS Project Manager to verify)
- Special Instructions
- Billing Information (may be added at later date by Laboratory Project Manager or designee)

A sequential PTS Laboratories file number is automatically assigned to each Job Information Form/Work Request. Each sample received will be annotated with the PTS Laboratories file number assigned to that specific project, job, or client. Each sample also receives a unique Laboratory sample identification number assigned by the LIMS. Samples that have been logged are stored by PTS Laboratories file number in the Sample Receiving & Storage Area according to sample type and preservation.

A printout of this information is immediately generated as a Job Information Work Request sheet and attached to the Project/Job Folder. The Project Manager then reviews the login summary and stores the job folder in project management's active file until all analyses are completed. Any other pertinent written or electronic communications including the electronic Laboratory Work Order email are added to the Project/Job Folder. Figure 3 illustrates a PTS Laboratories Job Information Work Request sheet.

Each project/job or Client is assigned to a Project Manager when a proposal is accepted or when samples are received. This individual is selected based on the scope of work, familiarity with a particular client's requirements, laboratory workload, or, in some cases, upon the client's specific needs or requests. The Project Manager is responsible for reviewing the LIMS-generated Job Information Form/Work Request against the COC and against known project requirements. The Project Manager tracks the progress of the analyses from receipt, through analysis and reporting, and communicates any analytical difficulties or questions to the client.

Laboratory Work Order
The data generated during sample log-in is also organized by the LIMS into a Laboratory Work Order form. The Laboratory Work Order form documents the sampling, holding, and shipment of core and samples from the Client to the Laboratory and when submitted to Client, serves as sample Condition of Receipt form. At the laboratory, the Work Order form also serves as the Client’s request/order to perform specific tests or analyses as requested. An electronic version of the Laboratory Work Order form is converted to PDF file and may be transmitted (if requested) via internet or FAX to Client within 24 hours or one business day following sample receipt. A printout of the Laboratory Work Order form is immediately generated and attached to the Project/Job Folder.

COOLER RECEIPT FORM

PTS Laboratories
ENVIRONMENTAL SERVICES

Date Received: _____ PTS File Number: _____ Client: _____

Project Name: _____ Project No: _____

PRELIMINARY EXAMINATION PHASE:

Date cooler was opened: _____By (print): _____ Sign: _____

Did cooler arrive with a shipping ticket (airbill, etc.)? Yes ☐ No ☐ NA ☐

If YES, enter carrier name and air bill number here: _____ Attach airbill.

Did samples arrive in a Cooler ☐ a Box ☐ Other ☐ describe: _____

1. Were custody seals on outside of cooler or box? Yes ☐ No ☐ NA ☐

2. Were custody seals unbroken and intact at the date and time of arrival? Attach seals. Yes ☐ No ☐ NA ☐

How many & where: _____, seal date: _____, seal name: _____

3. Were custody papers sealed in a plastic bag and taped inside to the cooler lid? Yes ☐ No ☐ NA ☐

4. Were custody papers filled out properly (ink, signed, etc.)? Document discrepancies on back. Yes ☐ No ☐ NA ☐

5. Did you sign custody papers in the appropriate place? If COC is not attached to this cooler, revise Yes ☐ No ☐ NA ☐

6. Was project identifiable from custody papers? and initial form when COC(s) are located. Yes ☐ No ☐ NA ☐

If YES, enter project name and number at the top of this form. COC # (if present) _____

7. If required, was enough ice used? Type of ice: Dry ☐ Wet ☐ Blue ☐ Yes ☐ No ☐ NA ☐

8. What was the cooler temperature upon receipt? _____ °F/°C Is Core Frozen? Yes ☐ No ☐ NA ☐

9. Have designated person initial here to acknowledge receipt of cooler _____ Date: _____

LOG-IN PHASE:

Date samples were logged in: _____ By (print): _____ Sign: _____

1. Type of Packing in cooler or box: Bubble Wrap ☐ Foam ☐ None ☐ Other ☐ Describe: _____

2. Did all cores/samples arrive intact and were labels in good condition? Yes ☐ No ☐ NA ☐

3. Were all cores/samples labeled correctly (ID, date, time, etc.)? Yes ☐ No ☐ NA ☐

4. Do core/sample labels agree with custody papers? Yes ☐ No ☐ NA ☐

5. Type of cores/samples: Shelby Tube ☐ Brass Sleeve ☐ size: _____ Acetate Sleeve ☐ size: _____

Bag ☐ Bucket ☐ Jar ☐ size: _____ Bottle ☐ size: _____ Other ☐ Describe: _____

6. Number of cores: _____ Number of bag/grab or jar samples: _____ Number of fluid samples:_____

Description of nonstandard samples: _____

7. Was the Lab Supervisor or Project Manager called & status discussed? Yes ☐ No ☐ NA ☐

If YES, who was called? _____ By whom (initial)? _____ Current or existing job? ☐

Sample storage location pending analysis (freezer, refrigerator, or bin number): _____

Minimum QA/QC Checklist for Data Evaluation

Upon receipt of the Draft Analytical Report, the draft report will be checked by the Project Manager to verify that the following are included:

1. Project Name and Number
2. Date of Issuance
3. Laboratory report contents
4. Test Program or Case narrative where applicable
5. Number of samples analyzed
6. Laboratory analysis performed
7. Condition of samples “as received”
8. Copy of cooler receipt form
9. Any deviation from the intended test program
10. Discussion of whether or not sample hold times were met
11. Discussion of technical problems or other observations which may have created analytical difficulties
12. Discussion of any laboratory QC checks which failed to meet reporting criteria
13. Analytical results in PTS Laboratories Electronic Data Deliverables (EDD, MS Excel, Word or PDF format) using client sample ID’s and laboratory ID’s
14. Summary page indicating dates of analyses for samples and quality control checks where applicable
15. Analytical test methods utilized
16. Quality control test results where applicable
17. Descriptions of data qualifiers where applicable
18. Matrix spike/matrix spike duplicate recoveries, laboratory control samples, method blank results calibration check compounds/standards, system performance check compounds/standards results, and precision results
19. Statement signed by Laboratory Director or QA/QC officer that all data and information submitted is valid.

Test America

Denver, CO

Test America

Denver, CO

QC Limits May 2009

Lab Reference Data Summary

Structured Analysis Code: A-11-P2-9H-04

Target Analyte List: All Analytes

Matrix: SOLID
Extraction: SOXHLET (NONE,Na2SO4)
Method: Compounds, Organophosphorus (8141A)
QC Program: CLIENT: COMMERCIAL-FULL LIST
Location: TestAmerica Denver

Analyte List			Detection Limits				Check List 4780							Spike List 4780						
Syn	Compound	RL	Units	MDL	Units	Run Date	T	A	Amt	Units	LCL	UCL	RPD	T	A	Amt	Units	LCL	UCL	RPD
3202	Anilazine	40	ug/kg	12.5	ug/kg	20080418														
158	Atrazine	67	ug/kg	12.13	ug/kg	20080418	C	Y	333	ug/kg	50	150	50	C	Y	333	ug/kg	50	150	50
187	Azinphos-methyl	13	ug/kg	3.50	ug/kg	20080418	C	Y	167	ug/kg	21	145	43	C	Y	167	ug/kg	21	145	43
309	Bolstar	13	ug/kg	4.24	ug/kg	20080418														
621	Chlorpyrifos	20	ug/kg	6.46	ug/kg	20080418	C	Y	167	ug/kg	57	115	37	C	Y	167	ug/kg	57	115	37
647	Coumaphos	13	ug/kg	2.80	ug/kg	20080418	C	Y	167	ug/kg	42	129	27	C	Y	167	ug/kg	42	129	27
809	Demeton-O	39	ug/kg	5.29	ug/kg	20080418														
812	Demeton-S	15	ug/kg	4.86	ug/kg	20080418														
815	Demeton (total)	39	ug/kg	7.52	ug/kg	20080418	C	Y	333	ug/kg	10	123	47	C	Y	333	ug/kg	10	123	47
833	Diazinon	22	ug/kg	7.27	ug/kg	20080418	C	Y	167	ug/kg	49	122	40	C	Y	167	ug/kg	49	122	40
1020	Dichlorvos	23	ug/kg	7.40	ug/kg	20080418	C	Y	167	ug/kg	25	147	77	C	Y	167	ug/kg	25	147	77
1099	Dimethoate	22	ug/kg	7.08	ug/kg	20080418	C	Y	167	ug/kg	10	156	98	C	Y	167	ug/kg	10	156	98
1225	Disulfoton	48	ug/kg	7.73	ug/kg	20080418	C	Y	167	ug/kg	10	133	40	C	Y	167	ug/kg	10	133	40
1285	EPN	13	ug/kg	3.68	ug/kg	20080418														
1303	Ethoprop	15	ug/kg	4.93	ug/kg	20080418	C	Y	167	ug/kg	51	119	54	C	Y	167	ug/kg	51	119	54
1372	Famphur	13	ug/kg	3.22	ug/kg	20080418	C	Y	167	ug/kg	33	144	31	C	Y	167	ug/kg	33	144	31
1382	Fensulfothion	25	ug/kg	8.15	ug/kg	20080418	C	Y	167	ug/kg	47	123	49	C	Y	167	ug/kg	47	123	49
1393	Fenthion	33	ug/kg	8.74	ug/kg	20080418	C	Y	167	ug/kg	52	115	43	C	Y	167	ug/kg	52	115	43
1620	Malathion	15	ug/kg	4.64	ug/kg	20080418	C	Y	167	ug/kg	49	124	53	C	Y	167	ug/kg	49	124	53
1708	Merphos	30	ug/kg	5.14	ug/kg	20080418														
1831	Methyl parathion	20	ug/kg	6.37	ug/kg	20080418	C	Y	167	ug/kg	51	115	53	C	Y	167	ug/kg	51	115	53
1879	Mevinphos	15	ug/kg	4.62	ug/kg	20080418	C	Y	167	ug/kg	15	143	78	C	Y	167	ug/kg	15	143	78
1929	Naled	70	ug/kg	22.6	ug/kg	20080418														
2062	Parathion	18	ug/kg	5.29	ug/kg	20080418	C	Y	167	ug/kg	38	134	47	C	Y	167	ug/kg	38	134	47
2074	Ethyl parathion	18	ug/kg	5.29	ug/kg	20080418	C	Y	167	ug/kg	38	134	47	C	Y	167	ug/kg	38	134	47
2170	Phorate	20	ug/kg	5.70	ug/kg	20080418	C	Y	167	ug/kg	45	115	40	C	Y	167	ug/kg	45	115	40
2997	Propazine	67	ug/kg	8.63	ug/kg	20080418														
2264	Ronnel	46	ug/kg	15.2	ug/kg	20080418	C	Y	167	ug/kg	46	115	41	C	Y	167	ug/kg	46	115	41
2300	Simazine	67	ug/kg	22.1	ug/kg	20080418	C	Y	167	ug/kg	11	162	58	C	Y	167	ug/kg	11	162	58
2462	Sulfotepp	20	ug/kg	6.26	ug/kg	20080418	C	Y	167	ug/kg	41	123	40	C	Y	167	ug/kg	41	123	40
2339	Tetrachlorvinphos	15	ug/kg	4.36	ug/kg	20080418	C	Y	167	ug/kg	30	130	24	C	Y	167	ug/kg	30	130	24
3293	Tetrachlorvinphos (Stirophos)	15	ug/kg	4.36	ug/kg	20080418														
1086	Thionazin	18	ug/kg	5.57	ug/kg	20080418	C	Y	167	ug/kg	50	124	40	C	Y	167	ug/kg	50	124	40
2485	Tokuthion	20	ug/kg	3.91	ug/kg	20080418														
2545	Trichloronate	20	ug/kg	6.25	ug/kg	20080418	C	Y	167	ug/kg	50	115	43	C	Y	167	ug/kg	50	115	43
2569	O,O,O-Triethyl phosphorothioate	39	ug/kg	7.85	ug/kg	20080418	C	Y	167	ug/kg	50	150	50	C	Y	167	ug/kg	50	150	50
2600	Triphenyl phosphate						X	Y	66.7	ug/kg	47	161	0	X	Y	66.7	ug/kg	47	161	0

Structured Analysis Code: A-11-P2-9H-04

Target Analyte List: All Analytes

Matrix: SOLID
Extraction: SOXHLET (NONE,Na2SO4)
Method: Compounds, Organophosphorus (8141A)
QC Program: CLIENT: COMMERCIAL-FULL LIST
Location: TestAmerica Denver

Analyte List		Detection Limits					Check List 4780							Spike List 4780						
Syn	Compound	RL	Units	MDL	Units	Run Date	T	A	Amt	Units	LCL	UCL	RPD	T	A	Amt	Units	LCL	UCL	RPD
3823	Chlormefos						X	Y	66.7	ug/kg	42	132	0	X	Y	66.7	ug/kg	42	132	0

Lab Reference Data Summary

Structured Analysis Code: I-09-P2-9H-04

Target Analyte List: All Analytes

Matrix: WATER
Extraction: LIQ/LIQ, SEP FUNNEL (PAH,P/P,TPH,Dioxin) - Nominal
Method: Compounds, Organophosphorus (8141A)
QC Program: CLIENT: COMMERCIAL-FULL LIST
Location: TestAmerica Denver

Analyte List		Detection Limits					Check List 4780							Spike List 4780						
Syn	Compound	RL	Units	MDL	Units	Run Date	T	A	Amt	Units	LCL	UCL	RPD	T	A	Amt	Units	LCL	UCL	RPD
3202	Anilazine	10	ug/L	0.140	ug/L	20090128														
158	Atrazine	10	ug/L	0.293	ug/L	20090128														
177	Azinphos-ethyl	0.70	ug/L	0.205	ug/L	20090128														
187	Azinphos-methyl	2.5	ug/L	0.168	ug/L	20090128	C	Y	5.0	ug/L	42	125	36	C	Y	5.0	ug/L	42	125	36
309	Bolstar	1.0	ug/L	0.314	ug/L	20090128														
5661	Carbophenothion	1.0	ug/L	0.280	ug/L	20090202	C	Y	5	ug/L	50	150	30	C	Y	5	ug/L	50	150	30
5662	Carbophenothion-methyl	0.80	ug/L	0.080	ug/L	20090128														
621	Chlorpyrifos	0.5	ug/L	0.360	ug/L	20090128	C	Y	5.0	ug/L	60	120	34	C	Y	5.0	ug/L	60	120	34
3367	Chlorpyrifos-methyl	0.5	ug/L	0.085	ug/L	20090128														
647	Coumaphos	1.0	ug/L	0.135	ug/L	20090128	C	Y	5.0	ug/L	61	115	43	C	Y	5.0	ug/L	61	115	43
809	Demeton-O	1.0	ug/L	0.140	ug/L	20090128														
812	Demeton-S	1.0	ug/L	0.069	ug/L	20090128														
815	Demeton (total)	1.0	ug/L	0.209	ug/L	20090128	C	Y	10.0	ug/L	33	141	50	C	Y	10.0	ug/L	33	141	50
833	Diazinon	0.5	ug/L	0.147	ug/L	20090128	C	Y	5.0	ug/L	47	149	40	C	Y	5.0	ug/L	47	149	40
1020	Dichlorvos	0.5	ug/L	0.162	ug/L	20090128	C	Y	5.0	ug/L	40	193	49	C	Y	5.0	ug/L	40	193	49
1099	Dimethoate	0.5	ug/L	0.449	ug/L	20090128	C	Y	5.0	ug/L	33	139	50	C	Y	5.0	ug/L	33	139	50
1225	Disulfoton	1.0	ug/L	0.322	ug/L	20090128	C	Y	5.0	ug/L	44	139	40	C	Y	5.0	ug/L	44	139	40
1285	EPN	1.2	ug/L	0.149	ug/L	20090128														
1303	Ethoprop	0.5	ug/L	0.177	ug/L	20090128	C	Y	5.0	ug/L	43	165	36	C	Y	5.0	ug/L	43	165	36
1372	Famphur	1.0	ug/L	0.179	ug/L	20090128	C	Y	5.0	ug/L	51	131	88	C	Y	5.0	ug/L	51	131	88
1382	Fensulfothion	2.5	ug/L	0.544	ug/L	20090128	C	Y	5.0	ug/L	46	115	62	C	Y	5.0	ug/L	46	115	62
1393	Fenthion	2.5	ug/L	0.154	ug/L	20090128	C	Y	5.0	ug/L	63	128	41	C	Y	5.0	ug/L	63	128	41
1620	Malathion	1.2	ug/L	0.133	ug/L	20090128	C	Y	5.0	ug/L	53	137	28	C	Y	5.0	ug/L	53	137	28
1708	Merphos	5.0	ug/L	0.174	ug/L	20090128														
1831	Methyl parathion	4.0	ug/L	0.141	ug/L	20090128	C	Y	5.0	ug/L	55	131	30	C	Y	5.0	ug/L	55	131	30
1879	Mevinphos	6.2	ug/L	0.460	ug/L	20090128	C	Y	5.0	ug/L	39	175	40	C	Y	5.0	ug/L	39	175	40
1929	Naled	10	ug/L	0.253	ug/L	20090128														
2074	Ethyl parathion	1.0	ug/L	0.144	ug/L	20090128	C	Y	5.0	ug/L	47	142	40	C	Y	5.0	ug/L	47	142	40
2062	Parathion	1.0	ug/L	0.144	ug/L	20090128														
2170	Phorate	0.5	ug/L	0.154	ug/L	20090128	C	Y	5.0	ug/L	46	142	40	C	Y	5.0	ug/L	46	142	40
2188	Phosmet	1.5	ug/L	0.475	ug/L	20090128	C	Y	5	ug/L	50	150	30	C	Y	5	ug/L	50	150	30
2997	Propazine	10	ug/L	0.293	ug/L	20090128														
2264	Ronnel	10	ug/L	0.116	ug/L	20090128	C	Y	5.0	ug/L	43	115	39	C	Y	5.0	ug/L	43	115	39
2300	Simazine	10	ug/L	0.223	ug/L	20090128	C	Y	5.0	ug/L	15	176	31	C	Y	5.0	ug/L	15	176	31
2462	Sulfotepp	1.5	ug/L	0.168	ug/L	20090128	C	Y	5.0	ug/L	29	166	40	C	Y	5.0	ug/L	29	166	40
2339	Tetrachlorvinphos	2.5	ug/L	0.08	ug/L	20040202	C	Y	5.0	ug/L	53	123	40	C	Y	5.0	ug/L	53	123	40
3293	Tetrachlorvinphos (Stirophos)	3.5	ug/L	0.124	ug/L	20090128														

Structured Analysis Code: I-09-P2-9H-04

Target Analyte List: All Analytes

Matrix: WATER
Extraction: LIQ/LIQ, SEP FUNNEL (PAH,P/P,TPH,Dioxin) - Nominal
Method: Compounds, Organophosphorus (8141A)
QC Program: CLIENT: COMMERCIAL-FULL LIST
Location: TestAmerica Denver

Analyte List			Detection Limits				Check List 4780							Spike List 4780						
Syn	Compound	RL	Units	MDL	Units	Run Date	T	A	Amt	Units	LCL	UCL	RPD	T	A	Amt	Units	LCL	UCL	RPD
1086	Thionazin	0.5	ug/L	0.312	ug/L	20090128	C	Y	5.0	ug/L	39	180	40	C	Y	5.0	ug/L	39	180	40
2485	Tokuthion	1.6	ug/L	0.123	ug/L	20090128														
2545	Trichloronate	0.5	ug/L	0.242	ug/L	20090128	C	Y	5.0	ug/L	60	115	38	C	Y	5.0	ug/L	60	115	38
2569	O,O,O-Triethyl phosphorothioate	1.0	ug/L	0.144	ug/L	20090128	C	Y	4.0	ug/L	65	143	40	C	Y	4.0	ug/L	65	143	40
2600	Triphenyl phosphate						X	Y	2.0	ug/L	60	154	0	X	Y	2.0	ug/L	60	154	0
3823	Chlormefos						X	Y	2.0	ug/L	49	171	0	X	Y	2.0	ug/L	49	171	0

Quality Assurance Manual

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Denver

BUSINESS CONFIDENTIAL INFORMATION
DO NOT COPY
DO NOT DISTRIBUTE

Electronic Document Cover

The electronic copy of this document, as maintained on the TestAmerica Denver computer network, is the controlled copy. Any printed copy becomes uncontrolled, and all work performed should ultimately reference the controlled electronic version.

Any printed or electronic copy of this document that is distributed external to TestAmerica Denver becomes uncontrolled. To arrange for automatic updates to this document, contact TestAmerica Denver.

TestAmerica Laboratories, Inc.
TestAmerica Denver
4955 Yarrow Street
Arvada, CO 80002

Phone: 303-736-0100
Fax: 303-431-7171

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Cover Page:

Quality Assurance Manual

TestAmerica Denver
4955 Yarrow Street
Arvada, CO 80002
303-736-0100
303-431-7171
www.testamericainc.com

Facility Distribution No. _____ **Distributed To:_____**

Title Page:

Quality Assurance Manual
Approval Signatures
Title Page:

Laboratory Director – Robert C. Hanisch — Date: 3/16/08

Quality Manager - Karen Kuoppala — Date: 3/14/08

Organic Operations Manager/Technical Director – Susan Decker — Date: 3/13/08

Inorganic Operations Manager/Technical Director – Richard Clinkscales — Date: 3/13/08

SECTION 2

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

SOPs AND POLICIES REFERRED TO IN THE QA MANUAL

SOP/Policy Reference	Title
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-003	Management of Change Procedure
CA-Q-S-004	Method Compliance & Data Authenticity Audits
CA-Q-S-005	Calibration Curves (General)
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CA-L-S-001	Internal Investigation of Potential Data Discrepancies and Determination for Data Recall
CA-L-S-002	Subcontracting Procedures
CA-L-P-001	Ethics Policy
CA-L-P-002	Contract Compliance Policy
CW-L-P-001	Record Retention
CW-F-P-002	Authorization Matrix
CA-C-S-001	Work Sharing Process
CA-T-P-001	Qualified Products List
CW-F-S-004	Controlled Purchases Policy

SECTION 3

INTRODUCTION
(NELAC 5.1 - 5.3)

3.1 INTRODUCTION AND COMPLIANCE REFERENCES

TestAmerica Denver's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. Each TestAmerica laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with the 2003 National Environmental Laboratory Accreditation Conference (NELAC) standards and ISO/IEC Guide 17025 (1999). In addition, the policies and procedures outlined in this manual are compliant with the various accreditation and certification programs listed in Appendix 6. The relevant NELAC section is included in the heading of each QAM section.

The QAM has been prepared to be consistent with the requirements of the following documents:

- EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991.
- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- EPA SW-846, *Test Methods for the Evaluation of Solid Waste, 3rd Edition,* September 1986; Update I, July 1992; Update II, September 1994; and Update III, December 1996.
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th and 21st Edition.
- *U.S. Department of Energy*, *Quality Systems for Analytical Services*, Revision 2.1, November 2005.
- U.S. Department of Defense, *Quality Systems Manual for Environmental Laboratories*, Final Version 3, January 2006.
- U.S. Department of Defense, *Air Force Center for Environmental Excellence Quality Assurance Project Plan(QAPP),* Version 4.0.02, May 2006.
- Nuclear Regulatory Commission (NRC) quality assurance requirements.
- Toxic Substances Control Act (TSCA).

3.2 TERMS AND DEFINITIONS

A Quality Assurance Program is a company-wide system designed to ensure that data produced by TestAmerica Denver conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error,

encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 5 for the Glossary/Acronyms.

3.3 SCOPE / FIELDS OF TESTING

TestAmerica Denver analyzes thousands of environmental and industrial samples every month. Sample matrices vary among drinking water, effluent water, groundwater, hazardous waste, sludge and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical, and biological parameters. The Program also contains guidelines on maintaining documentation of analytical process, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all requests to provide analyses are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested water, industrial waste, and soil methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Appendix 4. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet requirements. All methods performed by TestAmerica Denver shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.4 MANAGEMENT OF THE MANUAL

3.4.1 Review Process

The manual is reviewed annually by the QA Manager and laboratory personnel to assure that it reflects current practices and meets the requirements of TestAmerica Denver's clients and regulators. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. The updates will be reviewed by the QA Manager, Laboratory Director/Manager, Technical Director(s), relevant operational staff and Corporate Quality Assurance (if a change is made to the Corporate template) and then formally incorporated into the document in periodic updates. The QAM is based on a Corporate QAM Template that is prepared and approved by the Chief Operating Officers (COOs) and Corporate Quality Assurance. This template is reviewed annually by the COOs, Corporate Quality, and each laboratory. Necessary changes are coordinated by the Vice President of Quality and Environmental Health & Safety (EHS) and distributed to each laboratory for inclusion in the laboratory specific QA Manuals.

Policies in the QAM that require immediate attention may be addressed through the use of Corporate QA/QC Policy Memoranda. QA/QC Policy Memoranda are published from time to time to facilitate immediate changes to QA/QC Policy. QA/QC Policy Memoranda supersede the QAM and all other SOPs (refer to Section 5.3). All policy memoranda are dated, archived and distributed by their placement into the front of the QAM between the signature page and Section 2. At a minimum, each policy memorandum is approved by the same authorized signatories as shown on the cover page of the QA Manual. In addition, Corporate QA/QC Policy Memoranda are signed by the COOs and VP of Quality and EHS. The QA/QC Policy Memoranda are incorporated into the QAM during the periodic updates. Policy memorandum may also include an expiration date if appropriate. An example format can be found in Figure 3-1. A similar procedure is followed for local laboratory changes.

Laboratory-specific QAM changes are approved and documented through the Management of Change process (Refer to SOP No. CA-Q-S-003, Management of Change Procedure).

3.4.2 Control

This manual is considered confidential within TestAmerica and may not be altered in any manner by other than a duly appointed representative from TestAmerica. If the document has been provided to external users or regulators, it is for the exclusive purpose of reviewing TestAmerica Denver's quality systems and shall not be used in any other way without the written permission of an appointed representative of TestAmerica. The procedure for control of distribution is incorporated by reference to TestAmerica Denver policy QA-001, "Preparation and Management of Standard Operating Procedures (SOPs) and Other Controlled Documents".

The order of precedence in the event of a conflict between policies is outlined in Section 5.3 of this Quality Assurance Manual.

Figure 3-1.

Example - Format for a QA/QC Policy Memorandum

Corporate (or Laboratory) QA/QC Policy Memorandum # _____

Effective Date: _____ Expiration Date: When Appropriate QAM Section is Revised

Corporate: *(Only needed for Corporate Memorandum – Delete if Laboratory)*

_____		_____	
COO - West	Date	Vice-President, QA and EHS	Date
_____			
COO - East	Date		

Local:

___ _____		___ _____	
Organic Operations Manager Approval Technical Director	Date	Quality Assurance Approval	Date
_____		___ _____	
Laboratory Director Approval	Date	Inorganic Operations Manager Approval Technical Director	Date

1. **Purpose**

2. **Procedure**

3. **Attachments**

4. **References/Cross References**

SECTION 4

ORGANIZATION AND MANAGEMENT
(NELAC 5.4.1)

4.1 OVERVIEW

TestAmerica Denver is part of a national network of laboratories known as TestAmerica. This Quality Assurance Manual (QAM) is applicable to the TestAmerica Denver laboratory only.

TestAmerica Denver
4955 Yarrow Street
Arvada, CO 80002
Federal ID# CO0026

The Corporate organization chart can be found in Figure 4-1 and the laboratory's organization chart can be found in Appendix 2. The locations of other TestAmerica labs are as follows:

TestAmerica Anchorage
TestAmerica Austin
TestAmerica Buffalo
TestAmerica Burlington
TestAmerica Cedar Falls
TestAmerica Chicago
TestAmerica Connecticut
TestAmerica Corpus Christi
TestAmerica Dayton
TestAmerica Edison
TestAmerica Honolulu
TestAmerica Houston
TestAmerica Irvine
TestAmerica King of Prussia
TestAmerica Knoxville
TestAmerica Los Angeles
TestAmerica Mobile
TestAmerica Morgan Hill
TestAmerica Nashville
TestAmerica North Canton
TestAmerica Ontario
TestAmerica Orlando
TestAmerica Pensacola
TestAmerica Phoenix
TestAmerica Pittsburgh
TestAmerica Portland
TestAmerica Richland
TestAmerica San Francisco
TestAmerica Savannah
TestAmerica Seattle

TestAmerica Spokane
TestAmerica St. Louis
TestAmerica Tacoma
TestAmerica Tallahassee
TestAmerica Tampa
TestAmerica Valparaiso
TestAmerica Watertown
TestAmerica West Sacramento
TestAmerica Westfield

4.2 ROLES AND RESPONSIBILITIES

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions define each role in its relationship to the Quality Assurance Program. More extensive job descriptions are maintained by laboratory management.

4.2.1 Quality Assurance Program

The responsibility for quality lies with every employee of TestAmerica Denver. All employees have access to the QAM and are responsible for knowing the content of this manual and upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs.

4.2.2 President/Chief Executive Officer (CEO)

The President/CEO is a member of the Board of Directors and is ultimately responsible for the quality and performance of all TestAmerica facilities. Together with the Chairman/CEO, the President/CEO establishes the overall quality standard and data integrity program for the Analytical Division, providing the necessary leadership and resources to assure that the standard and integrity program are met.

4.2.3 Chief Operating Officer (COO)

The COO serves as the ranking executive for all respective analytical laboratory operational functions and reports to the President/CEO of the Analytical Division. The COO is responsible for the daily management of all analytical laboratories, long-term planning and development of technical policies and management plans. The COO ensures the attainment of corporate objectives through the selection, development, motivation, and evaluation of top management personnel. The COO approves all operating budgets and capital expenditures. The COO signs-off on the final QAM template that contains company policies for implementing the Quality Program.

4.2.4 General Manager (GM)

Each GM reports directly to the COO. Each GM has full responsibility for the overall administrative and operational management of their respective laboratories. The GM's responsibilities include allocation of personnel and resources, long-term planning, setting goals, and achieving the financial, business, and quality objectives of TestAmerica. The GM ensures timely compliance with corporate management directives, policies, and management systems reviews. The GM is also responsible for restricting any laboratory from performing analyses that

cannot be consistently and successfully performed to meet the standards set forth in this manual.

4.2.5 Vice President of Client and Technical Services

The Vice President (VP) of Client and Technical Services reports directly to the President/CEO and is responsible for offerings to clients including quality assurance, environmental health and safety, risk management, technical assistance, legal compliance and contract administration. The VP of Client and Technical Services provides support and direction to the Executive Director and Directors of these areas, and supports the COO in decisions regarding long term planning, resource allocation and capital expenditures.

4.2.6 Executive Director of Quality and Environmental Health and Safety (QA/EHS)

The Executive Director of QA/EHS reports to the VP of Client and Technical Services. With the aid of the Senior Management Team, Laboratory Director/ Managers, Quality Directors, EHS Directors, QA Managers and EHS Coordinators, the Executive Director-QA/EHS has the responsibility for the establishment, general overview and Corporate maintenance of the Quality Assurance and Environmental, Health and Safety Program within TestAmerica. Additional responsibilities include:

- Review of QA/QC aspects of Corporate SOPs, national projects and expansions or changes in services.
- Coordination/preparation of the Corporate QAM Template that is used by each laboratory to prepare its own laboratory-specific QAM.
- Maintenance of Corporate Policies, Quality Memorandums and SOPs. Maintenance of data investigation records that are reported to Corporate Management.
- Working with various organizations outside of TestAmerica to further the development of quality standards and represent TestAmerica at various trade meetings.
- Preparation of a monthly report that includes quality metrics across the Analytical Division and a summary of any quality related initiatives and issues.
- With the assistance of the Corporate Senior Management Team and the EHS Directors, development and implementation of the TestAmerica Environmental, Health and Safety Program.

4.2.7 Quality Directors (Corporate)

The Quality Directors report to the Executive Director-QA/EHS. Together with the Executive Director-QA/EHS, the Quality Directors have the responsibility for the establishment, general overview and maintenance of the Analytical Division's Quality Assurance Program within TestAmerica. The Quality Directors are responsible for:

- Oversight of the QA/QC programs within each laboratory. This includes a final review of each laboratory-specific QAM and receipt of each laboratory's QA monthly report.
- Working with management to develop a plan of correction when a laboratory's quality system is determined to be inadequate.

- Review of QA/QC aspects of national projects.
- Assistance with certification activities.
- Providing assistance as needed in the selection of Quality Assurance Managers and reviewing their effectiveness.

4.2.8 Ethics and Compliance Officers (ECOs)

TestAmerica has designated two senior members of the Corporate staff to fulfill the role of Ethics and Compliance Officer (ECO) – VP-Client and Technical Services and the Executive Director–QA/EHS. Each ECO acts as a back-up to the other ECO and both are involved when data investigations occur. Each ECO has a direct line of communication to the entire senior Corporate and lab management staff.

The ECOs ensure that the organization distributes the data integrity and ethical practices policies to all employees and ensures annual trainings and orientation of new hires to the ethics program and its policies. The ECO is responsible for establishing a mechanism to foster employee reporting of incidents of illegal, unethical, or improper practices in a safe and confidential environment.

The ECOs monitor and audit procedures to determine compliance with policies and to make recommendations for policy enhancements to the CEO, COO, Laboratory Director/Manager or other appropriate individuals within the laboratory. The ECO will assist the laboratory QA Manager in the coordination of internal auditing of ethical policy related activities and processes within the laboratory, in conjunction with the laboratories regular internal auditing function.

The ECOs will also participate in investigations of alleged violations of policies and work with the appropriate internal departments to investigate misconduct, remedy the situation, and prevent recurrence of any such activity.

4.2.9 Director of Technical Services

The Director of Technical Services is responsible for establishing, implementing and communicating TestAmerica's Technical Policies, SOPs, and Manuals. Other responsibilities include conducting technical assessments as required, acting as a technical resource in national contracts review, coordinating new technologies, establishing best practices, advising staff on technology advances, innovations, and applications.

4.2.10 Chief Information Officer (CIO)

The CIO is responsible for establishing, implementing and communicating TestAmerica's Information Technology (IT) Policies, SOPs and Manuals. Other responsibilities include coordinating new technologies, development of electronic communication tools such as TestAmerica's intranet and internet sites, ensuring data security and documentation of software, ensuring compliance with the NELAC standard, and assistance in establishing, updating, and maintaining Laboratory Information Management Systems (LIMS) at the various TestAmerica facilities.

4.2.11 Environmental Health and Safety Directors (EHSDs) (Corporate)

The EHSDs report directly to the Executive Director-QA/EHS. The EHSDs are responsible for the development and implementation of the TestAmerica Environmental, Health and Safety program. Responsibilities include:

- Consolidation and tracking all safety and health-related information and reports for the company, and managing compliance activities for TestAmerica locations.
- Coordination/preparation of the corporate Environmental, Health and Safety Manual Template that is used by each laboratory to prepare its own laboratory-specific Safety Manual/CHP.
- Development and execution of the company Environmental Health and Safety Internal Audit program.
- Preparation of information and training materials for laboratory EHS Coordinators.
- Assistance in the internal and external coordination of employee exposure and medical monitoring programs to insure compliance with applicable safety and health regulations.
- Serving as Department of Transportation (D.O.T.) focal point and providing technical assistance to location management.
- Serving as Hazardous Waste Management main contact and providing technical assistance to location management.

4.2.12 Laboratory Director

TestAmerica Denver's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective GM. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- Provides one or more technical directors for the appropriate fields of testing. The name(s) of the Technical Director will be included in the national database. If the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Director to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing. The role of the Technical Director at TestAmeria Denver is fulfilled by the Laboratory Director or appointed designee(s).
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.

- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements.
- Ensures client specific reporting and quality control requirements are met.
- Captains the management team, consisting of the QA Manager, the Technical Director(s), and the Operations Manager as direct reports.

4.2.13 Quality Assurance (QA) Manager

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system based on ISO 17025.

- The QA Manager reports directly to the Laboratory Director and has access to Corporate QA for advice and resources. This position is able to evaluate data objectively and perform assessments without outside (i.e., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Manager directs the activities of the QA officers to accomplish specific responsibilities, which include, but are not limited to:
- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Maintaining and updating the QAM.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems and the technical operation.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
- Maintain, improve, and evaluate the corrective action database and the corrective and preventive action systems.

- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 13.
- Monitoring standards of performance in quality control and quality assurance.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Review a percentage of all final data reports for internal consistency. Review of Chain of Custody (COC), correspondence with the analytical request, batch QC status, completeness of any corrective action statements, 5% of calculations, format, holding time, sensibility and completeness of the project file contents.
- Review of external audit reports and data validation requests.
- Follow-up with audits to ensure client QAPP requirements are met.
- Establishment of reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Development of suggestions and recommendations to improve quality systems.
- Research of current state and federal requirements and guidelines.
- Captains the QA team to enable communication and to distribute duties and responsibilities.

4.2.14 Quality Assurance Specialist

The Quality Assurance Specialist performs several roles. The QA Specialist reports to the facility QA Manager. The QA Specialist is responsible for QA documentation and involvement in the following activities:

- Assist the QA Manager in performing the annual internal laboratory audits, compiling the evaluation, and coordinating the development of an action plan to address any deficiency identified.
- Facilitate external audits, coordinating with the QA Manager and Laboratory Staff to address any deficiencies noted at the time of the audit and subsequently presented in the final audit report.
- Assist the QA Manager in the preparation of new SOP's and in the maintenance of existing SOPs, coordinating annual reviews and updates.
- Manages the performance testing (PT) studies, coordinates follow up studies for failed analytes and works with QA Manager and Laboratory Staff to complete needed corrective action reports.
- Personnel training records review and maintenance.
- Document control maintenance.
- Assists the Quality Manager and Project Management Group in the review of program plans for consistency with organizational and contractual requirements. Summarize and

convey to appropriate personnel anomalies or inconsistencies observed in the review process.

- Manages certifications and accreditations.
- Monitors for compliance the following QA Metrics: Temperature Monitoring of refrigeration units and incubators; thermometer calibrations; balance calibrations; eppendorf/pipette calibrations; and proper standard/reagent storage.
- Periodic checks on the proper use and review of instrument logs.
- Initiate the Mint-miner data file review process for organic instrumentation. Maintain tracking sheet of activity.
- Initiate the annual Instrument review.
- Assist in the technical review of data packages which require QA review.

4.2.15 Technical Director

The Technical Director(s) report(s) directly to the Laboratory Director. The role of the Technical Director at TestAmerica Denver is fulfilled by the Operations Managers or appointed designee(s). He/she is accountable for all analyses and analysts with respect to ISO 17025. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and second- and third-generation instrumentation. Specific responsibilities include, but are not limited to:

- Coordinating, writing, and reviewing preparation of all test methods, i. e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she insures that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.
- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and

providing technical and troubleshooting expertise on routine and unusual or complex problems.

- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.
- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Coordinating sample management from "cradle to grave," insuring that no time is lost in locating samples.
- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc.
- Captains department supervisors to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.
- Coordinates audit responses with supervisors and QA Manager.

4.2.16 LIMS Administrator

The LIMS Administrator reports to corporate IT. In the pursuit of his/her duties, he/she:

- Establishes and maintains the laboratory information system (LIMS) for tracking all samples in the laboratory.
- Updates and enhances LIMS.
- Develops expertise in the requirements described in Good Automated Laboratory Practices (GALP)-EPA 2185, 1995 Edition, in order to ensure compliance.
- Programs and tests software modifications/changes.
- Coordinates testing to ensure that all LIMS software accurately performs its intended functions. Testing is performed and documented after installation or when modifications/ changes are made.
- Maintains historical files of software, software operating procedures (manuals), software changes/modifications (Change Log) and software version numbers.
- Maintains log of repairs and service performed on LIMS hardware.
- Develops and verifies security practices to assure the integrity of LIMS data. Identifies threats, potential threats, and future threats.
- Maintains awareness of any environmental conditions of the facility housing the LIMS that may compromise LIMS raw data and informs management.
- LIMS database back-up once daily.

4.2.17 LAN Analyst

The LAN Analyst reports to the LIMS Administrator. Specific responsibilities include, but are not limited to:

- Working with corporate IT to solve problems and standardize laboratory IT equipment and processes
- Monitoring and supporting office automation so LAN is operational for internal and external communications
- Troubleshooting problems throughout the laboratory relating to computers, software, telephones, and other electronic equipment
- Managing software and hardware for all computer applications to give users legal and operational equipment to perform daily tasks
- Responsible for new user setup on network, LIMS, telephone, and voice mail
- Maintaining tape backups for multiple computer servers
- Providing after hour on-call support to keep network and PCs functioning properly
- Analyzing server log files for errors to look for potential problems with file servers
- Installing or upgrading computers and other equipment

4.2.18 Operations Manager

The Operations Manager manages and directs the analytical production sections of the laboratory. He/She reports directly to the Laboratory Director. He/She acts as the Technical Director in determining the most efficient instrument utilization. More specifically, he/she:

- Evaluates the level of internal/external non-conformances for all departments.
- Continuously evaluates production capacity and improves capacity utilization.
- Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments.
- Develops and improves the training of all analysts in cooperation with the Technical Director and QA Manager and in compliance with regulatory requirements.
- Is responsible for efficient utilization of supplies.
- Constantly monitors and modifies the processing of samples through the departments.
- Fully supports the quality system and, if called upon in the absence of the QA Manager, serves as his substitute in the interim.

4.2.19 Radiation Safety Officer

The Radiation Safety Officer (RSO) is responsible for implementing TestAmerica Denver's radiation safety program. The RSO reports directly to the Technical Director. The RSO's duties consist of:

- Manage the personnel radiation dosimetry program
- Maintains the Radioactive Materials License and radionuclide inventory
- Monitors laboratory operation for compliance with the Radiation Safety Manual

- Training, documenting, and evaluating the TestAmerica Denver personnel for handling radioactive material
- Creating, releasing, and decontaminating of Radiological Control Areas (RCAs)
- Monitoring and tracking of radioactive materials
- Conducting the radioactive material waste disposal program in accordance with State and Federal regulations
- Maintaining all records related to the radiation safety program

4.2.20 Employee Health and Safety Coordinator

The EH&S Coordinator is responsible for administering the EH&S program that provides a safe, healthy working environment for all employees and the environment. The Employee Health and Safety Coordinator (EH&S Coordinator) reports directly to the Laboratory Director and the corporate Environmental Health and Safety Director. He/She monitors all areas for unsafe conditions, acts, and potential hazards. Specific responsibilities include, but are not limited to:

- Staying current with the hazardous waste regulations
- Continuing training on hazardous waste issues
- Reviewing and updating annually the Hazardous Waste Contingency Plan in the Environmental Health & Safety Manual.
- Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan
- Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste
- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administer dispersal of all Material Safety Data Sheet (MSDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is “reasonable” and should be referred for medical consultation.

- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica's medical consultants.

4.2.21 Hazardous Waste Specialist

The Hazardous Waste Specialist is responsible for coordinating and implementing the divisional hazardous waste program to ensure compliance with all federal, state, local laws, and company policies. The Hazardous waste specialist reports to the EH&S Coordinator. The duties consist of:

- Staying current with the hazardous waste regulations
- Conducts weekly inspections of satellite accumulation areas and all hazardous waste storage areas
- Operates and maintains on-site wastewater treatment system
- Coordinates the proper storage, packing and disposal of laboratory wastes according to Department of Transportation (DOT) and Resource Conservation and Recovery Act (RCRA) regulations
- Maintains waste disposal records
- Coordinates spill response activities including documentation for waste storage areas

4.2.22 Waste Disposal Technician

The Waste Disposal Technician is responsible for proper disposal of spent chemicals, process waste, and unused laboratory samples used in the laboratory according to corporate, federal, state, and local guidelines. The Waste Disposal Technician reports to the Hazardous Waste Specialist and EH&S Coordinator. The duties consist of:

- Packaging hazardous waste for transport per DOT, RCRA and TSCA guidelines
- Identifying waste streams and maintaining satellite accumulation areas
- Packages expired chemicals for shipment or disposal
- Tracks volume of waste generated for reporting to corporate and EPA
- Prepares and tracks implementation of the Waste Minimization Plan
- Empties satellite containers into bulk containers and returns to the laboratory for reuse

4.2.23 Department Manager

Department Managers report to the Operations Manager. At TestAmerica Denver there are two levels of Department Managers (I or II). The level designation is based on the level of experience. Each one is responsible to:

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. They perform frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents.

- With regard to analysts, participates in the selection, training (as documented in Section 8.1), development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.
- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Director, Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, non-conformance and CPAR issues, the timely and accurate completion of performance evaluation samples and MDLs, for his department.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager, Technical Director, Operations Manager, and/or Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.24 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The Analyst position at TestAmerica Denver is divided into levels. These levels range from Analyst I to Analyst V. The level designation is based on experience, expertise, and responsibilities. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.

- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Director, and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggest method improvements to their supervisor, the Technical Director, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.25 Laboratory Technician

Laboratory Technicians are responsible for the preparation of samples and performing all tasks assigned to them by the group leader or supervisor. The Laboratory Technician position at TestAmerica Denver is divided into three levels. These levels are Laboratory Technician I, Laboratory Technician II, and Laboratory Technician III. The level designation is based on experience, expertise, and responsibilities. The responsibilities of the Laboratory Technician are listed below:

- Retrieving samples from Sample Control for analysis
- Performing sample preparation by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Documenting standard and sample preparation, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database
- Report all non-conformance situations, sample preparation problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Director, and/or the QA Manager or member of QA staff.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.26 Laboratory Assistant

The Laboratory Assistant position is an entry-level position to learn basic laboratory technician skills. The Laboratory Assistant reports to their group leader or supervisor. The Laboratory Assistants duties include the following:

- Assisting the Laboratory Technicians in preparation of samples for analysis
- Preparing routine forms and reports
- Collecting and preparing materials and supplies for the laboratory
- Assisting technicians in conducting routine analysis

4.2.27 Sample Control Manager

The Sample Control Manager reports to the Project Management Manager. The responsibilities are outlined below:

- Direct the logging of incoming samples into the LIMS
- Ensure the verification of data entry from login
- Provide daily assessments of sample receipts
- Monitor the preparation and shipment of bottle kits to clients
- Oversee the receipt, log in, and storage of samples
- Schedules couriers for sample pickup from customer sites

4.2.28 Sample Control Technician

The Sample Control Technician reports to the Sample Control Manager. The Sample Control Technician position at TestAmerica Denver is divided into levels. These levels range from Sample Control Technician I to Sample Control Technician IV. The level designation is based on experience and responsibilities of the Technician. The Sample Control Technician responsibilities include the following:

- Receive and unload samples or consignments in accordance with DOT regulations
- Verify samples against the Chain of Custody (COC)
- Log in sample into the LIMS to assign a lot number for tracking purposes and distribute the paperwork to the Project Managers and Department Managers
- Label samples with lot number assigned and deliver the samples to the appropriate labs for analysis daily
- Monitor freezer and cooler temperatures daily to confirm that the readings are within SOP guidelines
- Ship all subcontracted samples to designated lab in accordance with DOT regulations as needed

4.2.29 Shipping/Maintenance Technician

The Shipping/Maintenance Technician reports to the Sample Control Manager and the Project Management Manager. The Shipping/Maintenance Technician duties include the following:

- Maintaining the inventory control system
- Receiving and distributing incoming supplies
- Preparing and shipping bottle sampling kits to clients or on-site crews
- Maintaining bottle and cooler inventory
- Packing in-house samples for shipment to other laboratories

4.2.30 Courier

The Courier reports to the Sample Control Manager and the Project Management Manager. The Courier's duties include the following:

- Picking up and delivering samples and reports to clients and the laboratory
- Receiving and signing the chain of custody for samples
- Preparing and shipping bottle sampling kits to clients or on-site crews
- Performing preventative maintenance on company vehicles

4.2.31 Project Management Manager

The Project Management Manager reports to the Laboratory Director and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team.
- Technical liaison for the Project Management team.
- Human resource management of the Project Management team.
- Responsible to ensure that clients receive the proper sampling supplies.
- Accountable for response to client inquiries concerning sample status.
- Responsible for assistance to clients regarding the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the supervisors of incoming projects and sample delivery schedules.
- Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates.
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.

- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Inform clients of data package-related problems and resolve service issues.
- Coordinate requests for sample containers and other services (data packages).

4.2.32 Project Manager

The Project Managers report to the Project Management Manager and serve as liaisons between the laboratory and its clients. At TestAmerica Denver there are two levels of Project Managers (I or II). The level designation is based on experience, expertise, and responsibilities. The Project Manager's responsibilities include:

- Ensuring client specifications are met by communicating project and quality assurance requirements to the laboratory.
- Notifying laboratory personnel of incoming projects and sample delivery schedules.
- Monitoring the status of all projects in-house to ensure timely delivery of reports.
- Informing clients of project-related problems, resolving service issues and coordinating technical issues with the laboratory staff.
- Coordinating client requests for sample containers and other services.
- Scheduling sample pick-ups from client offices or project sites and notifying the laboratory staff of incoming samples.
- Coordinating subcontract work.
- Assisting clients in procuring the proper sampling supplies.
- Responding to client inquiries concerning sample status.
- Assisting clients with resolution of problems concerning Chains-of-Custody

4.2.33 Project Management Assistant

The Project Management Assistant reports to the Project Management Manager and designated Project Manager. The Project Management Assistant assists the Project Manager in servicing the client's needs and communicating those needs to the laboratory. The Project Management Assistant's responsibilities include:

- Collating data reports, expanded deliverables, CLP data packages and electronic data deliverables (EDD's) for delivery to clients.
- Writing case narratives accompanying data packages to communicate anomalies to clients
- Entering data from subcontracted laboratories
- Proof reading and filing data reports received from the laboratory

- Assisting Project Managers in changing compound lists, TAT, and setting up tables in Word or Excel
- Monitoring report due dates for timely delivery
- Invoicing completed data packages
- Generating credit or debit invoices to ensure proper payment
- Copying and paginating reports

4.2.34 Support Supervisor

The Support Supervisor reports to the Laboratory Director and Project Management Manager. He/She is responsible for ensuring the timely and correct shipment of data reports to clients. He/She oversees the data review and data packaging groups. In addition, he/she:

- Coordinates work projects with project managers
- Supervises the review of data packages and authorizes its release
- Oversees the completion, mailing, and archiving of data reports
- Supervises the review of data packages for compliance with any Quality Assurance Program Plan (QAPP)

4.2.35 Data Review Analyst

The Data Review Analyst reports to the Support Supervisor. The Data Review Analyst is responsible for the reviewing of analytical data for contract compliance, completeness, and appropriate documentation. In addition, the Data Review Analyst performs the following:

- Reviews routine and non-routine data as recorded/produced by instrumentation
- Looks for discrepancies/inconsistencies with other project related results
- Assures contract compliance and compliance with client expectations have been met
- Checks data for compliance with the QAPP

4.2.36 Data Packaging Technician

The Data Packaging Technician reports to the Support Supervisor. The Data Review Analyst is responsible for preparing complete and accurate client report packages in accordance with contract compliance. Data Review Technicians perform the following duties:

- Compiling of data packages
- Paginating of data packages
- Creating hard copy deliverables
- Entering of data needed for final reports into the appropriate database
- Printing of final reports

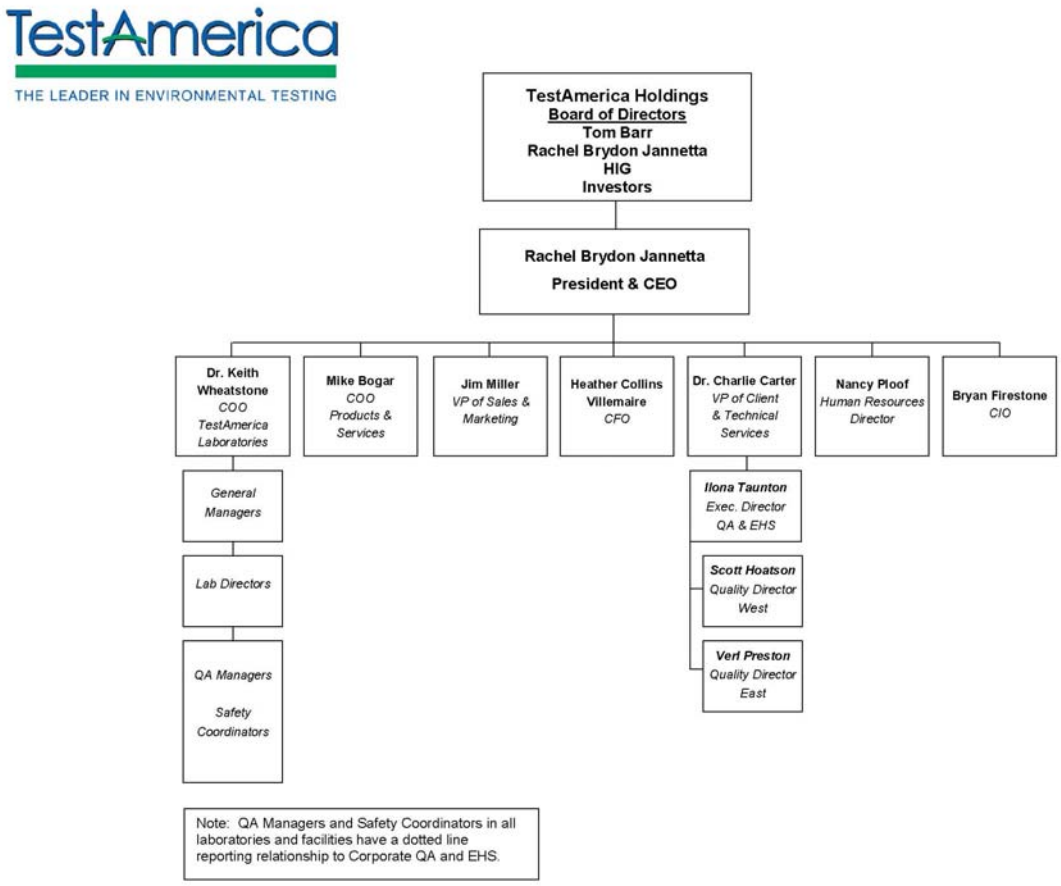
4.3 DEPUTIES

The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel Title	Key Personnel	Deputy
Laboratory Director	Robert C. Hanish	Brett VanDelinder
QA Manager	Karen Kuoppala	Maria Fayard
Organic Operations Manager Organic Technical Director	Susan Decker	Richard Clinkscales
Inorganic Operations Manager Inorganic Technical Director	Richard Clinkscales	Susan Decker
Project Management Manager	Brett VanDelinder	Pat McEntee
Organic MS Manager	William Rhoades	Susan Decker
Organic GC Manager	Dennis Jonsrud	Susan Decker
Metals Manager	Doug Gomer	Richard Clinkscales
Wet Chemistry Manager	Claire Likar	Richard Clinkscales
LCMS Manager	Andria Lenoble	Susan Decker
Support Supervisor	Dee Kettula	Brett VanDelinder
EHS Coordinator	Adam Alban	Robert Fayard
Radiation Safety Officer	Andrew Meyer	Adam Alban

Figure 4-1.

Corporate Organization Chart



SECTION 5

QUALITY SYSTEM
(NELAC 5.4.2)

5.1 QUALITY POLICY STATEMENT

The management of TestAmerica and TestAmerica Denver are committed to providing data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols described in this manual.

In all aspects of the laboratory and business operations, management is dedicated in maintaining the highest ethical standards. An Ethics Policy sign-off can be viewed in Appendix 1. Training on ethical and legal responsibilities is provided annually and each employee signs off annually on the policy as a condition of employment.

It is TestAmerica's Policy to continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. The company recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.

TestAmerica Denver strives to provide clients with the highest level of professionalism and the best service practices in the industry.

Every staff member at TestAmerica Denver plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 ETHICS AND DATA INTEGRITY

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The 7 elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Policy No. CA-L-P-001) and employee ethics statements (Appendix 1).
- An Ethics and Compliance Officer (ECO).
- A training program.
- Self-governance through disciplinary action for violations.
- A confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (SOP No. CA-L-S-001)
- Procedures and guidance for recalling data if necessary (SOP No. CA-L-S-001).
- An effective external and internal monitoring system that includes procedures for internal audits (Section 16).

As an American Council of Independent Laboratories (ACIL) member, all TestAmerica laboratories adhere to the following ACIL Code of Ethics:

- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.
- Provide employees with guidelines and an understanding of the ethical and quality standards of our industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 QUALITY SYSTEM SUPPORTING DOCUMENTATION

The laboratory's Quality System is communicated through a variety of documents prepared by the laboratory and company management:

- Quality Assurance Manual (QAM) Template
- Quality Assurance Manual – Each laboratory has a lab specific quality assurance manual.
- Corporate SOPs and Policies - Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions - A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Corporate TestAmerica QA/QC Policy Memorandums (Refer to Section 3.4).
- Laboratory QA/QC Policy Memorandums (Refer to Section 3.4).

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- TestAmerica QA/QC Policy Memorandum - Corporate
- Laboratory QA/QC Policy Memorandum
- Quality Assurance Manual
- Corporate SOPs and Policies
- Laboratory SOPs and Policies

- Other (Work Instructions (WI), memos, flow charts, etc.)

5.4 QA/QC OBJECTIVES FOR THE MEASUREMENT OF DATA

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples. The calculation of precision is described in Section 25.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery. The calculation of accuracy is described in Section 25.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories, and by the degree to which approval from the US EPA or other pertinent regulatory agencies is obtained for any procedure for which significant modifications have been made.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 CRITERIA FOR QUALITY INDICATORS

The laboratory prepares a Reference Data Summary (aka. Browser Report) that summarizes the precision and accuracy acceptability limits for analyses performed at TestAmerica Denver. This summary is updated each time new limits are generated and is obtained with the use of the QC Browser software/program. The new and previous limits are listed in a table format along with the control chart data generated from TestAmerica Denver's TraQar Control Limits program. The limits, control charts, and any notations pertaining to the data are compiled into a package that contains the effective date. The control limit data package is then scanned and stored in the QA/Read/Control Limits folder on the L drive. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, TestAmerica Denver has developed limits from evaluation of data from similar matrices. Criteria for the development of control limits are contained in Section 25.

5.6 STATISTICAL QUALITY CONTROL

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs [such as the Ohio Voluntary Action Plan (VAP)]. TestAmerica Denver routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The control charting process is defined in detail in SOP DV-QA-003P section 6. If a method defines the QC limits, the method limits are used. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Department Manager and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance Department maintains an archive of all limits used within the laboratory. If a method defines QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 25. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Surrogate limits are determined for a specific time period as defined above. The resulting ranges are entered in LIMS.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

As the QC limits are calculated, QC charts are generated showing warning and control limits for the purpose of evaluating trends. Refer to SOP DV-QA-003P section 6 for a description of the control charting process and evaluation of trending.

5.7 QUALITY SYSTEM METRICS

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 17). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6

DOCUMENT CONTROL
(NELAC 5.4.3)

6.1 OVERVIEW

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled at each laboratory Facility:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

The Corporate staff posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These are collectively termed "Official Documents" and encompass the Policies and Procedures that all facilities are required to employ. These official documents are only considered controlled when they are read on the company intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving official documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory specific SOP DV-QA-0010, Document Control provides additional information for TestAmerica Denver procedures.

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action reports. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports. Discussion on records control is described in Section 15.

The maintenance of purchasing data is discussed in Section 9.

The maintenance of sales and marketing contracts is discussed in Section 7.

6.2 DOCUMENT APPROVAL AND ISSUE

The pertinent elements of a control system for each document include a unique name and number, the number of pages of the item, the effective date, revision number and the

laboratory's name. The QA Manager or designee is responsible for the maintenance of the system and maintains the items in the QA Office.

Controlled documents are authorized by the QA Department and other management. In order to develop a new document, a department manager submits an electronic or hardcopy draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retains the official document on file. The official document is provided as needed to those using it. Controlled documents shall be available at all locations where the operational activity described in the document is performed (may include electronic access). Controlled documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum annually and revised as appropriate. Changes to documents occur when a procedural change warrants a revision of the document.

6.3 PROCEDURES FOR DOCUMENT CONTROL POLICY

For changes to the QA Manual, refer to SOP No. DV-QA-001P. Requirements for TestAmerica corporate quality documents are described in Corporate SOP no. CW-Q-S-001. Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department as described in SOP DV-QA-0005, Document Archiving Procedure. Electronic copies are stored on the Public server in the QA folder for the applicable revision under L:\QA\READ\SOPS\ESOPS\ALL.

For changes to SOPs, refer to SOP No. DV-QA-001P, Preparation and Management of Standard Operating Procedures (SOPs).

Forms, worksheets, work instructions, white papers, protocols, and information are organized by department and document type in the QA office. Electronic versions are kept on the Public server in the QA folder under L:\QA\READ\SOPS\ESOPS. The procedure for the care of these documents is in SOP DV-QA-001P.

6.4 OBSOLETE DOCUMENTS

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived as described in Section 15.

SECTION 7

REVIEW OF WORK REQUEST

7.1 OVERVIEW

TestAmerica has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is TestAmerica's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and TestAmerica's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these regulatory and client requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the lab's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and TestAmerica's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The review process is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 REVIEW SEQUENCE AND KEY PERSONNEL

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Customer Service Manager (CSM) is considered adequate. The CSM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the National Account Director, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below):

- Legal & Contracts Director
- General Manager
- The Laboratory Project Manager
- Customer Service Representative
- The Laboratory Operations Manager
- Laboratory and/or Corporate Technical Directors
- Laboratory and/or Corporate Information Technology Managers/Directors
- Regional and/or National Account representatives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The National Account Director, Legal Contracts Director, or local account representative then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Legal & Contracts Director maintains copies of all signed contracts. TestAmerica Denver's Customer Service Department maintains copies of all signed contracts for reference locally.

7.3 DOCUMENTATION

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. See Figure 7-3 for contract review forms.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Regional Account Manager. A copy of the contract and formal quote will be filed with the laboratory CSM and the Lab Director/Manager. Contracts filed by the CSM group are filed in locked fire proof cabinets.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log of conversations with the client. These are logged in the PMs notebook which is archived by the QA group upon completion.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, TestAmerica Denver assigns a PM to each client. The PM is the first point of contact for the client. It is the PM's responsibility to ensure that project specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements. The bid document form in figure 7-3 is used to disseminate information from the CSM staff to the PM.

PM's are the direct client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure the available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing. Unique or large programs generally have a Quality Assurance Summary prepared by the PM. This summary is posted on the outlook folders for anyone in the lab to access. The Quality Assurance Summary documents all requirements that are non-standard.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory management during production meetings. Such changes are updated to the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Department Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

TestAmerica strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

Figure 7-3.

Contract Review Requirements Checklist

CONTRACT NO.:_____ **DATE:**_____

	Exception Criteria	Comments
☐	The contract value is over $100K.	
☐	Payment terms are over 90 days, or payment terms requested indicate that TAL will be paid when the client is paid, with no maximum time limit.	
☐	A waiver of subrogation by TAL or our insurance company is required.	
☐	The warranty clause does not refer to TAL quality documents or the "standards of a competent professional in this industry."	
☐	Remedies for breach of warranty include resampling costs paid for by TAL.	
☐	The indemnification clause is very broad and can include liability for consequential damages.	
☐	There is a liquidated damages or penalty clause.	
☐	FAR flow down clauses impose cost accounting standards or defective pricing liability.	
☐	There is an organizational conflict of interest clause.	
☐	Insurance limits are over TAL's: a. General Liability - $2,000,000, Limits Requested _____ b. Automobile Liability - $1,000,000, Limits Requested _____ c. Workers Compensation–Other than statutory limit, Limits Requested _____ d. Employer's Liability - $1,000,000, Limits Requested _____ e. Professional/Pollution Liability - $5,000,000, Limits Requested _____ f. Umbrella Liability - $4,000,000, Limits Requested _____	

REVIEWER:_____

Figure 7-3.
Contract Summary Form

Prepared By:		**Contract No.:**		**Date:**	
This Summary is for:	(check one) ☒ **Completed contract** ☐ **Contract/proposal review due by:**				
	(check one) ☐ **Client contract** ☒ **Subcontract** ☐ **Teaming Agreement** ☐ **Vendor Contract**				
The estimated value of the Contract over its life ($000) is:		**Signed Original Contract Location:**		**Term of Agreement:**	
Contracting Party:					
Ultimate Client:					
Date of Contract:		**Project/Program Name/Location:**			
Responsible TAL Contacts:	**Sales:**	**PM/Technical:**	**Contract Reviewer(s):**		
Primary TAL Location(s):		**Secondary TAL Location(s):** (List All)			
Contracting Party Technical Contact:					
Address:					
Telephone:		**Fax:**			
Contracting Party Contracts Contact:					
Address:					
Telephone:		**Fax:**			
Type of Work: (check all that apply)	☐ **Lab Testing** ☐ **Consulting** ☐ **On-site Lab** ☐ **On-site Field Support** ☐ **Courier Service** ☐ **Includes work to be Subcontracted** **Work is** ☐ **Environmental or** ☐ **Not Environmental**				
Contract Type: (check all that apply)	☐ **MSA** ☐ **BOA** ☐ **Project-Specific** ☐ **Work Order under MSA or BOA** ☐ **Direct with Fed Gov't** ☐ **Fed Gov't Subcontract** ☐ **Direct State/Local Gov't** ☐ **State/Local Gov't Subcontract** ☐ **Commercial Client** ☐ **E/C Firm**				

Pricing:	☐ **Included** ☐ **Not Included**		
Standard TAL Term & Conditions?	☐ **Yes** ☐ **No**	Required Routine TAT:	☐ **EDD** (# of Days) _____ ☐ **Hard Copy** (# of Days) _____ ☐ **Business Days** ☐ **Calendar Days**
Reporting Formats Required:	☐ **Standard** ☐ **Standard + raw data** ☐ **Full CLP-Like** ☐ **Batch QC** ☐ **Project-specific QC**		
EDD Formats Required:	☐ **EDD** ☐ **CDROM** ☐ **iQ**		

Client Forecasts Required	☐ **Yes** ☐ **No**	**If yes, how much advance notice?**	
QAPP or Lab-standard Requirements?	☐ **QAPP** ☐ **Lab-Standard**	**Certification Required: (Describe)**	
Liquidated Damages or penalties?	☐ **Yes** ☐ **No**	**If Yes, Summarize:**	
Payment Terms		**Sample Disposal:**	☐ **Not stated or** ☐ **Must retain for Select One and/or** ☐ **Must get client approval for disposal**
Record Retention Requirement?	☐ **Yes** ☐ **No**	**If Yes, Summarize:**	
Special Invoicing Requirements?	☐ **Yes** ☐ **No**	**If Yes, Summarize:**	
How are Change Orders Handled?			
Other Special Requirements/ Comments/Notes: **TOPIC**	***COMMENTS***		

Figure 7-3.

Contract File

Company Name: _____

Site: _____

Contract Number _____

Contract Type
☐ C=Contract
☐ CO=Change Order
☐ DO=Delivery Order
☐ Mod=Modification
☐ MSA=Master Service Agreement
☐ PO=Purchase Order
☐ SC=Subcontract
☐ TO=Task Order
☐ WO=Work Order
☐ WR=Waiver/Release

Effective Date: _____

Expiration Date: _____

NTE Value: _____

Quote #: _____

Payment Terms: _____

Action	Completed	Date
Prepare Contract Summary	☐	
Legal Review	☐	
New Clients Only - Accounting Department Approval	☐	
TAL Execute Contract	☐	
Signed Contract to Client (Waiting on Executed Copy) ☐ **OR** **Signed Contract Received From Client** ☐	☐	
Fully Executed Contract Received from Client ☐ **OR** **Fully Executed Contract Returned to Client** ☐ ☐ **PDF-Email** ☐ **Original** ☐ **FAX**	☐	
Scan to Network (Fully Executed Contract)	☐	
Provide Contract Copy to Project Manager	☐	
Request Insurance Certificate	☐	

PM: _____

Final Lien Release Required ☐

Log Contract

TAL Denver Spread Sheet	☐
TAL Corporate Spread Sheet	☐
TAL Denver Signature Log	☐

Comments:

Figure 7-3. Con't

BID DOCUMENTATION FORM

ORIGINATOR:_____ DATE:_____

PROJECT NAME:_____SITE:_____

QUANTIMS QUOTE NO.:_____

TestAmerica LIMS QUOTE NO:_____CLIENT CODE:_____

EXISTING TA CONTRACT/PROJECT: ☐ Yes ☐ No TA LAB:_____

TA CONTRACT/PO NO.:_____ TA PRICING: ☐ Yes ☐ No

CREDIT CARD: ☐ AMEX ☐ Master Card ☐ VISA Other_____
☐ PM obtain name, account number, expiration date

CLIENT STATUS: ☐ Gold ☐ Gold Exception ☐ Standard
☐ Phase I ☐ Phase II

EMF FEE: ☐ Yes ☐ No

Minimum Log in Fee: ☐ Yes $___ ☐ No

CONTRACT/PO NO.:_____
PAYMENT TERMS: ☐ 30 Days ☐ 45 Days ☐ 60 Days ☐ 90 Days ☐ Other_____

PROJECT TYPE: ☐ Commercial ☐ State ☐ Federal:_____

QA/REGULATORY OVERSIGHT:
☐ EPA ☐ AFCEE ☐ USACE ☐ DOE ☐ STATE ☐ NONE

REGULATORY AREA: ☐ RCRA/RFI/GW ☐ NPDES/CWA/WW ☐ SDWA/DW

☐ TSCA ☐ CERCLA

TestAmerica ACCOUNT EXECUTIVE:_____ TestAmerica PROJECT MANAGER:_____

☐ AE Input Provided (See Attachment or Notes) ☐ No AE Input Received

CLIENT CONTACT:_____PHONE:_____

FAX:_____MOBILE:_____
E-MAIL:_____

COMPANY:_____
MANAGING OFFICE ADDRESS: _____
_____
_____

REPORT TO: _____
_____
_____

INVOICE TO: _____
_____
_____

PROJECT

MANAGER: _____ PHONE: _____

FAX: _____
E-MAIL: _____

PROJECT
CHEMIST: _____ PHONE: _____

FAX: _____
E-MAIL: _____

DATA
VALIDATOR: _____ PHONE: _____

FAX: _____
E-MAIL: _____

FIELD
CONTACT: _____ PHONE: _____

FAX: _____
E-MAIL: _____
START DATE: _____ DURATION: _____
BOTTLE ORDER REQUIREMENTS:
SHIP TO: _____
_____
_____
_____

DELIVERY DUE DATE: _____

RUSH SHIPPING BILLABLE ☐ YES (5 BUSINESS DAY'S NOTICE, MINIMUM, REQUESTED)

COURIER SERVICE REQUESTED ☐ YES
(BILLABLE FOR EVENT < $200; $25 MINIMUM; $1.00 PER MILE)

SAMPLING MATERIALS: ☐ COC Forms ☐ Labels ☐ Custody Seals
☐ USDA Permit ☐ PPQ Form 550 Stickers
☐ Quarantined Soil Stickers (DEN-QA-0019, NY, MD, NC, SC, GA, FL, AI, MS, LA, AR, TX)
VOA Vials ☐ Preserved ☐ Unpreserved
☐ Trip Blanks ☐ Temperature Blanks

☐ Encore Samplers
☐ 3 EnCore/kit, $30
☐ EnCore T Handle

☐ Terra Core Samplers
☐ 1 Terra Core/kit, $15

☐ Client will accept palletized containers
☐ Client will not accept palletized containers

SAMPLING
FREQUENCY: ☐ Single Event ☐ Weekly ☐ Monthly ☐ Quarterly
☐ Semi-Annual ☐ Annual

CERTIFICATIONS/
APPROVALS:
☐ STATE_____ ☐ USACE ☐ AFCEE
☐ DoD QSM Self Declaration Form
☐ NELAP ☐ Other_____
☐ DOE/Radioactive Materials License ☐ None

RADIOACTIVITY: known radioactivity at site: ☐ NO ☐ Yes
☐ µCi levels ☐ mCi levels (if yes, contact RSO)
☐ prescreening required (always, if radioactivity suspected)

QAPP/SOW:
☐ AFCEE 3.0 ☐ AFCEE 3.1 ☐ AFCEE 4.0
☐ USACE Shell ☐ DOD QSM V3 ☐ TECQ TRRP
☐ Project/Client Specific (See Attachment) ☐ None

☐ MDL current
☐ need to request MDL from QA Department and Operations Manager
☐ MDLV required
☐ need to request MDLV from QA Department and Operations Manager

TAT REQUIREMENTS (BUSINESS DAYS):
☐ FAX_____ ☐ E-MAIL_____ ☐ CD _____

☐ HARDCOPY_____ ☐ EDD_____

SERVICE REQUIREMENTS:
☐ Email Sample Confirmation Receipt Form
☐ Notify client of all nonconformances within 1 business day of occurrence

HARDCOPY DELIVERABLES: ☐ Standard ☐ CLP-Like Forms ☐ AFCEE Forms

☐ Raw Data ☐ Other:_____

☐ MULTIPLE REPORTS ISSUED/REISSUED
☐ LEVEL IV HARDCOPY REPORT, $40 EACH
☐ LEVEL III HARDCOPY REPORT, $25 EACH

☐ Airbill ☐ Chain of Custody ☐ Sample Confirmation Receipt Form

EDDs:
☐ QUA 08 ☐ ERPIMS 4.0 (Standard) ☐ None

☐ Client-Specific_____

☐ Specifications Attached

☐ STL STANDARD EDD, $10 EACH
☐ ALL OTHER EDDs, $25 EACH

SACs:
☐ STL DEN Standard, short spike list, standard data flags (QC 01)
☐ AFCEE 3.1 QAPP, AFCEE spike list, AFCEE flags (9G)
☐ AFCEE 4.0 QAPP, AFCEE spike list, AFCEE flags (A4)
☐ Full spike list, IDLs for metals, non-verified MDLs , standard data flags (9H)
☐ DoD QSM V3, full spike list, verified MDLs, routine data flags (Q3)
☐ Need New SAC? _____

PROJECT QC:
☐ Batch MS/MSDs
☐ Project-Specific MS/MSDs
☐ See CoC for client designation
☐ Lab designate MS/MSD
☐ MS/MSD billable at unit cost
☐ MS/MSD gratis

☐ LCS ☐ LCSD

☐ MS/MSD -- for AFCEE/QSM: Method SW8081A requires toxaphene, technical chlordane, and single component pesticides if these are target compounds

☐ Standard Spike List ☐ Full Spike List (Attached)

☐ Standard QC Limits ☐ Project-Specific QC Limits (Attached)

☐ Field Blanks ☐ Field Duplicates ☐ Laboratory Duplicates

☐ Custom Calibration/Calibration Verification Requirements (Attached)

☐ Project-Specific QC Evaluation Criteria (Attached)

PROJECT PARAMETERS/ MDLs/RLs: ☐ Standard Method List (Attached) ☐ Project-Specific List (Attached)

GC/MS TICs needed? ☐ Yes ☐ No Number per fraction: ____

☐ Report on Dry Weight Basis ☐ Report on As-Received Basis

☐ Weigh out additional amount to compensate for dry weight correction

☐ Report to MDL ☐ Report to RL

Multiple dilutions required to be analyzed and reported? ☐ Yes ☐ No

☐ ANALYTICAL DILUTION > 10X, EXTRACTED SAMPLE. 50% SURCHARGE, EACH SAMPLE.

☐ ANALYTICAL DILUTION > 10X, DAI/P&T SAMPLE. 70% SURCHARGE, EACH SAMPLE.

Metals preparation for water samples: ☐ Total ☐ Total Recoverable ☐ Dissolved

SPECIAL TECHNICAL REQUIREMENTS:

Method 8260B:	Acrolein, Acrylonitrile or 2-Chloroethyl vinyl ether required?	☐ Yes	☐ No
	Unpreserved analysis required?	☐ Yes	☐ No
	Client apprised of impact on results?	☐ Yes	☐ No
	7-Day holding time specified in special instructions?	☐ Yes	☐ No
Method 624	Acrolein, Acrylonitrile or 2-Chloroethyl vinyl ether required?	☐ Yes	☐ No
	3-Day holding time specified in special instructions?	☐ Yes	☐ No
Method 524.2:	Unpreserved analysis required?	☐ Yes	☐ No
	Client apprised of 24 hour HT for unpreserved samples?	☐ Yes	☐ No
DV-WC-0048H (Hydrazines)	Client apprised of 48 hour HT for laboratory filtration and preservation of water samples?	☐ Yes	☐ No

Client apprised of requirement for unchlorinated water sample? ☐ Yes ☐ No

Client apprised of potentially elevated soil RLs due to required dilutions? ☐ Yes ☐ No

TX1005

PM apprised of requirement to store soil samples at –12° C? ☐ Yes ☐ No

PFOA/APFO

☐ Report target compound as PFOA (perfluorooctanoic acid)
☐ Report target compound as APFO (ammonium perfluorooctanoate)

BTEX/GRO

☐ analyze separately, using two SACs -- BTEX requires 2nd column confirmation; GRO quantified from gasoline standard
☐ analyze together, using "XU" SAC -- BTEX does not require 2nd column confirmation; GRO quantified from synthetic HC standard

SW5035 Sampling

☐ EnCore Sampler required
☐ Terra Core Sampler required
☐ 48h HT to freezing or methanol preservation
☐ 7d HT to freezing or methanol preservation
☐ 14d HT to freezing or methanol preservation
☐ methanol preservation required
☐ sodium bisulfate preservation required

Hexachlorophene by Method SW8270C -- Appendix IX analyses

☐ client advised that 40CFR Part 264 advises PQL = 10ug/L; STL DEN's estimated PQL = 300ug/L
☐ client advised that TAL DEN analyzes a single-point standard at 1000ug/L, estimates a DL of 30-330ug/L, and has no MDL value for this compound (compound subject to non-reproducible performance)
☐ PM needs to include disclaimer in case narrative

Digestion of Soil Samples by Method SW3050B / SW6020

☐ client advised that alternate digestion procedure exists for antimony, which improves solubility and recovery of antimony from soil matrices (Section 7.5)
☐ client declined alternate digestion for antimony (Section 7.5)
☐ client requested alternate digestion procedure for antimony (Section 7.5)

Metals Analysis

☐ Beryllium by ICP/AES only
☐ "QO" method Code only for SW6010B
☐ "AS" method Code only for EPA200.7
☐ Cations by ICP/AES only
☐ New ICP/MS instrument is operated in collision cell mode. This instrument may not be used for drinking water compliance monitoring (per Method EPA 200.8). If samples are analyzed for drinking water compliance monitoring and Method EPA 200.8 is required, then include this text in Special Instructions: "EPA 200.8 Drinking Water -- collision cell instrument may not be used to analyze samples."

Fluoride by 340.2

☐ Client notified that the lab does not perform distillation – needed for wastewater
☐ If for wastewater compliance, EPA 300 is used, subcontract lab, or the client already has history of comparability for distillation vs. no distillation & ISE.

SAMPLE/EXTRACT STORAGE AND WASTE DISPOSAL

☐ Storage beyond 30 days after invoice billable at $____/container.

☐ Lab refrigerate samples and extracts 30 / 60 / 90 / ___ days after invoice

☐ Lab maintain samples and extracts at room temperature 30 / 60 / 90 / ___ days after invoice

☐ Lab dispose of samples and extracts 30 / 60 / 90 / ___ days after invoice

☐ Return samples and extracts 30 / 60 / 90 / ____ days after invoice

DATA RETENTION

☐ 5 / 7 / 10 years after invoice

PROJECT KICKOFF MEETING

☐ Need to schedule with departments: ☐ Organics ☐ Metals ☐ Wet Chemistry ☐ Reporting

PROJECT TESTS BY MATRIX

METHOD	WATER	SOIL	WASTE	BIOTA	AIR	COMMENTS

Comments:

SUBCONTRACTED TESTS:

TEST	MINIMUM SAMPLE AMOUNT	SAMPLE CONTAINER/ PRESERVATIVE	UNIT COST ($)

SUBCONTRACT VENDOR: _____

VENDOR POC: _____

PHONE:_____FAX:_____

ADDRESS: _____

_____

_____

SATURDAY DELIVERY: ☐ YES ☐ NO ☐ VENDOR ADDRESS ☐ HOLD AT CARRIER

VENDOR QUOTE NO.: _____ VENDOR QUOTE DATE: _____

VENDOR TAT (BUSINESS DAYS) _____ VENDOR DELIVERABLES: _____

ADDITIONAL INFORMATION:

SECTION 8

SUBCONTRACTING OF TESTS
(NELAC 5.4.5)

8.1 OVERVIEW

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the corporate network. The phrase "work sharing" refers to internal transfers of samples between company laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When we must outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to the SOP on Subcontracting Procedures (CA-L-S-002) and the Work Sharing Process SOP (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in NELAC/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-NELAC accredited work where required. Refer to TestAmerica Denver's SOP DV-QA-0027 for laboratory specific procedures.

For DOD projects the subcontractor laboratories used must have an established and documented laboratory quality system that complies with DoD QSM requirements. The subcontractor laboratories are evaluated following the procedures outlined below and as seen in Figure 8-1. The subcontractor laboratory must receive written project-specific approval from the DoD client before any samples are analyzed.

The QSM has 5 specific requirements for subcontracting:

1. Subcontractor laboratories must have an established laboratory quality system that complies with the QSM.
2. Subcontractor laboratories must be approved by the specific DoD Component laboratory approval process.
3. Subcontractor laboratories must demonstrate the ability to generate acceptable results from the analysis of PT samples, subject to availability, using each applicable method, in the specified matrix, and provide appropriate documentation to the DoD client.
4. Subcontractor laboratories must receive project-specific approval from the DoD client before any samples are analyzed.
5. Subcontractor laboratories are subject to project-specific, on-site assessments by the DoD client or their designated representatives.

Project Managers (PMs), Customer Service Managers (CSM), or Regional Account Executives (RAE) for the Export Lab are responsible for obtaining client approval prior to outsourcing any samples. The laboratory will advise the client of a subcontract or work sharing arrangement in writing and when possible approval from the client shall be retained in the project folder.

Note: TestAmerica Denver discloses, in all work proposals/contracts, the laboratories that could be used as a subcontract laboratory. In addition to the client, some regulating agencies, such as the US Army Corps of Engineers and the USDA, require notification prior to placing such work. It is required to have written approval from the client, whether it be email or in the contract itself, for all subcontract work.

8.2 QUALIFYING AND MONITORING SUBCONTRACTORS

Whenever a PM, Regional Account Executive (RAE), or Customer Service Manager (CSM) becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- The first priority is to attempt to place the work in a qualified network laboratory;
- Firms specified by the client for the task (Documentation that a subcontractor was designated by the client must be maintained with the project file. This documentation can be as simple as placing a copy of an e-mail from the client in the project folder);
- Firms listed as pre-qualified and currently under a subcontract with the company (in JD Edwards): A listing of all approved subcontracting laboratories and supporting documentation is available on the TestAmerica intranet site. Verify necessary accreditation for the requested tests prior to sending samples.
- Firms identified in accordance with the company's Small Business Subcontracting program as small, women-owned, veteran-owned and/or minority-owned businesses;
- NELAC, A2LA, State and/or Federal accredited laboratories.
- In addition, the firm must hold the appropriate certification to perform the work required.

All intra-company laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. Refer to SOP No. CA-C-S-001, Work Sharing Process.

When the potential sub-contract laboratory has not been previously approved, CSMs, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director/Manager. The Laboratory Director/Manager requests that the QA Manager begin the process of approving the subcontract laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented).

8.2.1 The QA Manager must ensure that the Preliminary Evaluation Documentation Checklist (Figure 8-1) has been completed and have supporting documentation on file prior to initiation of any work. This does not apply to other TestAmerica facilities. A letter or e-mail is sent to the lab requesting the following information:

8.2.1.1 If a lab is NELAC or A2LA accredited,

8.2.1.1.1 Copy of necessary certifications verifying that the required approvals are current. Ensure that all needed analytes are included; some may not be accredit-able (if so, document). Certificate and scope of International Standard accreditation are required, when applicable.

8.2.1.1.2 Insurance Certificate. This is required by TestAmerica's Chief Financial Officer

8.2.1.1.3 USDA soil permit if available**

8.2.1.2 For Laboratories accredited by other agencies with an auditing program:

8.2.1.2.1 Copy of necessary certifications verifying that the required approvals are current. Ensure that all needed analytes are included; some may not be accredit-able (if so, document). Certificate and scope of International Standard accreditation are required, when applicable.

8.2.1.2.2 Insurance Certificate. This is required by TestAmerica's Chief Financial Officer

8.2.1.2.3 USDA soil permit if available**

8.2.1.2.4 Description of Ethics and Data Integrity Plan.

8.2.1.2.5 The most recent 2 sets of full proficiency testing (PT) results relevant to the analyses of interest and any associated corrective action.

8.2.1.2.6 State Audit with Corrective Action Response

8.2.1.2.7 Example final report to confirm format is compliant and provides the necessary information. Minimally, it must be determined that Batch QC results are included in the laboratory reports and data is appropriately qualified.

8.2.1.2.8 A copy of raw data associated with the first project is requested for internal review. The raw data is reviewed by the QA Manager and the PM to ensure that the results meet the client's needs. If the QA manager is unfamiliar with the analysis being performed, notify Corporate QA for guidance on the review (it may need to be sent elsewhere for evaluation). This requirement can be skipped if an on-site visit of the laboratory is planned. (This requirement is effective as of the effective date of this section. Laboratories worked with previously [minimum of 6 months] are grandfathered in.)

8.2.1.2.9 DoD work includes additional requirements as described in Section 8.1 above.

8.2.1.3 For laboratories performing tests that are unaccredited or accredited by an agency without an audit program:

8.2.1.3.1 A copy of their Quality Assurance Manual (controlled if possible). Ensure data quality limits for relevant methods are acceptable and that training procedures are adequate.

8.2.1.3.2 Copy of necessary certifications (if available) verifying that the required approvals are current. Ensure that all needed analytes are included; some may not be accredit-able (if so, document). Certificate and scope of International Standard accreditation are required, when applicable.

8.2.1.3.3 Insurance Certificate. This is required by TestAmerica's Chief Financial Officer.

8.2.1.3.4 USDA soil permit if available**

8.2.1.3.5 Evidence of a current SOP per method. A copy of the first page and signature page of the SOP is acceptable. A table of contents including effective dates may also be acceptable. The SOP can be examined if an on-site audit is performed.

8.2.1.3.6 Description of Ethics and Data Integrity Plan.

8.2.1.3.7 The most recent 2 sets of full proficiency testing (PT) results relevant to the analyses of interest and any associated corrective action.

8.2.1.3.8 Example final report to confirm format is compliant and provides the necessary information. (minimally, it must be determined that Batch QC results are included in the laboratory reports and data is appropriately qualified.

8.2.1.3.9 Statement of Qualification (SOQ) or summary list of Technical Staff and Qualifications – position, education and years of experience.

8.2.1.3.10 DoD work includes additional requirements as described in Section 8.1 above.

8.2.1.3.11 A copy of raw data associated with the first project is requested for internal review. The raw data is reviewed by the QA Manager and the PM to ensure that the results meet the client's needs. If the QA manager is unfamiliar with the analysis being performed, notify Corporate QA for guidance on the review (it may need to be sent elsewhere for evaluation). This requirement can be skipped if an on-site visit of the laboratory is planned. (This requirement is effective as of the effective date of this section. Laboratories worked with previously [minimum of 6 months] are grandfathered in.)

8.2.2 Once the information is received by the QA Manager, it is evaluated for acceptability and forwarded to Corporate Contracts for formal contracting with the laboratory. They will add the lab to the approved list on the intranet site along with the associate documentation and notify the finance group for JD Edwards.

**USDA permit is required if soils less than three feet deep from New York, North Carolina, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Texas, Oklahoma, New Mexico, Arizona, California, Hawaii, or outside the continental U. S. are to be analyzed. These samples require special shipping measures; check with the EHS Department. It may be necessary to heat-treat the samples before shipping if the subcontract laboratory does not have a USDA permit; however, some analytes/tests may be irrelevant after heat treatment.

8.2.3 The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. The company does not certify laboratories. The subcontractor is on our approved list and can only be recommended to the extent that we would use them.

8.2.4 The status and performance of qualified subcontractors will be monitored periodically by the Corporate Contract Department. Any problems identified will be brought to Corporate QA attention.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints must be posted using the Vendor Performance Report (Form No. CW-F-WI-009).
- Information must be updated on the intranet when new information is received from the subcontracted laboratories.
- Subcontractors in good standing will be retained on the intranet listing. The QA Manager will notify all network laboratories and Corporate QA and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all Lab Directors/Managers, QA Managers and Sales Directors.

8.3 OVERSIGHT AND REPORTING

The PM (or RAE or CSM) must request that the selected subcontractor be presented with a subcontract, if one is not already executed between the laboratory and the subcontractor. The subcontract must include terms which flow down the requirements of our clients, either in the subcontract itself or through the mechanism of work orders relating to individual projects. A standard subcontract and the Lab Subcontractor Vendor Package (posted on the intranet) can be used to accomplish this, and the Legal & Contracts Director can tailor the document or assist with negotiations, if needed. The PM (or RAE or CSM) responsible for the project must advise and obtain client consent to the subcontract as appropriate, and provide the scope of work to ensure that the proper requirements are made a part of the subcontract and are made known to the subcontractor.

Prior to sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented, with the initial setup of each project or annual basis, on a Verification of Subcontract Lab Status (Figure 8-2) and the form is retained in the project folder. For network laboratories, certifications can be viewed on the company website.

The Sample Control department is responsible for ensuring compliance with QA requirements and applicable shipping regulations when shipping samples to a subcontracted laboratory.

All subcontracted samples must be accompanied by a Chain of Custody (COC). A copy of the original COC sent by the client must be included with all samples subbed within the network.

The PM will communicate with the subcontracted laboratory to monitor the status of the analyses, facilitate successful execution of the work and ensure the timeliness and completeness of the analytical report.

Non-NELAC accredited work must be identified in the subcontractor's report as appropriate. If NELAC accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a network work sharing laboratory may be transferred electronically and the results reported by the network work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 CONTINGENCY PLANNING

The Laboratory Director/Manager may waive the full qualification of a subcontractor process temporarily to meet emergency needs. In the event this provision is utilized, Corporate QA must be informed, and the QA Manager will be required to verify adequacy of proficiency scores and certifications. The laboratory must also request a copy of the raw data to support the analytical results for the first project submitted to the subcontract laboratory unless the laboratory has NELAC accreditation. -The raw data is reviewed by the QA Manager and the PM to ensure that the results meet the client's needs. The QA Manager will request full documentation and qualify the subcontractor under the provisions above. The approval process should be completed within 30 calendar days of subcontracting.

Figure 8-1.
Example - Preliminary Evaluation Documentation Checklist

Laboratory Under Evaluation:	
Client/Project For Which the Lab Will Be Subcontracted:	
Type of Analytical Services Required: ___Inorganic ___Radiochemistry ___General ___Organic _____Physical Testing _____Microbiological	**Type of Sample Matrices Required:** ___Drinking Water ___Waste Water ___Groundwater ___Mixed Waste ___Hazardous Waste

Item	Yes	No	NA	Comments
1. Which parameters will be subcontracted to this laboratory? List all:				
Did the subcontractor submit the following items and are they acceptable:				
2. Was a most recent audit, of requested parameters, performed by a state or federal agency, NELAP or other related third party audit submitted? Did the laboratory pass the state or the federal agency, NELAP, or other related third party audit?				
a. Was the Corrective action response sent to the state for federal agency? Was the laboratory corrective action response sufficient to address the problems found by the auditor?				
3. Were the two most recent PE samples for the requested parameters submitted?				
a. Did the PE samples pass criteria? If not, was the laboratory's corrective action response sufficiently explanatory?				
4. From the list of equipment submitted, does the auditor feel that sufficient equipment is available for performing the subcontracted analysis? Are equipment appropriate of the required test(s)?				
5. Was the laboratory QA manual submitted? Does the laboratory have a valid QA program and a QA manual?				
a. Are all subcontracted methods referenced in the QA manual?				

Laboratory Under Evaluation:	
Client/Project For Which the Lab Will Be Subcontracted:	
Type of Analytical Services Required: ___Inorganic ___Radiochemistry ___General ___Organic _____Physical Testing _____Microbiological	**Type of Sample Matrices Required:** ___Drinking Water ___Waste Water ___Groundwater ___Mixed Waste ___Hazardous Waste

Item	Yes	No	NA	Comments
b. Do reporting limits; referenced methods numbers; sample containers, preservations and holding times; summary of method calibrations; laboratory quality control samples/criteria; and preventive maintenance referenced in the QA manual. If not, list the missing key elements:				
6. Were MDLs and reporting limits (RLs) submitted? Are they acceptable? From the MDLs and RLs submitted, can the potential subcontractor routinely meet the required RLs for the listed parameters?				
7. Are required local state agency certifications for laboratory testing available, current, and acceptable?				
8. Does the laboratory use EPA approved standard methods? Does the laboratory have the necessary SOPs to perform the required analyses?				
9. Does the laboratory meet client/project-specific analytical and QA requirements?				
10. Was an example of a standard client sample data report for the above parameters submitted? Is it acceptable?				
11. From the documentation presented by the potential subcontractor, does the QA auditor reviewing the data feel that the subcontractor can be used? If response is no, explain why?				
12. Has the auditor discussed these reasons with the TestAmerica Denver laboratory management, that requested the laboratory, and are the concerns shared by TestAmerica Denver management?				
13. Does the auditor feel that an on-site laboratory audit of the potential subcontractor is required?				
a. Has a date and time been set for the on-site audit?				

Laboratory Under Evaluation:	
Client/Project For Which the Lab Will Be Subcontracted:	
Type of Analytical Services Required: ___Inorganic ___Radiochemistry ___General ___Organic _____Physical Testing _____Microbiological	**Type of Sample Matrices Required:** ___Drinking Water ___Waste Water ___Groundwater ___Mixed Waste ___Hazardous Waste

Item	Yes	No	NA	Comments
14. If radioactive materials involved, Radioactive Materials License and Radiation Protection Program.*				
*Any questions, contact the Corporate Health & Safety Director.				
Additional Comments:				
Prepared By:	**Date:**			
Reviewed By:	**Date:**			

Figure 8-2.
Example - Verification of Subcontract Lab Status.

TestAmerica Denver is responsible to our clients for on-going assurance that subcontracted analytical services meet TestAmerica Denver's expectations for quality. As part of this program, we require on-going verification that the following statements are true. Please return the completed form with the final report to TestAmerica Denver.

Laboratory Name: _____

	True	False	N/A	Comments
Your laboratory continues to hold current certifications as applicable to the requested fields of testing?				
Your laboratory has successfully completed PT samples for at least 2 of the last 3 of the requested fields of testing?				
Your laboratory has successfully completed method detection limits for the requested fields of testing within the last 12 months?				
There are no changes in equipment that affect the laboratory's capability to perform the requested fields of testing?				
There are no changes in qualified personnel that affect the laboratory's capability to perform the requested fields of testing?				
All testing is performed at the location to which the samples were delivered?				
Your laboratory does not have any OSHA, DOT, DoE, DoD, or EPA citations or pending investigations?				

Completed by: _____ on _____.
Name

SECTION 9

PURCHASING SERVICES AND SUPPLIES
(NELAC 5.4.6)

9.1 OVERVIEW

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to the specified requirements, all purchases from specific vendors are approved by a member of the supervisory or management staff.

Capital expenditures are made in accordance with the Controlled Purchases Procedure, CW-F-S-004. Only one quote is required where the item being purchased is a sole source product, Examples of sole source capital expenditures are laboratory test equipment, client specified purchases and building leases. A minimum of two quotes is required where the opportunity exists to source from more than one vendor. All documentation related to the purchase of capital items will be maintained in the individual CapEx files located in Corporate Purchasing. Data will be held in accordance with the record retention policy.

TestAmerica will enter into formal contracts with vendors when it is advantageous to do so. Contracts will be signed in accordance with the Authorization Matrix Policy, CW-F-P-002. Examples of items that are purchased through vendor contracts are laboratory instruments, consumables, copiers and office supplies. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

Non-capital expenditure items are purchased through the requisition and approval process in JD Edwards or through other TestAmerica authorized methods (approved web-sites, purchasing cards). Labs have the ability to select from the approved vendors in JD Edwards.

9.2 GLASSWARE

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 REAGENTS, STANDARDS & SUPPLIES

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Purchasing guidelines for equipment and reagents must meet with the requirements of the specific method and testing procedures for which they are

being purchased. Solvents and acids are pre-tested in accordance with Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001, *Verification and Storage of Chemical Standards*, SOP No. DV-QA-0015, and the TestAmerica Addendum to S-T-001, SOP No. S-T-001 DEN-1.

9.3.1 Purchasing

The nature of the analytical laboratory demands that all material used in any of the procedures is of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. The Department Manager should complete the Purchase Request Order Form (Figure 9-1) when requesting reagents, standards, or supplies.

The analyst must provide the item number, item description, package size, and the quantity needed. The Department Manager completes the purchase request order form and provides it to the Shipping/Maintenance Technician. The Shipping/Maintenance Technician places the order with the corporate office, which in turn places the order with the vendor.

9.3.2 Receiving

It is the responsibility of the Shipping/Maintenance Technician to receive the shipment. It is the responsibility of the Shipping/Maintenance Technician to date the material when received for the vendor storage and purchasing area. If the material received was ordered directly by the lab for laboratory use, the analyst that placed the order is responsible for dating the material when received. Once the ordered reagents or materials are received, the shipping/maintenance technician compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. Material Safety Data Sheets (MSDSs) are maintained and updated by the EH&S officer and online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

There are many different grades of analytical reagents available to the analyst. All methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, it may be assumed that it is not significant in that procedure and, therefore, any grade reagent may be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals unless noted otherwise by the manufacturer or by the reference source method.

- An expiration date can not be extended if the dry chemical is discolored or appears otherwise physically degraded, the dry chemical must be discarded.

- Expiration dates can be extended if the dry chemical is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).

- If the dry chemical is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical is compared to an unexpired independent source in performing the method and the performance of the dry chemical is found to be satisfactory. The comparison must show that the dry chemical meets CCV limits. The comparison studies are maintained within each department.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. The minimum total pressure must be 100 psig. The tank regulators are set at 100 psig, when the tank pressure goes at/below 100 psig the automatic system switches to a tank with higher pressure, and then the empty tank must be replaced. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a conductivity of less than 1mmho/cm (or resistivity of greater than 1.0 megaohm-cm) at 25°C. The conductivity is checked and recorded daily. If the water's conductivity is less than the specified limit, the Laboratory Director must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade water (or other similar quality) for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased VOA vials must be certified clean and the certificates must be maintained. If uncertified VOA vials are purchased, all lots must be verified clean prior to use. This verification must be maintained.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Table 9-1 details specific storage instructions for reagents and chemicals. Section 22 discusses conditions for standard storage.

9.4 PURCHASE OF EQUIPMENT/INSTRUMENTS/SOFTWARE

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Operations Manager and/or the Laboratory Director/Manager. If they agree with the request the procedures outlined in Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as

to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed, approved by corporate (CapEx), and the order is given to the corporate office to place the actual order.

Upon receipt of a new or used piece of equipment, it is given a short name, such as HP-20, added to the equipment list described in Section 21 that is maintained by the QA Department and IT must be notified so that can be linked for back-ups. The instrument name is then added into the LIMS system for data recording purposes. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (see Section 20). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department or QA Department as specified in the laboratory's procedure for software verification (see SOP S-ITQ-007). Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained within the department that the equipment/instrument is located.

9.5 SERVICES

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 21. The need for service is determined by analysts and/or Department Managers. The service providers that perform the services are approved by the Department Managers/Laboratory Director.

9.6 SUPPLIERS

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). The level of control used in the selection process is dependent on the anticipated spend and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers /vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report (CW-F-WI-009).

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form (CW-F-WI-007 – refer to Figure 9-2).

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Laboratory Director are consulted with vendor and product selection that have an impact on quality.

Figure 9-1.

Purchase Order Request Form

TestAmerica Denver
Purchase Order Request Form

Vendor Name	Vendor #	Item Description	Item #	Qty.	U/M	Unit Cost	Total	Billing Acct. Number	Requested Delivery Date	Requested By
							$0.00			
							$0.00			
							$0.00			
							$0.00			
							$0.00			
							$0.00			
							$0.00			
			Total	**0**		**Total**	**$0.00**			

Department #

Order Placed By:_____

Group Leader Approval:_____

Date: _____

Manager Approval_____

Req Creation Date:_____

Type of Shipping	
Overnight Rush (1-day)	
Rush 2 Day (2-days)	
Ship Ground (5-7 days)	
Ship For Sure - (Date)	

If type of shipping is not designated the order will ship ground.
Rush orders processed late will need an extra day for delivery.
Please fill out form in its entirety.
Ordering days are Tues. and Thurs. before 10 am.

Accounting Codes:

58100 - Building MX
60000 - Glassware
61000 - Sample Bottles
62500 - Consumable Lab Supplies
63000 - Solvents/Chemicals
63000.001 - Standards
64000 - Gases
71000 - MX and Repairs (Contract)
71100 - MX & Repairs (Non-Contract)
77000 - Office Supplies

Table 9-1.

Storage of Reagents and Chemicals

Chemical	Storage Requirements
Concentrated Acids and Bases	Stored in the original containers at room temperature. All organic acids must be stored separately from inorganic acids. Acids should not be stored with bases.
Bulk Dry Chemicals	Stored in the original containers at room temperature. All organic acids must be stored separately from inorganic acids. Acids should not be stored with bases.
Working Solutions containing Organic Compounds	Stored as per method recommendation/ requirement. They are generally stored refrigerated at 4°C± 2°C.
Working Solutions containing only Inorganics	Stored at room temperature; refrigeration is optional, but recommended.
Flammable Solvents	Stored in solvent cabinets at room temperature.
Non-Flammable Solvents	Stored separately from the flammable solvents in cabinets at room temperature.

Figure 9-2
Example – JD Edwards Vendor Add Request Form

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

JD Edwards Vendor Add Request Form

Vendor name:	Lab location and individual making request:
Vendor address (remit to):	Vendor phone:
Vendor address (remit to):	Vendor fax:
Contact name:	Product / service provided:

Reason for Vendor Addition: Check all reasons that apply

☐ Cost Reduction	Estimated Annual Savings $
☐ Replace Current Vendor	Reason?
	Vendor being Replaced?
☐ New Product / Service	Describe:
☐ ISO Approved (Required for Aerotech / P&K only)	

Small Business:

Does this vendor help us to meet our small business objectives: _____

If yes, which category: _____

Personal and Ethical Considerations:

Is there any personal conflict of interest with a TestAmerica employee and the vendor listed above? _____

_____

Have ethical considerations been taken into account in your evaluation of this vendor?_____

_____

Can this product be sourced from another TestAmerica facility?_____

Please complete form and email to NCPurchasing@testamericainc.com or fax to (330) 966-9275.

I approve the addition of this vendor:

_____ _____

Purchasing Manager - Patrick Eckman Corporate Controller - Leslie Bowers

Form No. CW-F-WI-007

SECTION 10

SERVICE TO THE CLIENT
(NELAC 5.4.7)

10.1 OVERVIEW

TestAmerica Denver cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements discussed in Section 5. The laboratory has procedures to ensure confidentiality to clients (Section 16 and 26).

Note: ISO 17025/NELAC 2003 states that a laboratory "shall afford clients or their representatives cooperation to clarify the client's request". This topic is discussed in Section 7.

10.2 SPECIAL SERVICES

The laboratory's standard procedures for reporting data are described in Section 26. When requested the following special services are provided:

- The laboratory will provide the client or the client's representative reasonable access to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- The laboratory will work with client-specified third party data validators as specified in the client's contract.
- The laboratory will provide the client with all requested information pertaining to the analysis of their samples. An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

10.3 CLIENT COMMUNICATION

Project managers are an important communication link to the clients. The lab shall inform its clients of any delays in project completion as well as any non-conformances in either sample receipt (refer to Section 24) or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

The QA Manager or Technical Director are available to discuss any technical questions or concerns that the client may have.

10.4 REPORTING

The laboratory will work with the client to produce any special communication reports required by the contract.

10.5 CLIENT SURVEYS

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service.

TestAmerica Denver participates in the American Council of Independent Laboratories (ACIL) Seal of Excellence program. This program includes the submission of a survey to laboratory clients. The clients send their responses directly to ACIL.

TestAmerica's Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 11

COMPLAINTS
(NELAC 5.4.8)

11.1 OVERVIEW

TestAmerica Denver believes that effective client complaint handling processes have important business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that helps to continually improve processes and improving client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services, communications, responsiveness, data, reports, invoicing and other functions expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for dealing with both external and internal complaints.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 13 (Corrective Actions) and is documented following SOP DV-QA-013P, Customer Complaints. It is the laboratory's goal to provide a satisfactory resolution to complaints in a timely and professional manner.

11.2 EXTERNAL COMPLAINTS

An employee that receives a complaint initiates the complaint resolution process and the documentation of the complaint.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likely hood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

11.3 INTERNAL COMPLAINTS

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 13. In addition, Corporate management, Sales and Marketing and Information Technology (IT) may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 13.

11.4 MANAGEMENT REVIEW

The number and nature of client complaints is reported by the QA Manager to the laboratory and QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 17)

SECTION 12

CONTROL OF NON-CONFORMING WORK
(NELAC 5.4.9)

12.1 OVERVIEW

When data discrepancies are discovered or deviations and departures from laboratory standard procedures, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 13).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. Refer to SOP DV-QA-0031, Nonconformance and Corrective Action System for the procedure to handle such situations.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 20. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Department Manager and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with NELAC (or the analytical method) requirements and the reason. Data being reported to a non-NELAC state would need to note the change made to how the method is normally run.

12.2 RESPONSIBILITIES AND AUTHORITIES

SOP No. CA-L-S-001, Internal Investigation of Potential Data Discrepancies and Determination for Data Recall, outlines the general procedures for the reporting and investigation of data discrepancies and alleged incidents of misconduct or violations of the company's data integrity policies as well as the policies and procedures related to the determination of the potential need to recall data.

Under certain circumstances the Laboratory Director or Department Manager, with approval from the QA Manager may exceptionally authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc.. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures described in Section 13 and in SOP DV-QA-0031, Nonconformance and Corrective Action

System. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility senior laboratory management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, the Department Manager, the Manager of the PM staff, and the Operations Manager. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO) and Quality Director within 24 hours.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director/Manager, QA Manager, ECOs, COO's – East and West, General Managers and the Quality Directors – East and West have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

12.3 EVALUATION OF SIGNIFICANCE AND ACTIONS TAKEN

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

SOP No. CA-L-S-001 distinguishes between situations when it would be appropriate for the laboratory QA Manager and Laboratory Director/Manager (or his/her designee) to make the decision on the need for client notification (written or verbal) and data recall (report revision) and when the decision must be made with the assistance of the ECO's and Corporate Management. Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting (Section 13) in lieu of the data recall determination form contained in SOP No. CA-L-S-001.

12.4 PREVENTION OF NONCONFORMING WORK

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system (Section 13).

On a monthly basis, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

12.5 METHOD SUSPENSION/RESTRICTION (STOP WORK PROCEDURES)

In some cases it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 12.2, Paragraph 5 above.

Prior to suspension/restriction, confidentiality will be respected, and the problem and the required corrective and preventive action will be stated in writing and presented to the Laboratory Director/Manager.

The Laboratory Director/Manager shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line.

The QA Manager will also initiate a corrective action report as described in Section 13 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate General Manager and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director/Manager to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (i.e., Project Management, Log-in, etc…). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, QA Manager, Department Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management, the Director of Client Services and Sales and Marketing should be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report as described in Section 13.

SECTION 13

CORRECTIVE ACTION
(NELAC 5.4.10)

13.1 OVERVIEW

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memos (NCM) and Corrective Action Reports (CAR) (refer to Figure 13-1).

13.2 DEFINITIONS

- **Correction***:* Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions are contained in the method specific SOPs. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis**.** No significant action is taken to change behavior, process or procedure.

- **Corrective Action***:* The action taken is not only a correction made to the immediate event, but a change in process, procedure or behavior that is required to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence.

13.3 GENERAL

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc..

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility for investigation.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify Systematic Problems before they become serious.
- Identify and track Client complaints and provide resolution (see more on client complaints in Section 11).

13.3.1 Non-Conformance Memo (NCM) - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits (non matrix related)

- Isolated Reporting / Calculation Errors
- Client Complaints
- Holding Time Violations
- Observations

13.3.2 Corrective Action Report (CAR) - is used to document the following types of corrective actions:

- Questionable trends that are found in the monthly review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Failed or Unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic Reporting / Calculation Errors

13.4 CLOSED LOOP CORRECTIVE ACTION PROCESS

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

13.4.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An NCM or CAR must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 13-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Department Manager, QA Manager (or QA designee), or Technical Director is consulted. The laboratory may also consult the technical contacts designated in the company for assistance.

13.4.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or CAR is used for this documentation.

13.4.3 Monitoring of the Corrective Actions

- The Department Manager and QA Manager is responsible to ensure that the corrective action taken was effective.

- Ineffective actions will be documented and re-evaluated until acceptable resolution is achieved. Department Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCM and CAR is entered into a database for tracking purposes and a monthly summary of all corrective actions is printed out for review to aid in ensuring that the corrective actions have taken effect.
- The QA Manager reviews monthly NCMs and CARs for trends. Highlights are included in the QA monthly report (refer to Section 17). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

13.4.4 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements. (Section 16 includes additional information regarding internal audit procedures.)
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

13.5 TECHNICAL CORRECTIVE ACTIONS

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 12 for information regarding the control of non-conforming work). The documentation of these procedures is through the use of an NCM or CAR, refer to SOP DV-QA-0031, Nonconformance and Corrective Action System.

Table 13-1 includes examples of general technical corrective actions. For specific criteria and corrective actions refer to the analytical methods or specific method SOPs, SOP DV-QA-024P, Requirements for Federal Programs, or Appendix 4.

Table 13-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, SOP DV-QA-003P, SOP DV-QA-024P, and Appendix 4, QAM Sections 20 and 21, and SOP CA-L-S-001 (Internal Investigation of Potential Data Discrepancies and Determination for Data Recall). All corrective actions are reviewed at a minimum monthly by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by a written NCM and appropriate corrective action (e.g., reanalysis) is taken and documented**.**

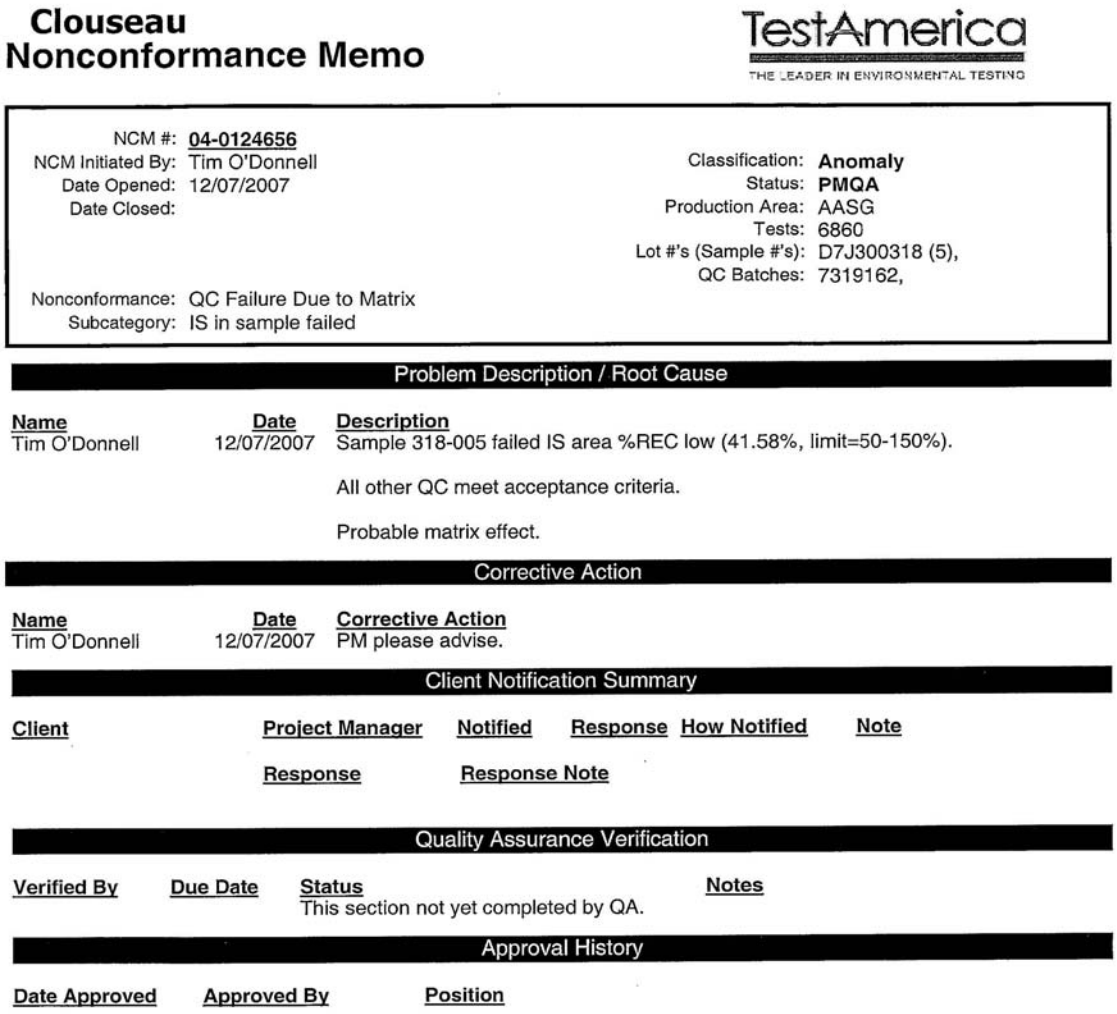
13.6 BASIC CORRECTIONS

When mistakes occur in records, each mistake shall be crossed-out, and not erased, deleted, made illegible, or otherwise obliterated (e.g. no white-out), and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original "uncorrected" file must be maintained intact and a second "corrected" file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 13-1.
Example Non-Conformance Memo



Clouseau
Nonconformance Memo

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

NCM #: 04-0124656
NCM Initiated By: Tim O'Donnell
Date Opened: 12/07/2007
Date Closed:

Classification: **Anomaly**
Status: **PMQA**
Production Area: AASG
Tests: 6860
Lot #'s (Sample #'s): D7J300318 (5),
QC Batches: 7319162,

Nonconformance: QC Failure Due to Matrix
Subcategory: IS in sample failed

Problem Description / Root Cause

Name	Date	Description
Tim O'Donnell	12/07/2007	Sample 318-005 failed IS area %REC low (41.58%, limit=50-150%). All other QC meet acceptance criteria. Probable matrix effect.

Corrective Action

Name	Date	Corrective Action
Tim O'Donnell	12/07/2007	PM please advise.

Client Notification Summary

Client	Project Manager	Notified	Response	How Notified	Note	Response	Response Note

Quality Assurance Verification

Verified By	Due Date	Status	Notes
		This section not yet completed by QA.	

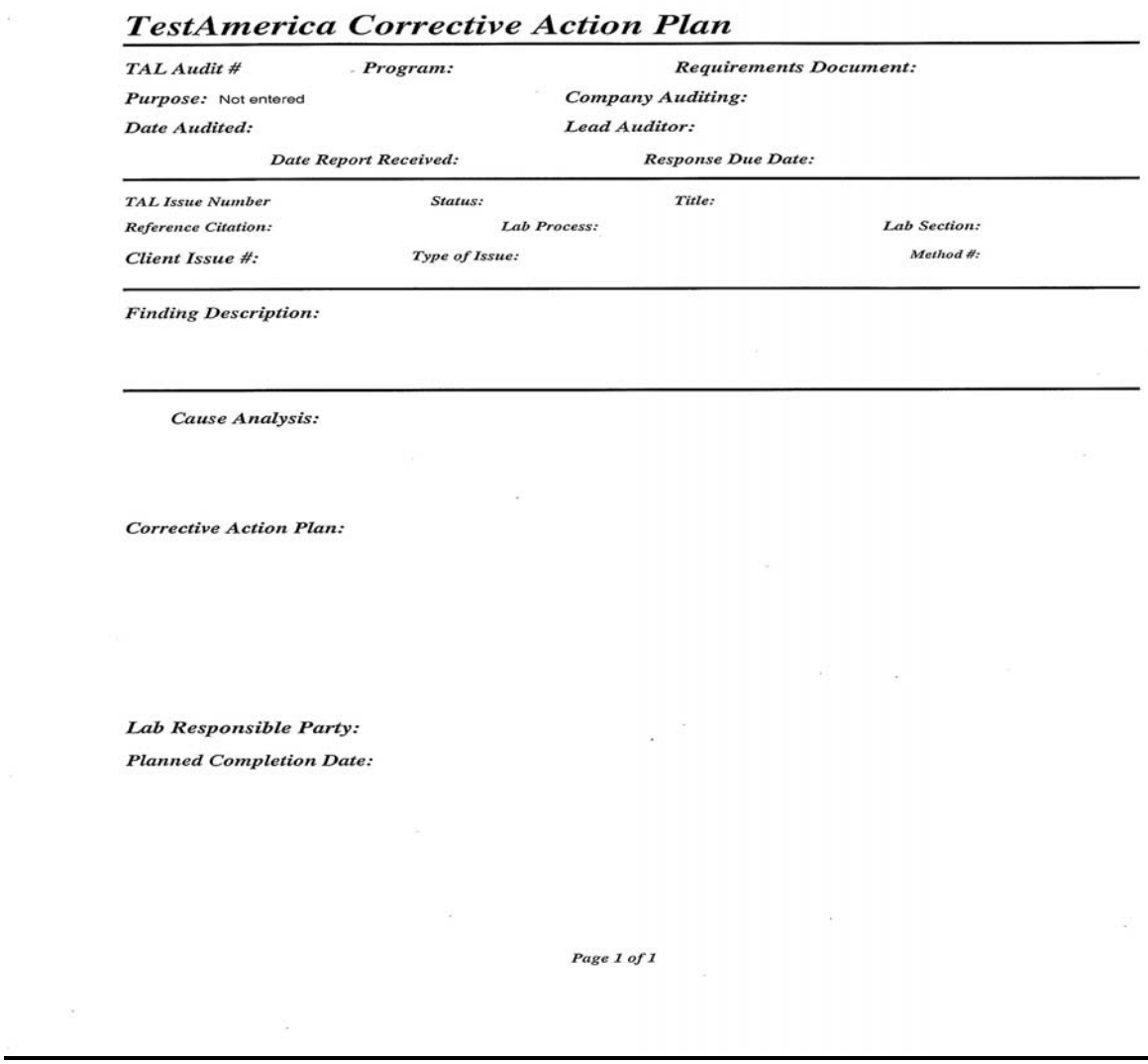
Approval History

Date Approved	Approved By	Position

Date Printed: 12/7/2007

Page 1 of 1

Figure 13-1. Con't
Example - Corrective Action Report



TestAmerica Corrective Action Plan

TAL Audit # *Program:* *Requirements Document:*

Purpose: Not entered *Company Auditing:*

Date Audited: *Lead Auditor:*

Date Report Received: *Response Due Date:*

TAL Issue Number *Status:* *Title:*

Reference Citation: *Lab Process:* *Lab Section:*

Client Issue #: *Type of Issue:* *Method #:*

Finding Description:

Cause Analysis:

Corrective Action Plan:

Lab Responsible Party:

Planned Completion Date:

Page 1 of 1

Figure 13-1. Con't
Example Open Corrective Action Summary Table

TestAmerica Denver

Summary of Open Federal Audits

LabName	AuditDate	Audit#	ProgName	Doc	CoAuditing	RcvdDate	DueDate
Denver	10/9/2006	63	Internal CA	NELAC	STL Denver	9/20/2006	10/9/2006
Denver	10/9/2006	74	External CA	Other	Clean Harbors/S	9/28/2006	10/31/2006
Denver	10/9/2006	64	Internal CA	NELAC	STL Denver	10/9/2006	10/9/2006
Denver	10/24/2006	71	Internal Audit	Other	STL Denver	10/24/2006	10/24/2006
Denver	10/26/2006	81	State Audit	Other	State of Arizona	11/29/2006	1/16/2007
Denver	11/7/2006	72	Internal Audit	Other	STL Denver	11/7/2006	11/10/2006
Denver	11/27/2006	76	Internal CA	Other	STL Denver	11/27/2006	11/28/2006
Denver	11/30/2006	78	Client Audit	Other	USGS	11/30/2006	12/5/2006
Denver	12/13/2006	86	AFCEE	AFCEE 4.0	EQM	1/9/2007	2/9/2007
Denver	1/17/2007	83	PT Failures	NELAC	STL Denver	1/16/2007	1/19/2007
Denver	4/27/2007	103	Internal Audit	Other	STL Denver	4/27/2007	5/4/2007
Denver	5/10/2007	113	Client Audit	NELAC	Parsons	5/10/2007	5/11/2007
Denver	5/11/2007	111	Internal Audit	AFCEE 4.0	STL Denver	5/4/2007	5/11/2007
Denver	5/16/2007	117	Client Audit	QSM V. 3	USACE	5/21/2007	6/4/2007
Denver	7/11/2007	123	Client Audit	Other	SM Stoller		7/13/2007
Denver	7/30/2007	127	PT Failures	NELAC	ERA	7/30/2007	8/13/2007
Denver	8/15/2007	131	State Audit	Other	State of WV	9/11/2007	9/26/2007
Denver	8/23/2007	133	Client Audit	QAPjP	ENSR	10/3/2007	10/30/2007
Denver	8/30/2007	129	State Audit	Other	State of Colorad	9/5/2007	9/28/2007

Table 13-1. Con't

General Corrective Action Procedures

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Initial Instrument Blank *(Analyst)*	- Instrument response < ½ RL	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc.
Initial Calibration Standards *(Analyst, Supervisor)*	- Correlation coefficient > 0.99. - Standard concentrations should bracket reporting limit. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Independent Calibration Verification (Second Source) *(Analyst, Supervisor)*	- % Recovery within control limits as defined in the method SOPs.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery within control limits as defined in the method SOPs. SOP DV-QA-027P has additional information for GC analyses.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in LIMS.	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. See SOP DV-QA-003P for detailed corrective actions.
Laboratory Control Sample (LCS) *(Analyst, Data Reviewer)*	- % Recovery within limits specified in LIMS.	See SOP DV-QA-003P for detailed corrective actions.
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits of method or within three standard deviations of the historical mean (limits stored in LIMS).	See SOP DV-QA-003P for detailed corrective actions.
Method Blank (MB_ *(Analyst, Data Reviewer)*	< Reporting Limit [1]	See SOP DV-QA-003P for detailed corrective actions.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Proficiency Testing (PT) Samples *(QA Manager, Department Manager/Supervisor)*	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Internal / External Audits *(QA Manager, Department Manager/Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc..	- Non-conformances must be investigated through CAR system and necessary corrections must be made.
Reporting / Calculation Errors (Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Department Manager, QA Manager, Corporate QA, Corporate Management)	- SOP CA-L-S-001, Internal Investigation of Potential Data Discrepancies and Determination for Data Recall.	- Corrective action is determined by type of error. Follow the procedures in SOP CA-L-S-001 and DV-QA-019P.
Client Complaints *(Project Managers, Lab Director/Manager, Sales and Marketing)*	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated). See SOP DV-QA-013P.
QA Monthly Report (Refer to Section 17 for an example) (QA Manager, Lab Director/Manager, Department Supervisors/Managers)	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Health and Safety Violation (Safety Officer, Lab Director/Manager, Department Supervisor/Manager)	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through CAR system.

Note:

1. Except as noted below for certain compounds, the method blank should be below the reporting limit (several programs require controlling to ½ the RL, see SOP DV-QA-024P for Federal Program Requirements). Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants: methylene chloride, toluene, acetone, 2-butanone, phthalates, zinc, iron, copper, and lead **provided** they appear in similar levels in the reagent blank and samples. This allowance presumes that the detection limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur. For benzene and ethylene dibromide (EDB) and other analytes for which regulatory limits are extremely close to the detection limit, the method blank must be below the method detection limit

SECTION 14.0

PREVENTIVE ACTION
(NELAC 5.4.11)

14.1 OVERVIEW

The laboratory's preventive action programs improve, or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive continuous process improvement activity that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes TestAmerica Denver's commitment to its Quality Assurance (QA) program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, customer service and satisfaction can be improved through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered during management reviews, the QA Metrics Report, internal or external audits, proficiency testing performance, client complaints, staff observation, etc..

The monthly Quality Assurance Metrics Report shows performance indicators in all areas of the quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. These metrics are used to help evaluate quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

The laboratory's Corrective Action process (Section 13) is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action provides a valuable mechanism for identifying preventive action opportunities.

14.1.1 The following elements are part of a preventive action system:

- Identification of an opportunity for preventive action.
- Process for the preventive action.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action. /=
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action. Documentation of Preventive Action is incorporated into the monthly QA reports, corrective action process, management review, and the Management of Change process (see below).

Note: There may be varying levels of formality and documentation during the preventive action process due to the simplicity/complexity of the action taken.

14.1.2 Any Preventive Actions undertaken or attempted shall be taken into account during the Annual Management Review (Section 17). A highly detailed recap is not required; a simple recount of success and failure within the preventive action program will provide management a measure for evaluation.

14.2 MANAGEMENT OF CHANGE

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these procedures, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of changes covered under this system include: Facility Changes, Major Accreditation Changes, Addition or Deletion to Division's Capabilities or Instrumentation, Key Personnel Changes, Laboratory Information Management System (LIMS) changes. This process is discussed in further detail in SOP CA-Q-S-003, Management of Change.

SECTION 15.0

CONTROL OF RECORDS
(NELAC 5.4.12)

TestAmerica Denver maintains a record system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued.

15.1 OVERVIEW

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 15-1. Quality records are maintained by the Quality Assurance (QA) Manager in a combination system of a paper filing and database system, which is backed up as part of the regular network backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by the Department Manager or their designee.

Table 15-1. Record Index[1]

Technical Records	Official Documents	QA Records	Project Records	Administrative Records
Retention: 5 Years from analytical report issue*	5 Years from document retirement date*	5 Years from archival* **Data Investigation:** 5years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)	5 Years from analytical report issue*	**Personnel:** 7 Years (HR Records must be maintained as per Policy CW-L-P-001) **Finance:** See Accounting and Control Procedures Manual
Raw Data Logbooks[2] Standards Certificates Analytical Records Lab Reports	Quality Assurance Manual (QAM)	Internal and External Audits/ Responses	Sample receipt and COC Documentation	Finance and Accounting
	Work Instructions	Certifications	Contracts and Amendments	EH&S Manual, Permits, Disposal Records
	SOPs	Corrective/Preventive Action	Correspondence	Employee Handbook
	Manuals	Management Reviews	QAPP	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)
		Method & Software Validation, Verification data	SAP	
		Data Investigation	Telephone Logbooks	Administrative Policies
	Policies		Lab Reports	Technical Training Records

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 15-2.

All records are legible and stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or the Iron Mountain data storage facility that provides a suitable environment to prevent damage or deterioration and to prevent loss**.** The laboratory retains analytical records for 2 months on-site at the laboratory and client reports for 6 months, after their generation and moved offsite for the remainder of the required storage time. Records are maintained for a minimum of five years unless other wise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 15-2 have lengthier retention requirements and are subject to the requirements in Section 15.1.3. Policy CW-L-P-001 (Record Retention) provides additional information on record retention requirements.

15.1.1 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 15-3, with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data. The specific requirements for the length of retention of documents are listed in the statement of work in the contract set up between the client and the laboratory. The laboratory then marks the Iron Mountain storage box with the longer time of storage.

Table 15-2. Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	10 years (project records)
Drinking Water Lead and Copper Rule	12 years (project records)
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Alaska	10 years
Louisiana – All	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

15.1.2 All records are held secure and in confidence. Records maintained at the laboratory are located in Arvada**.** Records archived off-site are stored in a secure location where a record is maintained of any entry into the storage facility. Logs are maintained in each storage box to note removal and return of records.

15.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, see section 20.12.1 'Computer and Electronic Data Related Requirements' for more information. Refer to SOP DV-QA-025P, Electronic Data Backup.

15.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data (Records stored off site should be accessible within 2 days of a request for such records). The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the chain of custody is stored with the invoice and the work order sheet generated by the LIMS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set per the Data Archiving SOP No. DV-QA-0005. Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method; a copy of each day's run long or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data. Standard and reagent information is recorded in logbooks, entered into the LIMS or the standards log program for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such

as “sampled by,” “prepared by,” “reviewed by”, or “Analyzed by”.

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory’s ability to retrieve the information prior to the destruction of the hard copy that was scanned.

- Also refer to Section 20.13.1 ‘Computer and Electronic Data Related Requirements’**.**

15.2 TECHNICAL AND ANALYTICAL RECORDS

15.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement (refer to Section 15.1). The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for performance of each analysis and checking of results.

15.2.2 Observations, data and calculations are recorded at the time they are made and are identifiable to the specific task.

15.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. Changes to electronic records in LIMS or instrument data are recorded in audit trails.
The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include (previous discussions relate where most of this information is maintained – specifics may be added below):

- laboratory sample ID code**;**
- Date of analysis and time of analysis is required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in the method specific logbook or benchsheet.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs where available.
- analysis type**;**
- all manual calculations and manual integrations**;**
- analyst's or operator's initials/signature**;**
- sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations,

reagents;

- test results;
- standard and reagent origin, receipt, preparation, and use;
- calibration criteria, frequency and acceptance criteria;
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;
- quality control protocols and assessment;
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated in the LIMS, on specific analytical report formats, and in client specific QAPPs and QASs.

15.3 LABORATORY SUPPORT ACTIVITIES

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;
- copies of final reports;
- archived SOPs;
- correspondence relating to laboratory activities for a specific project;
- all corrective action reports, audits and audit responses;
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

15.3.1 Sample Handling Records

Sample handling and tracking is discussed in Section 24. Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms;

and

- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

15.4 ADMINISTRATIVE RECORDS

The laboratory also maintains the administrative records in either electronic or hard copy form. See Table 15-1.

15.5 RECORDS MANAGEMENT, STORAGE AND DISPOSAL

15.5.1 All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available to the accrediting body upon request.

15.5.2 All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

15.5.3 Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access**.**

15.5.4 TestAmerica Denver has a record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued on a per analysis basis, and are numbered sequentially within a given analysis and/or instrument. No analysis and/or instrument have more than one active notebook at a time, so all data are recorded sequentially within a series of sequential notebooks. Bench sheets are filed sequentially by method and analysis date. Standards are maintained in the Standards Log program – no logbooks are used to record that data**.**

15.5.5 Records are considered archived when moved off-site. Access to archived hard-copy information is documented with an access log and in/out records is used in archived boxes to note data that is removed and returned. All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration. Access to the data is limited to laboratory and company employees**.**

15.5.6 In the event that the laboratory transfers ownership or goes out of business, TestAmerica Denver shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

15.5.7 Records Disposal

15.5.7.1 Records are removed from the archive and disposed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration.

15.5.7.2 Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

15.5.7.3 If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required. [Refer to Policy No. CW-L-P-001 (Records Retention).]

SECTION 16

AUDITS
(NELAC 5.4.13)

16.1 OVERVIEW

Audits measure laboratory performance and insure compliance with accreditation/certification and project requirements. Audits specifically provide management with an on-going assessment of the quality of results produced by the laboratory, including how well the policies and procedures of the QA system and the Ethics and Data Integrity Program are being executed. They are also instrumental in identifying areas where improvement in the QA system will increase the reliability of data. There are two principle types of audits: Internal and External. Internal audits are performed by laboratory or corporate personnel. External audits are conducted by regulators, clients or third-party auditing firms. In either case, the assessment to program requirements is the focus.

Table 16-1. Audit Types and Frequency

Internal Audits	Description	Performed by	Frequency
	Analyst & Method Compliance	QA Department or Designee	- 100% of all methods over a two year period. - 100% of all analysts annually.
	Instrument	QA Department or Designee	100% of all organic instruments and any inorganic chromatography instruments. Annually.
	Final Report	QA Department or Designee	- 1 complete report each month.
	Support Systems	QA Department or Designee	- Annual for entire labs support departments & equipment (e.g., thermometers, balances), can be divided into sub-sections over the course of the year.
	Performance Audits (Double-Blind PTs)	Corporate QA, Laboratory QA Department or Designee	- As needed.
	Special	QA Department or Designee	- As Needed
External Audits	**Description**	**Performed by**	**Frequency**
	Program / Method Compliance	Regulatory Agencies, Clients, accreditation organizations	- As required by program and/or clients needs
	Performance Audits	Provided by a third party.	- As required by a client or regulatory agency. Generally provided semi-annually through the analysis of PT samples.

16.2 INTERNAL AUDITS

Annually, the laboratory prepares a schedule of internal audits to be performed throughout the year. As previously stated, these audits verify and monitor that operations continue to comply with the requirements of the laboratory's QA Manual and the Corporate Ethics Program, the

DoD Quality Systems Manual, and other Federal Programs. A schedule of the internal audits is maintained by the QA Manager in the *Internal Audit Workbook*. An example can be found in Attachment 1.

It is the responsibility of the QA Manager to plan and organize audits in consideration of the laboratory work load and the department personnel schedules so that all pertinent personnel and operations are thoroughly reviewed. When designees (other than QA department personnel & approved by the QA Manager), perform audits, the QA Manager shall insure that these persons do not audit their own activities except when it can be demonstrated that an effective audit will be carried out. In general, the auditor:

- is neither the person responsible for the process being audited nor the immediate supervisor of the person responsible for the project/process.
- Is free of any conflicts of interest.
- Is free from bias and influences that could affect objectivity.

Laboratory personnel (e.g., supervisors and analysts) may assist with both method and support system audits as long as the items listed in the above paragraph are observed. These audits are conducted according to defined criteria listed in the checklists of the *Internal Audit Workbook.* These personnel must be approved by the QA Manager; and must complete the audit checklists in their entirety. This process introduces analyst experience and insight into the laboratory's auditing program.

The auditor must review the previous audit report and identify all items for verification of corrective actions. A primary focus will be dedicated to the ability of the laboratory to correct root-cause deficiencies and that the corrective action has been implemented and sustained as documented.

Refer to SOP DV-QA-0029, Independent QA Data Review for details on TestAmerica Denver's internal lab audit process.

16.2.1 Systems

An annual systems audit is required to ensure compliance to analytical methods and SOPs, the laboratory's Data Integrity and Ethics Policies, NELAC quality systems, client and State requirements. This audit is performed in portions throughout the year through method, analyst, instrument, work order/final report and support system audits. Audits are documented and reported to management within 1 week of their performance. Systems audits cover all departments of the facility, both operational and support. The multiple audits are compiled into one systems audit package at the end of the year (*Internal Audit Workbook*).

16.2.1.1 Method, Analyst, Instrument and Work Order/Final Report Audits

Procedures for the method compliance, analyst, instrument and work order/final report audits are incorporated by reference to SOP No. CA-Q-S-004, Method Compliance and Data Authenticity Audits. These audits are not mutually exclusive. For example, the performance of a method audit will also cover multiple analysts and instruments. The laboratory's goal is to annually review all analysts and instruments as described in SOP No. CA-Q-S-004. The

laboratory will also audit all methods within a two year time period and audit a minimum of one Work Order/Final Report from receiving through reporting on a monthly basis.

16.2.1.2 Support Systems

Support system audits are performed to ensure that all departments & ancillary equipment are operating according to prescribed criteria. Support system audits include the review of both non-analytical and operational departments. Support equipment audits (e.g., metrology items) include the review of balance calibrations, weight calibrations; water quality testing, etc.. Non-analytical may include sample receiving and bottle preparation. These types of support audits ensure that the operations are being performed to support ethical data as well as ensuring the accuracy & precision of the utilized equipment.

These audits can be performed in portions throughout the year or in one scheduled session. However, the audit schedule must document that these aspects are reviewed annually. Many of the metrology systems are considered to be surveillance activities that can be monitored by QA personnel or delegated to specified department personnel. These surveillance activities are performed on a semi-annual basis unless issues warrant a greater frequency or previous audits continually showing no deficiencies allow the frequency to be reduced to once a year.

An example audit checklist can be found in Attachment 2. Instructions for reporting findings are included in the *Internal Audit Workbook*. In general, findings are reported to management within 1 week of the audit and a response is due from management within 30 days.

16.2.2 Performance Audits

Corporate QA may arrange for double blind PT studies to be performed in the laboratories. Results are given to Management and Corrective actions of any findings are coordinated at each facility by the QA Managers and Laboratory Directors/Managers. These studies are performed on an as needed basis. They may be performed when concerns are raised regarding the performance of a particular method in specific laboratories, periodically to evaluate methods that may not normally be covered in the external PT program or may be used in the process of developing best practices. The local QA Manager may also arrange for PT studies on an as needed basis. (Refer to Section 16.3.2 for additional information on Performance Audits.)

16.2.3 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

16.3 EXTERNAL AUDITS

TestAmerica facilities are routinely audited by clients and external regulatory authorities. External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. The department managers are

responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. This time frame is generally 30 days.

> Be aware that NELAC requires that the audit response report be acceptable to the primary accrediting authority after the second submittal. The lab shall have accreditation revoked for all or any portion of its scope of a accreditation for any or all fields of testing, a method, or analyte within a field of testing if it is not corrected.

TestAmerica Denver cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

16.3.1 Confidential Business Information (CBI) Considerations

During on-site audits, on-site auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2003 NELAC standards.

16.3.2 Performance Audits

The laboratory is involved in performance audits conducted semi-annually through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Water Pollution studies, Water Supply studies, Soil and Hazardous Waste studies, DMRQA studies, and project specific or client requested studies.

- It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Further, where PT samples present special or unique problems in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

- PTs generally do not have holding times associated with them. In the absence of any holding time requirement, it is recommended that the holding time begin when the PT sample is prepared according to the manufacturers instructions. Holding times should apply to full volume PT samples only if the provider gives a meaningful "sampling date". If this is

not provided, it is recommended that the date/time of opening of the full volume sample be considered the beginning of holding time.

- Login will obtain the COC information from the documentation provided with the PTs with review by QA or other designated staff.

- Vials will be prepared as required in the instruction set provided with the samples. After preparation to full volume the sample may be spiked, digested, concentrated, etc., as would be done for any normal sample requiring similar analysis.

- PT samples will not undergo multiple preps, multiple runs, multiple methods (unless being used to evaluate multiple methods), multiple dilutions, UNLESS this is what would be done to a normal client sample (e.g. if a client requests, as PT clients do, that we split VOA coeluters, then dual analysis IS normal practice).

- The type, composition, concentration and frequency of quality control samples analyzed with the PT samples shall be the same as with routine environmental samples.

- Instructions may be included in the laboratory's SOPs for how low level samples are analyzed, including concentration of the sample or adjustment of the normality of titrant. When a PT sample falls below the range of the routine analytical method, the low-level procedure may be used.

- No special reviews shall be performed by operation and QA, UNLESS this is what would be done to a normal client sample. To the degree that special report forms or login procedures are required by the PT supplier, it is reasonable that the laboratory WOULD apply special review procedures, as would be done for any client requesting unusual reporting or login processes.

- Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

16.4 AUDIT FINDINGS

Internal or External Audit findings should be documented using the corrective action process and database (refer to Section 13). The laboratory is expected to prepare a response to audit findings within 30 days of receipt of an audit report unless the report specifies a different time frame. The response may include action plans that could not be completed within the 30 day timeframe. In these instances, a completion date must set and agreed to by operations management and the QA Manager.

Responsibility for developing and implementing corrective actions to findings is the responsibility of the Department Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been

affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

The procedures must be in accordance to SOP No. CA-L-S-001, Internal Investigations of Data Discrepancies and Determination of Data Recall.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

Figure 16-1.

Example - Internal Audit Workbook

Laboratory: TAL Denver

Internal Audit Schedule 2007

***Schedule to be completed 4/2007 for remainder of the year.**

Area Audited	Type	Cycle	SOP Reference	Comments	Scheduled	Audited	Closed
Balances	System	6 mo	DEN-QA-0014	CHRISTINA	5/7/2007	5/1/2007	5/1/2007
					12/7/2007	9/19/2007	9/19/2007
Temperature Logs/Thermometers	System	6 mo	DEN-QA-0001 & DEN-(	MARIA	5/7/2007	5/15/2007	5/15/2007
					12/7/2007	12/10/2007	12/10/2007
Sample Storage and Disposal	System	1 yr	DEN-QA-0003	MIKE	7/1/2007		
Maintenance Logs	System	6 mo	QA-008	CHRISTINA	5/7/2007	5/1/2007	5/1/2007
					12/7/2007		
Holding Blanks for Volatile Ref/Freezers (where required)	System	6 mo	DEN-QA-0013	Although blanks are tracked routinely, a six-month review of all VOA blanks will be	4/6/2007	4/6/2007	4/6/2007
Lab Water Quality Testing	System	6 mo	DEN-QA-0026	See audit database a	4/7/2007	5/17/2007	5/17/2007
					11/7/2007		
Sample Control (Log In)	System	1 yr	DEN-QA-0003	MIKE	7/1/2007		
Shipping Procedures	System	1 yr	DEN-QA-0017	CHRISTINA	6/1/2007		
Computer Operations (LIMS)	System	1 yr	S-ITQ-001	MIKE	7/1/2007		
SOP Distribution System	System	1 yr	QA-001	MARIA	8/1/2007		
Archiving of Paper Records	System	1 yr	DEN-QA-0005	CHRISTINA	8/1/2007	5/30/2007	5/30/2007
Statistical Process Control	System	1 yr	QA-003	MIKE	8/1/2007	8/14/2007	8/14/2007
Electronic Archiving	System	1 yr	QA-025	MARIA	9/1/2007		
Data Review System	System	1 yr	QA-012	CHRISTINA	9/1/2007	9/10/2007	9/26/2007
Final Report Generation	System	1 yr	DEN-QA-0022	CHRISTINA	9/1/2007	10/19/2007	11/2/2007
Standards/Reagents	System	6 mo	DEN-QA-0015	MIKE	5/7/2007	5/1/2007	5/1/2007
					12/7/2007	10/22/2007	11/2/2007
Manual Integration	System	1 yr	DPOL-QA-011	MIKE	10/1/2007		
Corrective Action System	System	1 yr	DEN-QA-0031	CHRISTINA	10/1/2007	11/6/2007	
Training Records	System	6 mo	DEN-QA-0024	MARIA	5/7/2007	6/28/2007	6/28/2007
					12/7/2007	11/7/2007	11/7/2007
MDLs	System	1 yr	QA-005	CHRISTINA	11/1/2007		
SOPs	System	1 yr	QA-001	MARIA	11/1/2007		
Purchasing/Procurement	System	1 yr	STL.PG-001	MIKE	11/1/2007		
Pipette/Diluter/Dispenser Calibration Check	System	6 mo	DEN-QA-0008	MIKE	5/7/2007	7/9/2007	7/9/2007
					12/7/2007		
Subcontract Lab Approval	System	1 yr	DEN-QA-0027	CHRISTINA	11/1/2007	11/21/2007	
Customer Complaint System	System	1 yr	QA-013	MARIA	11/1/2007		
Annual Systems Audit	System	1 yr	NA	Larry Penfold	January 7-10		
Methods	Method	2 yr					

Figure 16-2.

Example – Internal Audit System Checklist: Corrective Actions

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica <Location>

INTERNAL AUDIT - Corrective Actions

(Summary Page)

[Printed Name(s) or Date(s)]

Area Audited:	
Auditor:	
Date:	
Persons Contacted During Audit:	
Date Reported to Department Manager:	
Reported To:	
Date Reported to Lab Director/Manager:	
Reported To:	
Date Response Due:	
Response Received and Accepted by QA Manager:	
Associated Corrective Action Report Number(s):	
Scheduled Follow-up:	

Item	Requirement	Ref.	Y	N	NA	Evidence/Comments	Follow Up
1	Does the laboratory have a corrective action program in place?	5.4.10.1					
2	Does the laboratory have a current corrective action SOP or is this information in the QA Manual?	5.4.10.1					
3	Do all laboratory personnel have documented training and access to initiate corrective actions?	5.4.10.1					
4	Are causes clearly identified by department, staff name, scope of issue (how many reports affected)?	5.4.10.6					
5	Is a root cause for the issue identified?	5.4.10.2					
6	Is a corrective action (plan) clearly described?						
7	Was the corrective action fully implemented?						
8	Is documentation (if applicable) completed as specifed by the corrective action (training, revised SOP, etc)						
9	Has a follow-up assessment been conducted to verify the corrective action was successful?						
10	Are corrective actions reviewed on a regular basis by management?	5.4.10.6a 5					
11	Is there a defined distribution flow for corrective action notification, review, closure, and follow-up?	5.4.10.6a					
12	Are non-conformances reviewed on a regular basis and used, if necessary, to initiate root cause corrective actions?						
13	Does the lab have a documented procedure for QC corrective action (i.e., documented within each method / parameter SOP or in the QA Manual)?	4.10.1					
14	***Verify Corrective Actions from previous systems audits. List Items:***						
15							
16							
17							

Auditor Signature:_____

Primary Reference(s): Corporate SOP CA-Q-S-002, Acceptable Manual Integration Practices
NELAC Standard, June 2003
DoD Quality Systems Manual, Version 3, January 2006
EPA Manual for the Certification of Laboratories Analyzing Drinking Water

Figure 16-2. Con't
Example Internal Lab Section Audit Checklist

TestAmerica Denver

Organic Preparation QA Data Audit Checklist

Date Audited:_____ Batch Number(s) Audited:_____

Method:_____ Auditor:_____

Analyst(s):_____

Evaluation	Acceptance Criteria	Acceptable (Y/N/NA)?	*Comments*
IDOC on file?	Required for each analyst		
Is internal COC complete?	All required info entered.		
Is original handwritten version of benchsheet available?	Original records must be kept 5 yrs		
Is Data Recording Policy followed?	Entries in ink, single line cross-out, date & initials		
Method and/or SOP# clearly indicated?	Entry must be made		
Personnel clearly indicated?	Everyone involved must be listed		
Sample pH entered?	Entry must be made for most tests		
Times on & off for extraction recorded?	CLLE & Soxhlet need it		
All standards traceable?	Std #s required		
All reagents traceable?	Lot #s required		
Nonconformances recorded?	See NCM SOP		
NCMs described accurately in case narrative?	All NCMs must be communicated to client		
All required fields entered?	Per method SOP		
2nd-level review documented?	Name or initials & date		

Overall Comments:

Corrective Action Required:

A copy of this report will be maintained in the Quality Assurance office.

Auditor Signature _____ Date _____

L:/QA/Read/Audit/Data Audit/QA Data Review Forms/Organic Prep
9/10/07 version

SECTION 17

MANAGEMENT REVIEWS
(NELAC 5.4.14)

17.1 QUALITY ASSURANCE REPORT

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director for review and comments. The final report shall be submitted to the Operations Manager as well as the appropriate Quality Director and General Manager. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. At a minimum, the report content will contain the items listed below. During the course of the year, the Laboratory Director/Manager, General Manager or Corporate QA may request that additional information be added to the report.

The TestAmerica QA Report template is comprised of a discussion of three key QA issues facing the laboratory and ten specific sections (Figure 17-1):

- **Metrics:** Describe actions or improvement activities underway to address any outlying quality metrics.
- **SOPs:** Report SOPs that have been finalized and report status of any outstanding SOP reviews.
- **Corrective Actions:** Describe highlights and the most frequent cause for report revisions and corrective/preventive action measures underway. Include a discussion of any recalls handled at the lab level as per Section 6.2.2 in the Investigation/Recall SOP (SOP: CA-L-S-001). Include a section for client feedback and complaints. Include both positive and negative feedback. Describe the most serious client complaints and resolutions in progress.
- **MDLs and Control Limits:** Report which MDLs/ MDL verifications are due. Report the same for Control Limits.
- **Audits:** Report Internal and External Audits that were conducted. Include all relevant information such as which methods, by whom, corrective actions needed by when and discuss unresolved audit findings.
- **Performance Testing (PT) Samples:** Report the PT tests that are currently being tested with their due dates, report recent PT results by study, acceptable, total reported and the month and year.
- **Certifications:** Report on any certification programs being worked on by due date, packages completed. Describe any issues, lapses, or potential revocations.
- **Regulatory Updates:** Include information on new state or federal regulations that may impact the laboratory. Report new methods that require new instrumentation, deletion of methods, changes in sampling requirements and frequencies etc…
- **Miscellaneous:** Include any issues that may impact quality within the laboratory. This section is also used to communicate the status on any Management of Change Request Forms (CRFs) that have missed targeted due dates.
- **Next Month:** Report on plans for the upcoming month.

- **Lab Director Comments Section:** This section gives the Laboratory Director/Manager the opportunity to comment on issues discussed in the report and to document plans to resolve these issues. Unresolved issues that reappear in subsequent monthly reports must be commented on by the Laboratory Director/Manager.
- **Metrics:** The report also includes statistical results that are used to assess the effectiveness of the quality system. Effective quality systems are the responsibility of the entire laboratory staff. Each laboratory provides their results in a template provided by Corporate QA (Figure 17-2).

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The VP-QA/EHS prepares a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Analytical Division Senior Management Team and General Managers.

17.2 ANNUAL MANAGEMENT REVIEW

The senior lab management team (Laboratory Director, Operations Manager, Department Managers, and QA Manager) conducts an annual review of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. Corporate Operations and Corporate QA personnel may be included in this meeting at the discretion of the Laboratory Director/Manager. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that can not be solved by the lab and report them to Corporate IT.

This review uses information generated during the preceding year to assess the “big picture” by ensuring that routine quality actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review (refer to Section 17.1) should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior Senior Management team meetings. Issues that may be raised from these meetings include:
    - Adequacy of staff, equipment and facility resources.
    - Adequacy of policies and procedures.
    - Future plans for resources and testing capability and capacity.

- The annual internal double blind PT program sample performance (if performed),
- Review of the ACIL seal of excellence program performance.
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

The annual review includes the previous 12 months. Based on the annual review, a report is generated by the QA Manager and management. The report is distributed to the appropriate General Manager and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

The QA Manual is also reviewed at this time and revised to reflect any significant changes made to the quality systems.

17.3 POTENTIAL INTEGRITY RELATED MANAGERIAL REVIEWS

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. The Corporate Data Investigation/ Recall SOP shall be followed (SOP No. CA-L-S-001). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

The Chairman/CEO, President/CEO, COOs and Quality Directors receive a monthly report from the VP of Quality and EHS summarizing any current data integrity or data recall investigations as described in SOP No. CA-L-S-001. The General Manager's are also made aware of progress on these issues for their specific labs.

Figure 17-1.

Example - QA Monthly Report to Management

QUALITY REPORT TO MANAGEMENT

LABORATORY: TAL Denver
PERIOD COVERED: November 2007
PREPARED BY: QA Manager DATE: December 10, 2007
DISTRIBUTED TO: Corporate QA, Lab Director, Program Manager, Operations Manager

THREE KEY ISSUES FOR MONTH:
1. Working through QAM update, scheduled to be complete 12/15/07.
2. DOE acceptance of corrective action report received.
3. Owe Corporate Federal QA Manager limits/SOPs/MDLs for FUDS Contract.

1. METRICS
Data submitted for WP153 and soil study 60.

2. SOPs

Please see the SOP tracking database, and weekly QA % currency updates.

The following SOPs were finalized (or reviewed for accuracy):
Reviewed/Revised in October:

DV-OP-0013 Mutli-increment Sampling
DV-OP-0013 Multi-increment Sampling for Metals only
DV-GC-0020 Chlorinated Pesticides by 8081

2. CORRECTIVE ACTION

Highlights:
Received DOE acceptance for CAR

Revised Reports:
Please see the attached metrics.

Data Investigations/Recalls (Corporate Data Investigation/Recall SOP) :
none.

Client Feedback and Complaints:
1.) Several client complaints were received regarding TAT. Reduced TAT is occurring as lab backlog drops.
2.) The PM and lab received compliments from Mactec for performance on the DFC work.

4. MDLs AND CONTROL LIMITS

MDLs Due:
Please see the MDL tracking database and Denver QA HelpDesk Records.

# of MDLs in QA pending review/update:1
# of MDLs in QA being reviewed: 0

The GCMS lab is working on MDLs for APIX SVOC compounds.

CSLP MDLs are completed and will be turned in to QA this week.
Meeting was held with GC, GCMS, and Organic Extractions this week to prepare MDL schedule.

Control Limits Due:

5. AUDITS

INTERNAL AUDITS
Electronic Data back-up:

A CAPEX has been placed to replace computers that require removal of the drive for backup. The IT staff estimates a 30 day time frame for completion of the software program that will run each night and perform backups for LCMS and some of the other instruments currently requiring manual backup. This issue will be closed when that program is completed.

EXTERNAL AUDITS
Response for Navy audit due 12/13//07.

6. PT SAMPLES

The following PT samples are now in house (Due Dates):
WP153
Soils study #60

7. CERTIFICATIONS

Certification Packages Being Worked On (Include Due Date):
Arizona

Describe any issues, lapses, or potential revocations.

8. REGULATORY UPDATE
Lab still updating quotes and notifying clients of Method Update Rule (MUR) changes.

9. MISCELLANEOUS
On-time delivery is poor due to lab backlog. Average for the month ≈50%.

10. NEXT MONTH
The lab will be audited by Larry Penfold January 7-10.

LAB DIRECTOR COMMENTS AND PLANNED CORRECTIVE ACTIONS:
LAB DIRECTOR REVIEW: DATE:

Figure 17-2.

Example - Laboratory Metrics Categories

Reports for month
Reports revised due to lab error
% Revised Reports
# of Data Recall Investigations
# of Reports Actually Recalled
Corrective Action Reports
Corrective Action Reports still open
Total Number of Unresolved Open Corrective Action Reports
% of Unresolved Open Corrective Action Reports
# Reports independent QA reviewed
% QA Data Review: Reports
# Technical staff (Analysts/technicians, including Temps)
# of Analyst work product reviewed year-to-date
# of Analytical instruments w/electronic data file storage capability
# of Analytical instruments reviewed for data authenticity year-to-date
% Analyst/Instrument Data Authenticity Audits
 # Client Complaints
 # Client Compliments
# of planned internal audits
# of planned internal method audits performed year-to-date
% Annual Internal Audits Complete
# of Open Internal Audit Findings Past Due
Total Number of External Audit Findings
# of Open External Audit Findings Past Due
% External Audit Findings Past Due
# of PT analytes participated and received scores
# of PT analytes not acceptable
% PT Cumulative Score
 # PT Repeat Analyte Failures Cumulative **(analyte failed more than once in 4 consecutive studies by PT Type) (only applies to failed analytes)**
SOPs

SOPs Reviewed/revised within 24 months
Methods **or Administrative procedures** without approved SOPs
SOP Status
Method certification Losses due to performance/audit issues
Hold Time Violations due to lab error
Date of Last Comprehensive Ethics Training Session
 # Staff that haven't Received Comprehensive Ethics Training (>30 Days From Employment Date)
MDL Status (Good, Fair, or Poor) >90%, >70%, <70%
Training Documentation Records (Good, Fair, or Poor)
LQM Revision/review Date
QAM Updated to New Integrated Template
Last Annual Internal Audit Date (Opened, Closed)
Last Management QS Review Date
#SOPs required for 12 month review cycle (DOD *or drinking water)*
#SOPs for 12 month cycle/revised within 12 months *(Includes QS and Methods Listed in QSM)*
12 month % SOP Status *(Includes QS and Methods Listed in QSM)*

SECTION 18

PERSONNEL
(NELAC 5.5.2)

18.1 OVERVIEW

TestAmerica's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Appendix 2.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

18.2 EDUCATION AND EXPERIENCE REQUIREMENTS FOR TECHNICAL PERSONNEL

TestAmerica makes every effort to hire analytical staff that posses a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. There are competent analysts and technicians in the industry who have not earned a college degree. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are

located on the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, colony counting, aseptic or quantitation techniques, etc. are also considered).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
GFAA, CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience
Department Managers – **General**	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee
Department Manager – **Wet Chem** only (no advanced instrumentation)	Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry	And 2 years relevant experience

Specialty	Education	Experience
Department Manager – Microbiology	Bachelors degree in applied science with at least 16 semester hours in general microbiology and biology An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years of relevant experience

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Department Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

18.3 TRAINING

TestAmerica is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame*	Employee Type
Environmental Health & Safety – Initial Training	Prior to work in designated area	All
Environmental Health & Safety	Refer to EH&S Manual	All
Ethics – New Hires	1 week of hire	All
Ethics - Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	1 week of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 20.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 20).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics). This information is maintained in the employee's secured personnel file.

Further details of the laboratory's training program are described in the Laboratory Training SOP (DV-QA-0024).

18.4 DATA INTEGRITY AND ETHICS TRAINING PROGRAM

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established an Ethics Policy No. CA-L-P-001 and an Ethics Statement/Agreement (Appendix 1). All initial and annual training is documented by signature on the signed Ethics Policy and Code of Ethical Conduct demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy (Appendix 1)
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.

- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 19

ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS
(NELAC 5.5.3)

19.1 OVERVIEW

TestAmerica Denver is a 54,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc.. OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, and administrative functions.

19.2 ENVIRONMENT

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may effect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity, voltage, temperature, and vibration levels in the laboratory.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels (refer to Section 12).

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

The lab is equipped with a generator to maintain temperature on the sample refrigerators in the event of a power outage. The laboratory walk-in refrigerators are monitored around the clock and linked to an alarm system, which notifies the appropriate personnel of any temperature outages.

19.3 WORK AREAS

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Sample grinding and sample analytical areas.
- Organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.
- Waste disposal and sample/extract handling areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

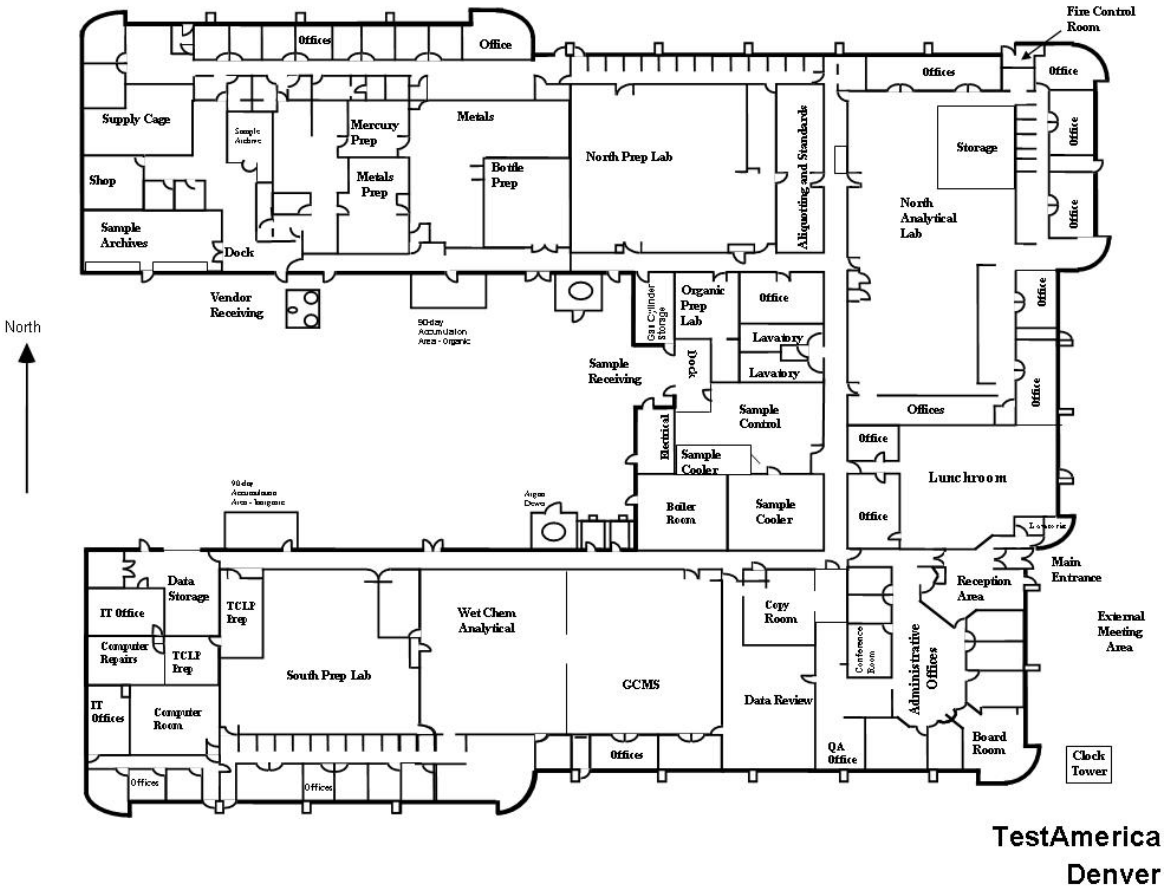
Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory.

Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

Refer to Standard Methods, 20th Ed., 9020B, Section 2 for specific requirements for microbiological laboratory facility requirements.

19.4 FLOOR PLAN



19.5 BUILDING SECURITY

Building security cards and alarm codes are distributed to employees as necessary.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of TestAmerica Denver. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed.

Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 20.0

TEST METHODS AND METHOD VALIDATION
(NELAC 5.5.4)

20.1 OVERVIEW

TestAmerica Denver uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

20.2 STANDARD OPERATING PROCEDURES (SOPs)

TestAmerica Denver maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory (refer to Section 6 on Document Control):

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for preparation, review, revision and control are incorporated by reference to SOPs: **CW-Q-S-002** (Writing a Standard Operating Procedure (SOP) and SOP DV-QA-001P.
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water and DoD SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

20.3 LABORATORY METHODS MANUAL

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP. Refer to the corporate SOP CW-Q-S-002 "Writing a Standard Operating Procedure" for content and requirements of technical and non-technical SOPs and DV-QA-001P, Preparation and Management of Standard Operating Procedure.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from

the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

20.4 SELECTION OF METHODS

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists, etc.), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

20.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

In general, TestAmerica Denver follows procedures from the referenced methods shown below in 20.4.1.1.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

20.4.1.1 The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM); Non-polar Material) by Extraction and Gravimetry, EPA-821-R-98-002, February 1999*
- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water. Revised as of July 1, 1995, Appendix A to Part 136 - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600 Series)*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*

- *Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992. Supplement III EPA/600/R-95/131 - August 1995 (EPA 500 Series) (EPA 500 Series methods)*
- *Technical Notes on Drinking Water Methods, EPA-600/R94-173, October 1994*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996.*
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

20.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

20.4.2.1 A demonstration of capability is performed whenever there is a change in instrument type, method or personnel.

20.4.2.2 The initial demonstration of capability must be thoroughly documented and approved by the Operations Manager and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures (refer to Section 15, Control of Records).

20.4.2.3 The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct a method detection limit study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method).
- The reporting limit is set at or above the first standard of the curve for the analyte.
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*
- Refer to Section 12 (Control of Non-Conforming Work).

20.4.3 Initial Demonstration of Capability (IDOC) Procedures

20.4.3.1 Refer to SOP DV-QA-0024, Employee Training.

A certification statement (see Figure 20-1 as an example) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

20.5 LABORATORY DEVELOPED METHODS AND NON-STANDARD METHODS

Any new method developed by the laboratory must be fully defined in an SOP/Methods Manual (Section 20.2) and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method. The information included in the checklist below (Figure 20-2) is needed before samples are accepted for analysis by a new method.

20.6 VALIDATION OF METHODS

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled. (From 2003 NELAC Standard)

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to

meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

20.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

20.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

20.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed. The laboratory determinations of MDLs are described in Section 20.6.

20.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum level at which both the presence of an analyte and its concentration can be reliably determined. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

20.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

20.6.1.5 Determination of Range

Where appropriate, a determination of the applicable range of the method may be performed. In most cases, range is determined and demonstrated by comparison of the response of an analyte in a curve to established or targeted criteria. The curve is used to establish the range of

quantitation and the lower and upper values of the curve represent upper and lower quantitation limits. Curves are not limited to linear relationships.

20.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

20.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

20.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in SOP DV-QA-0024, Employee Training. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

20.7 METHOD DETECTION LIMITS (MDL)/ LIMITS OF DETECTION (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value is not zero. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements (refer to 20.7.10). The analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. This low level standard may be analyzed every batch or every week or some other frequency rather than doing the study all at once. In addition, a larger number of data points may be used if the appropriate student t-value is used. TestAmerica Denver's SOP procedures are outlined in detail in SOP DV-QA-003P, Determination of Method Detection Limits for Chemical Tests.

20.7.1 METHOD DETECTION LIMITS (MDL)/ LIMITS OF DETECTION (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B. For details, refer to SOP DV-QA-003P, Determination of Method Detection Limits for Chemical Tests.

DL for reportiMDL's are initially performed for each individual instrument and non-microbiological method analysis. Unless there are requirements to the contrary, the laboratory will use the highest calculated MDL for all instruments used for a given method as the Mng purposes. This MDL is not required for methods that are not readily spiked (e.g. pH, turbidity,

etc.). Titration and gravimetric methods where there is no additional preparation involved, the MDL is based on the lowest discernable unit of measure that can be observed.

20.7.2 MDL's must be run against acceptable instrument QC, including ICV's and Tunes. This is to insure that the instrument is in proper working condition and falsely high or low MDL's are not calculated.

20.7.3 Use only clean matrix which is free of target analytes (e.g.: Laboratory reagent water, Ottawa Sand) unless a project specific MDL is required in a field sample matrix.

20.7.4 The Reporting Limit (also may be referred to as Limit of Quantitation or LOQ) should generally be between 2 and 5 times the MDL (see SOP DV-QA-024P for federal program requirements). If the MDL is being performed during method development, use this guideline to determine the Reporting Limit for the analysis. If a sample is diluted, the reported MDL is adjusted according to the dilution factor.

20.7.5 If the MDL is < 1/10 of the spike concentration for more than 10% of the analytes in the method (< 1/5 of spike recovered for DoD for water samples) the MDL must be repeated (including extraction or digestion) using a lower spike level unless the % recovery is < 50% or > 150% of the "true value". Note: The concentration of the spike will be at a level below the calibration range.

20.7.6 The calculated MDL cannot be not greater than the spike amount.

20.7.7 If the most recent calculated MDL does not permit qualitative identification of the analyte then the laboratory may use technical judgment for establishing the MDL (e.g., calculate what level would give a qualitative ID, compare with IDL (20.7), spike at a level where qualitative ID is determined and assign that value as MDL, minimum sensitivity requirements, Standard deviation of method blanks over time, etc.). Refer to SOP DV-QA-003P for details.

20.7.8 Each of the 7 spikes must be qualitatively identifiable (e.g., appear in both columns for dual column methods, characteristic ions for GCMS mass spectra, etc). Manual integrations to force the baseline for detection are not allowed.

20.7.9 The initial MDL is calculated as follows:

$$MDL = t_{(n-1,\ 1-a\ =\ 0.99)} \times (\text{Standard Deviation of replicates})$$

where $t_{(n-1,\ 1-a\ =\ 0.99)} = 3.143$ for seven replicates.

20.7.10 Subsequent to the initial MDL determination, periodic MDL verification, confirmation or determinations may be performed by the procedure in 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices (e.g., method blanks over time, single standard spikes that have been subjected to applicable sample prep processes, etc.). Refer to SOP DV-QA-003P for details.

20.7.11 Because of the inherent variability in results outside of the calibration range, TestAmerica does not recommend the reporting of results below the lowest calibration point in a curve; however, it is recognized that some projects and agencies require the reporting of results

below the RL. Any result that falls between the MDL and the Reporting limit, when reported, will be qualified as an estimated value.

20.7.12 Detections reported down to the MDL must be qualitatively identified.

20.7.13 MDLs and Reporting limits are adjusted in LIMs based on moisture content. Adjustments for sample aliquot size are made if the aliquot used is less than 80% or more than 120% of the standard aliquot, or if it is required for a given project.

20.8 INSTRUMENT DETECTION LIMITS (IDL)

20.8.1 The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

20.8.2 IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

20.8.3 If IDL is > than the MDL, it may be used as the reported MDL.

20.9 VERIFICATION OF DETECTION AND REPORTING LIMITS

20.9.1 Once an MDL is established, it must be verified, on each instrument, by analyzing a quality control sample (prepared as a sample) at approximately 2-3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, Atomic Absorption, etc.) and 1-4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified or see section 20.6.7 for other options. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL does not verify, then the lab will not report to the MDL, or redevelop their MDL or use the level where qualitative identification is established (See 20.6.7). MDLs must be verified at least annually (see SOP DV-QA-024P for federal program frequency requirements).

20.9.2 When a Reporting limit is established, it must be initially verified by the analysis of a low level standard or QC sample (LCS at 1-2 the reporting limit) and annually thereafter. Unless there are requirements to the contrary the acceptance criteria is $\pm$ 50%. The annual requirement is waved for methods that have an annually verified MDL.

20.10 RETENTION TIME WINDOWS

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method.

For GC, HPLC and IC methods, there must be sufficient separation between analyte peaks so as to not misidentify analytes. In the mid-level standard, the distance between the valley and peak height cannot be any less than 25% of the sum of the peak heights of the analytes. This also applies to GCMS in the case where the two compounds share the same quantitation ion.

Note: Some analytes do not separate sufficiently to be able to identify or quantitate them as separate analytes (e.g. m-xylene and p-xylene) and are quantitated and reported as a single analyte (e.g. m,p-xylenes).

Once the analyst has determined that the instrument is in optimum working condition through calibration and calibration verification procedures, he or she uses a mid-range calibration or calibration verification standard to establish the retention times for each of the individual analytes in a method. The analyst makes three injections of the same standard over a 72-hour (24 hr period for 300.0) period, tabulating the retention times for each analyte for each of the three injections. The width of retention time window is normally the average absolute retention time ± 3 Standard Deviations (see SOP DV-QA-024P for federal program requirements). A peak outside the retention time window will not be identified by the computer as a positive match of the analyte of interest.

It is possible for the statistically calculated RT window to be too tight and need to be adjusted based on analyst experience. In these instances method default retention time windows may be used (e.g., for 8000 series methods a default of 0.03 minutes may be used, and EPA CLP 0.05 minutes is used). The same concept is applied when any peak outside of that window will not be identified by the computer as a positive match.

The calibration verification standard at the beginning of a run may be used to adjust the RT for an analyte. This is essentially re-centering the window but the size of the window remains the same. The RTs are verified when all analytes are within their RT windows and are properly identified.

20.11 EVALUATION OF SELECTIVITY

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, spectrochemical, and specific electrode response factors.

20.12 ESTIMATION OF UNCERTAINTY OF MEASUREMENT

20.12.1 Uncertainty is “a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the analytical result” (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result’s validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an “expanded uncertainty”: the range within which the value of the result is believed to lie within at least a 95% confidence level with the coverage factor k=2.

20.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

20.12.3 The uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

20.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent a 99%-certain range for the reported result. As an example, suppose that the result reported is 1.0 mg/l, and the LCS percent recovery range is 50 to 150%. The uncertainty range would be 0.5 to 1.5 mg/l, which could also be written as 1.0 +/- 0.5 mg/l.

20.12.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g. 524.2, 525, etc) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

20.13 CONTROL OF DATA

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

20.13.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. More detail is outlined in SOPs P-I-006, Virus Protection Policy, P-I-008, internet Security Policy, and P-I-003 Computer Systems Account and Naming Policy. The laboratory is currently running Quantims which is a custom in-house developed LIMS system that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS for the remainder of this section. The LIMS utilizes IBM DB-2 which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

20.13.1.1 **Maintain the Database Integrity:** Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use.

  Note: "Commercial off-the-shelf software in use within the designed application range is considered to be sufficiently validated." *From NELAC 2003 Standard.* However, laboratory specific configurations or modifications are validated prior to use.

- In order to assure accuracy, all data entered or transferred into the LIMS data system goes through a minimum of two levels of review.
- The QA department performs random data audits to ensure the correct information has been reported.
- Changes to reports are documented in a Non-Conformance Memo. Details are specified in SOP DV-QA-019P, Result and Report Revisions.

- Analytical data file security is provided through three policies.
  - The first policy forbids unauthorized personnel from using laboratory data acquisition computers.
  - The second policy is the implementation of network passwords and login names that restrict directory access.
  - The third layer is maintained through the LIMS and includes the use of username/password combinations to gain access to the LIMS system, the fact that all data in the LIMS is associated with the user to added/reviewed the data, and the restriction of review authority of data.
- All software installations will be in accordance with any relevant copyright licensing regulations.
- All software installed on any computer within the laboratory must be approved by the Information Technology Department regional support technician assigned to the laboratory. Shrink-wrapped or otherwise sealed OEM software that is directly related to instrument usage does not need approval but the Information Technology department must be notified of the installation.
- Anti-virus software shall be installed on all servers and workstations. The anti-virus software shall be configured to check for virus signature file and program updates on a daily basis and these updates will be pushed to all servers and workstations. The anti-virus software will be configured to clean any virus-infected file if possible, otherwise the file will be deleted. Disks and CDs brought from any outside source that are not OEM software must be scanned for viruses before being accessed.

- **Interlab LIMS Permissions Policy**
  - PURPOSE - The purpose of this policy is to provide a mechanism for maintaining the integrity of information contained in each laboratory's LIMS while providing the necessary access for information sharing to staff at other laboratory facilities.
  - DEFINITIONS - Host Laboratory: The laboratory facility that 'owns' the LIMS system or 'hosts' a project/job.
  - POLICIES
    (a) All permissions for the laboratory's LIMS system must only be granted by a representative of that laboratory.

- If someone outside of the host lab needs permissions for Project Management or other uses, they must go through the Lab Director or his/her designated representative.
- Permissions must never be granted without the knowledge of the host laboratory.

(b) Only laboratory analytical or QA staff from the home laboratory may have edit permissions for laboratory analysis data.

(c) Any changes made in laboratory's LIMS system:

- Must be documented and traceable.
- If made by staff of an affiliate lab, written permission from the home lab to make the changes (email approval is sufficient) is required.
- No corrections may be made in another laboratories system without their knowledge.

(d) Data qualifiers in laboratory reports must only be corrected, edited, etc. by the staff at the host laboratory.

(e) Full analytical data "View" only permissions may be granted to outside Project Management and Sales staff. ~~Query~~ Search permissions may also be granted so status may be checked.

(f) All qualifiers must be approved by QA staff before adding to standard reference tables. In addition, changes to qualifiers in the LIMS master list must be approved by corporate QA.

20.13.1.2 **Ensure Information Availability:** Protection against loss of information or service through scheduled back-ups, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

- Insured by timely backup procedures on reliable backup media, stable file server network architecture, and UPS protection
- UPS Protection: Each fileserver is protected by an appropriate power protection/backup unit. In the event of a power outage, there is approximately 15-30 minutes of up-time for the servers prior to shutdown. This allows for proper shutdown procedures to be followed with the fileservers.
- File Server Architecture
  - All files are maintained on multiple Windows 2000 or newer servers which are secured physically in the Information Technology office. Access to these servers is limited to members of the Information Technology staff.
  - All supporting software is maintained for at least 5 years from the last raw data generated using that software. [Length of time is dependent on local regulations or client requirements (e.g., OVAP requires 10 years).]
- System Back-up Overview and Procedures
  - Data from both servers and instrument attached PC's are backed up and purged in compliance with the corporate back-up policy.
  - A Maintenance Plan has been defined to create a daily archive of all data within the LIMS database to a backup location. This backup is initiated automatically by either the database or back-up system.

- Backup tapes will be stored in compliance with the corporate Data Backup Policy. Backup verifications are carried out in accordance with the corporate Data Backup Policy.
- Instrument data back-ups are verified on a periodic basis by the QA department when performing electronic data audits. The audit takes place on data that has been moved to a back-up location ensuring that it has been moved. Refer to SOP DV-QA-025P, Electronic Data Backup.

20.13.1.3 Maintain Confidentiality: Ensure data confidentiality through physical access controls, and encryption of when electronically transmitting data.

- All servers are located in a secure area of the IT department offices. Access to the servers is limited to IT staff members, lab directors, the President and Vice President of Operations. Individuals with access at TestAmerica Denver are: Wendlee Fischler, Michael Sara, Mark Dean, Damien Kaaz, Conner Sargent, Stephen Madrid, Jeff Woodruff, Nathan Mead, and Joanne Thomas.
- The company website contains SSL (Secure Socket Layer) encryption for secure website sessions and data transfers.
- The reporting portion of the LIMS system requires a project manager to enter their unique password anytime they create a report that displays a signature on it (.PDF).
- Electronic documents such as PDF files and electronic data deliverables will be made available to clients via the secure web site. The logon page for this web site contains an agreement that the customer must accept before they will be logged on which states that the customer agrees not to alter any electronic data made available to them.

20.13.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values. Details for data review at TestAmerica Denver are defined in SOP DV-QA-0020, Data Review.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then entry into the LIMS is verified by the second level reviewer. The review checklists are signed by both the analyst and second level reviewer to confirm the accuracy of the manual entry(s) as well as review the data for technical accuracy. Refer to SOP DV-QA-0020, Data Review for details of the review process.

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP CA-Q-S-002, Acceptable Manual Integration Practices and TestAmerica Denver SOP DV-QA-0033.

Analytical results are reduced to appropriate concentration units specified by the PM in LIMS, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by second level review staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

20.13.2.1 All raw data must be retained in the batch folder and computer file (if appropriate). All information pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed and initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

20.13.2.2 In general, concentration results are reported in milligrams per liter (mg/L) or micrograms per liter (µg/L) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/Kg) for solids. The units "mg/L" and "mg/kg" are the same as "parts per million (ppm)". The units "µg/L" and "µg/kg" are the same as "parts per billion (ppb)." Some low level methods utilized primarily for aqueous samples are reported in "ng/L", which are the same as "parts per trillion" (ppt). For values greater than 10,000 mg/L, results can be reported in percent, i.e., 10,000 mg/L = 1%.

- Several environmental methods, such as color, turbidity, conductivity, use very specific, non-concentration units to report results (e.g., NTU, umhos/cm etc).
- Occasionally, the client requests that results be reported in units which take into account the measured flow of water or air during the collection of the sample. When they provide this information, the calculations can be performed and reported.

20.13.2.3 Refer to SOP DV-QA-004P, Rounding and Significant Figures for details regarding the number of significant figures to report for each step in the process.

20.13.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

20.13.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument's printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained with the data file. The data file is stored in a monthly folder on the instrument computer; periodically, this file is transferred to the server and, eventually, to a tape file.

20.13.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 13.

- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be "Z"'d out, signed and dated.
- Worksheets are created with the approval of the Department Manager/QA Manager at the facility. The QA Department controls all worksheets following the procedures in Section 6.

20.13.4 Review / Verification Procedures

Review procedures are out lined in several SOPs (DV-QA-0003, Sample Management and Chain of Custody, DV-QA-0020, Data Review, and DV-QA-0022, Package Assembly), to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory also has an SOP discussing Manual Integrations to ensure the authenticity of the data, SOP DV-QA-0033, Acceptable Manual Integration Practices. The general review concepts are discussed below, more specific information can be found in the SOPs.

20.13.4.1 The data review process at TestAmerica Denver starts at the Sample Control level. Sample Control personnel review chain-of-custody forms and input the sample information and required analyses into a computer LIMS. The Sample Control Supervisor reviews the transaction of the chain-of-custody forms and the inputted information. The Project Managers perform final review of the chain-of-custody forms and inputted information. Refer to SOP DV-QA-0003.

20.13.4.2 The next level of data review occurs with the Analysts. As results are generated, analysts review their work to ensure that the results generated meet QC requirements and relevant EPA methodologies. The Analysts transfer the data into the LIMS and add data qualifiers if applicable (see Appendix 7 for list of common data qualifiers). To ensure data compliance, a different analyst performs a second level of review. Second level review is accomplished by checking reported results against raw data and evaluating the results for accuracy. During the second level review, blank runs, QA/QC check results, continuing calibration results, laboratory control samples, sample data, qualifiers and spike information are evaluated. TestAmerica Denver performs second level review on all batches, verifying 100% of data manually entered into LIMS and at least 10% of data that is automatically uploaded to the LIMS. Manual integrations are also electronically reviewed utilizing auditing software to help ensure compliance to ethics and manual integration policies. Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration

- Transcription errors
- Results outside of calibration range

20.13.4.3 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Assurance Manager, Technical Manager, or Department Manager for further investigation. Corrective action is initiated whenever necessary. SOP DV-QA-018P, *Repeat Analysis and Reporting* provides detail on this process.

20.13.4.4 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

20.13.4.5 As a final review prior to the release of the report, the Project Manager reviews the report for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that chemical relationships are evaluated, COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met. The following are some examples of chemical relationships that are reviewed (if data is available):

- Total Results are ≥ Dissolved results (e.g. metals)
- Total Solids (TS) ≥ TDS or TSS
- TKN ≥ Ammonia
- TKN ≥ total organic nitrogen
- TKN = ammonia + total organic nitrogen
- Total Phosphorus ≥ Orthophosphate
- COD ≥ TOC
- Total cyanide ≥ Amenable Cyanide
- TDS ≥ individual anions
- TDS ≥ total alkalinity
- TDS ≥ hardness
- Hexavalent chromium ≤ total chromium

20.13.4.6 Some federal programs require independent review of a percentage of the report packages by the QA Department (see SOP DV-QA-024P). The Project Manager then signs the final report. (*Also see section 26 on Reporting Results*). When complete, the report is sent out to the client.

20.13.4.7 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 20-3.

20.13.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using SOP CA-Q-S-002 and SOP DV-QA-0033, *Acceptable Manual Integration* Practices as the guidelines**.**

20.13.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

20.13.5.2 Analysts shall not increase or decrease peak areas to for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principals and policy and is grounds for immediate termination.

20.13.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

20.13.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale “after” chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale “before” chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 20-1. Example - Demonstration of Capability

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Analyst Demonstration of Capability

Certification Statement

8270C-SIM *- 8270C-SIM*
SOP:
Matrix: Water

Date: 11-Dec-07

STL - Denver laboratory
4955 Yarrow Street
Arvada, CO 80002
(303) 736-0100

We, the undersigned, CERTIFY that:

1. The analyst identified above, using the cited test method with the specifications in the cited SOP, which is in use at this facility for the analysis of samples under the TestAmerica Quality Assurance Plan, has met the Initial or Ongoing Demonstration of Capability.

2. The test method was performed by the analyst identified on this certification following the TestAmerica SOP

3. A copy of the laboratory-specific SOP is available for all personnel on-site.

4. The data associated with the initial/ongoing demonstration of capability are true, accurate, complete and self-explanatory (*). These data are attached to this certification statement.

5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized inspectors.

Comments/Observations:

Analyst's Name	Signature	Date
Technical Director's Name	Signature	Date
QA Manager's Name	Signature	Date

* *True: Consistent with supporting data.*
Accurate: Based on good laboratory practices consistent with sound scientific principles/practices..
Complete: Includes the results of all supporting performance testing.
Self-explanatory: Data properly labeled and stored so that the results are traceable and require no additional explanation.

12/11/2007 *Page 1 of 4*

Figure 20-2.

Example - New Method / Additional Analyte Checklist

New Method / Additional Analyte Checklist

The following items are **required** to be completed prior to the acceptance of client samples. Fill in any blanks that do not apply with "NA". Provide associated instrument QC when samples or QC samples are analyzed (includes run log).

New Method _____ Added Analytes _____

1_____ Standard Operating Procedure

- Note: For additional analytes, a **ROMD [or whatever an internal communication memo is named in your lab]** can be used to add the analytes, include RL and matrix.
  - _____ Analysis SOP
  - _____ Preparation SOP
  - _____ SOP for any other relevant process
  - _____ Pages from any applicable logbooks (instrument, standards, etc)

2_____Evaluation of Selectivity. As applicable: e.g. Retention Time Window Study, second column confirmation, Interelement correction checks, spectral or fluorescence profiles, etc.

3_____ Initial Calibration Curve (Include Tune verification or similar (e.g. degradation checks) if applicable)

4_____ Method Detection Limit (MDL) Study (summary and raw data)

- _____ Water
- _____ Soil
- _____ Other

5_____ Real Sample and MS, MSD ***(CA ELAP Requirement)***

- Tap Water for water only methods
- Local Soil sample for SW-846 methods (if applying for soil or soil/water)
- Local water sample may be used in lieu of tap water if it is a non- drinking water method
- Does not have to contain the target analytes

6_____ Reporting Limit Verification standard

- Spike a blank matrix at the RL and process through the entire method. MDL study should be able to be used if recovery is good. Note the spike level(s) and recovery(~~y~~ies)

7_____ Demonstration of Capability (DOC) per analyst (Precision and Accuracy (P&A) verification)

- 4 LCS for each matrix – most acceptance criteria are in the methods. The MDL study may be used if DOC criteria are met.
- Non-Standard methods – 3 x (1 LCS at LOQ-25%, 50%, 75% of the calibration range + Blank) prepared each day. (see NELAC Chpt 5, appendix C.3.3 (b))

8_____ Acceptable PT sample(s) if available

Notes: PT sample required for all new methods
PT sample required for all new analytes under NELAP

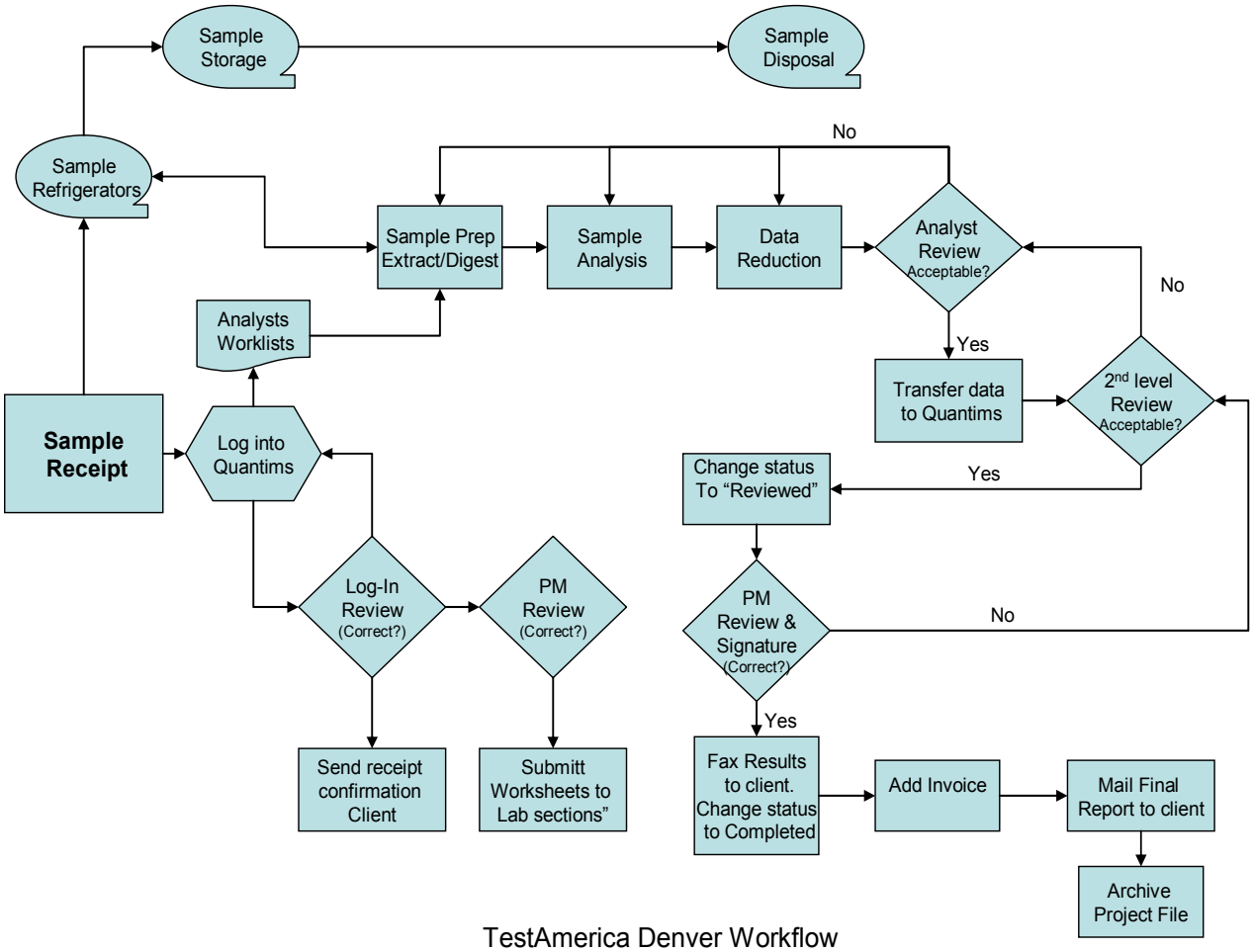
Submitted by _____ Date _____

9_____ Certification/Approval from Regulatory Agency where available.

QA Review / Acceptance _____ Date _____

Figure 20-3.

Work Flow



TestAmerica Denver Workflow

SECTION 21

EQUIPMENT (AND CALIBRATIONS)
(NELAC 5.5.5)

21.1 OVERVIEW

TestAmerica purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory method SOPs, in SOP DV-QA-024P for federal programs, and in Appendix 4. A list of laboratory equipment and instrumentation is presented in Table 21-1.

Equipment is only operated by authorized and trained personnel. Manufacturers instructions for equipment use are readily accessible to all appropriate laboratory personnel.

21.2 PREVENTIVE MAINTENANCE

21.2.1 TestAmerica Denver follows a well-defined program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

21.2.2 Routine preventive maintenance procedures and frequency, such as lubrication, cleaning, and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

21.2.2.1 Calibrations, routine maintenance, and adjustments are part of the analysts' and Department Managers' responsibilities. However, service contracts may be in place for some instruments to cover any major repairs.

21.2.2.2 High purity gases, reagents, and spare parts are kept on hand to minimize repair time and optimize instrument performance.

21.2.3 Table 21-2 summarizes the schedule for routine maintenance. It is the responsibility of each Department Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may also be outlined in analytical SOPs or instrument manuals. (Note: for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

21.2.4 Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all

major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

21.2.4.1 Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.

21.2.4.2 Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.).

21.2.4.3 When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

21.2.5 In addition, the maintenance records contain:

- The identification of the instrument/equipment **(**instrument's Serial Number and Model Number)
- The date the instrument/equipment was put into use.
- If available, the condition when the instrument was received (e.g. new, used, reconditioned).
- Required maintenance is listed in the maintenance logbooks, as well as any maintenance performed.

21.2.6 If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out of service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses (refer to Sections 12 and 13).

21.2.7 In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted using the procedures outlined in Section 8.

If an instrument is sent out for service or transferred to another facility, it must be recalibrated and verified (including new initial MDL study) prior to return to lab operations.

21.3 SUPPORT EQUIPMENT

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, field sampling devices, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

21.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least annually by an outside calibration laboratory to NIST standards.

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file. Refer to SOP DV-QA-0014, *Balance Calibration Check*.

21.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to $\pm$ 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

21.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer. IR thermometers, electronic thermometers, digital probes and thermocouples are calibrated quarterly refer to SOP DV-QA-0001, *Thermometer Calibration Procedure*.

The NIST thermometer is recalibrated every five years (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer has increments of 0.2 ºC, and has a range applicable to all method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logbooks. More information on this subject can be found in SOP DV-QA-0001, *Thermometer Calibration Procedure.*

21.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day on a continual basis. Refer to SOP DV-QA-0012, *Monitoring Refrigerator Temperature and Power Failure Contingency Plan.*

Ovens, waterbaths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks posted on or near the device.

21.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware) are checked for accuracy at least quarterly.

The laboratory maintains a sufficient inventory of autopipettors, and dilutors of differing capacities that fulfill all method requirements.

These devices are given unique identification numbers, and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis. Any device not regularly verified can not be used for any quantitative measurements. Refer to SOP DV-QA-0008, *Calibration and Verification of Mechnical Pipettes.*

21.3.6 Autoclaves

TestAmerica Denver uses an autoclave for sterilization of microbiological equipment and used media only. All information regarding the autoclave is maintained in the Autoclave, Coliform lot,

and Monthly check logbook. The information recorded includes the date, contents, maximum temperature, total run time and the analyst's initials.

Demonstration of sterilization of the autoclave is performed each time of use with a Diack sterilization monitor, a maximum reading thermometer, and temperature sensitive tape. On a monthly basis, spore strips are used for the determination of effective sterilization.

The autoclaves timing device is checked on a monthly basis against a clock/watch and the actual time elapsed is documented.

Any maintenance that is performed on the autoclave (internally or by service contract) is recorded in the maintenance section of the check logbook.

21.4 INSTRUMENT CALIBRATIONS

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.
If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 13).

Note: Instruments are calibrated initially and as needed after that and at least annually.

21.4.1 CALIBRATION STANDARDS

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. However, the general procedures are described below.

21.4.1.1 For each analyte and surrogate (if applicable) of interest, prepare calibration standards at the minimum number of concentrations as stated in the analytical methods. If a reference or mandated method does not specify the number of calibration standards, the minimum number is three, not including blanks or a zero standard. All of the standard solutions are prepared using Class A volumetric

glassware, calibrated pipettes, and/or microsyringes and appropriate laboratory quality solvents and stock standards.

21.4.1.2 Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to NIST whenever possible. Dilution standards are prepared from stock standards purchased from commercial suppliers. TestAmerica Denver uses Veritas Standards Log software for standards tracking. It is maintained for each department, containing concentration, date of receipt, date of standard preparation, any dilutions made, lot number, supplier, type of solvent and a unique code number to identify the standard.

21.4.1.3 The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

21.4.1.4 The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to 3 significant figures) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The lowest calibration standard must be at or below the reporting limit.

21.4.1.5 Given the number of target compounds addressed by some of the organic methods, it may be necessary to prepare several sets of calibration standards, each set consisting of the appropriate number of solutions at different concentrations. The initial calibration will then involve the analysis of each of these sets of the appropriate number of standards.

21.4.1.6 All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, such as Disodium Iminodiacetate (IDA) analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

21.4.2 CALIBRATION FOR ORGANIC METHODS (GC, HPLC, GC/MS)

21.4.2.1 Many of the organic analytical methods utilize an internal standard calibration (GCMS and some GC). Because of the complex nature of the multipeak chromatograms produced by the method, some instruments necessitate the use of external standard calibration (most GC and HPLC). Surrogate compounds are included in the calibration processes for all appropriate organic analyses. For more details on the calibration types listed below, refer to SOP No. CA-Q-S-005, Calibration Curves.

21.4.2.2 Once the operating parameters have been established according to the method, each instrument is calibrated for the appropriate method. The analyst prepares five or more standard solutions at various concentrations containing all of the analytes of interest, internal standards, and surrogates that are appropriate for the method. Note: There are a several EPA methods that have different requirements and are exceptions (e.g. EPA 547) where a minimum of 3 calibration standards are prepared and analyzed.

21.4.2.3 The standard solutions are introduced into the instrument in the same manner as samples are; whether it be by direct injection, by headspace analysis, or by purge and trap. The calibration factor (CF) for methods that use external standards, and the response factor (RF) for methods that use internal standards are calculated for the five standards.

- External standard calibration involves comparison of instrument responses from the sample to the responses from the target compounds in the calibration standards. Sample peak areas (or peak heights) are compared to peak areas (or heights) of the standards. The ratio of the response to the amount of analyte in the calibration standard is defined as the Calibration factor (CF).

- Internal standard calibration involves the comparison of instrument responses from the target compounds in the sample to the responses of specific standards added to the sample or sample extract prior to injection. The ratio of the peak area (or height) of the target compound in the sample or sample extract to the peak area (or height) of the internal standard in the sample or sample extract is compared to a similar ratio derived for each calibration standard. The ratio is termed the response factor (RF), and may also be known as a relative response factor in other methods.

In many cases, internal standards are recommended. These recommended internal standards are often brominated, fluorinated, or stable isotopically labeled analogs of specific target compounds, or are closely related compounds whose presence in environmental samples is highly unlikely. The use of specific internal standards is available in the method SOP.

Whichever internal standards are employed, the analyst needs to demonstrate that the measurement of the internal standard is not affected by method analytes and surrogates or by matrix interferences. In general, internal standard calibration is not as useful for GC and HPLC methods with non-MS detectors because of the inability to chromatographically resolve many internal standards from the target compounds. The use of MS detectors makes internal standard calibration practical because the masses of the internal standards can be resolved from those of the target compounds even when chromatographic resolution cannot be achieved.

When preparing calibration standards for use with internal standard calibration, add the same amount of the internal standard solution to each calibration standard, such that the concentration of each internal standard is constant across all of the calibration standards, whereas the concentrations of the target analytes will vary. The internal standard solution will contain one or more internal standards and the concentration of the individual internal standards may differ within the spiking solution (e.g., not all internal standards need to be at the same concentration in this solution). The mass of each internal standard added to each sample extract immediately prior to injection into the instrument or to each sample prior to purging must be the same as the mass of the internal standard in each calibration standard. The volume of

the solution spiked into sample extracts should be such that minimal dilution of the extract occurs (e.g., 10 uL of solution added to a 1 mL final extract results in only a negligible 1% change in the final extract volume which can be ignored in the calculations).

An ideal internal standard concentration would yield a response factor of 1 for each analyte. However, this is not practical when dealing with more than a few target analytes. Therefore, as a general rule, the amount of internal standard should produce an instrument response (e.g., area counts) that is no more than 100 times that produced by the lowest concentration of the least responsive target analyte associated with the internal standard. This should result in a minimum response factor of approximately 0.01 for the least responsive target compound. Refer to SOP No. CA-Q-S-005, Calibration Curves, for specific calculations.

21.4.2.4 Policies regarding the use of calibration standard results for creating the calibration curve are as follows:

- A low calibration standard may be excluded from the calibration if the signal-to-noise ratio or spectral criteria are not suitable. The reporting level must be elevated to be the lowest calibration standard used for calibration.

- The upper calibration standard may be excluded if it saturates the detector or is obviously becoming non-linear. Any sample exceeding the upper standard used in the calibration must be diluted and re-analyzed.
- Mid-calibration standards may not be excluded unless an obvious reason is found, i.e., cracked vial, incorrectly made, etc. The failed standard should be re-run immediately and inserted into the initial calibration. If not useful, recalibration is required.

21.4.2.5 Percent RSD Corrective Action

Given the potentially large numbers of analytes that may be analyzed in some methods, it is likely that some analytes may exceed the acceptance limit for the RSD for a given calibration. In those instances, the following steps are recommended, but not required.

21.4.2.5.1 The first step is generally to check the instrument operating conditions. This option will apply in those instances where a linear instrument response is expected. It may involve some trade-offs to optimize performance across all target analytes. For instance, changes to the operating conditions necessary to achieve linearity for problem compounds may cause the RSD for other compounds to increase, but as long as all analytes meet the RSD limits for linearity, the calibration is acceptable.

21.4.2.5.2 If the RSD for any analyte is greater than the acceptance criteria in the applicable analytical method or SOP, the analyst may wish to review the results (area counts, calibration or response factors, and RSD) for those analytes to ensure that the problem is not associated with just one of the initial calibration standards. If the problem appears to be associated with a single standard, that one standard may be reanalyzed and the RSD recalculated. Replacing the standard may be necessary in some cases.

21.4.2.5.3 A third alternative is to narrow the calibration range by replacing one or more of the calibration standards with standards that cover a narrower range. If linearity can be achieved using a narrower calibration range, document the calibration linearity, and proceed with analyses. The changes to the upper end of the calibration range will affect the need to dilute samples above the range, while changes to the lower end will affect the overall sensitivity of the method. Consider the regulatory limits or action levels associated with the target analytes when adjusting the lower end of the range.

Note: When the purpose of the analysis is to demonstrate compliance with a specific regulatory limit or action level, the laboratory must ensure that the method quantitation limit is at least as low as the regulatory limit or action level.

21.4.2.6 Alternatively, the least squares regression may be used to determine linearity. A five point line must result in a correlation coefficient (r) of 0.990 or better using the least squares method to be considered acceptable. In many cases it may be preferred that the curves be forced through zero (not to be confused with including the origin as an additional data point, which is not allowed). See SOP DV-QA-024P for requirements for federal programs.

Note: EPA method 8000B does not allow forcing through zero however the agency has revaluated this position and has since changed this stance to allow forcing through zero. In addition, from EPA Method 8000C: "However, the use of a linear regression or forcing the regression through zero may NOT be used as a rationale for reporting results below the calibration range demonstrated by the analysis of the standards.").

21.4.2.7 Instead of a linear curve model (either Average RF or least squares regression), a second order curve (Quadratic) may be used (and preferred) as long as it contains at least six data points. As a rule of thumb, if there is a consistent trend in RFs (or CFs) in the calibration curve, either up or down, then quadratic curve fit may be indicated as the preferred calibration routine for that analyte. The coefficient of determination (COD or r^2) for the quadratic curve must be at least 0.99 for it to be considered acceptable. For more details on the calculations see Calibration Curve SOP CA-Q-S-005. Some limitations on the use of Quadratic Curve fits:

21.4.2.7.1 Care MUST be exercised to assure that the results from this equation are real, positive, and fit the range of the initial calibration.

21.4.2.7.2 They **may not** be used to mask instrument problems that can be corrected by maintenance. (Not to be used where the analyte is normally found to be linear in a properly maintained instrument).

21.4.2.7.3 They **may not** be used to compensate for detector saturation. If it is suspected that the detector is being saturated at the high end of the curve, remove the higher concentration standards from the curve and try a 1^{st} order fit or average RF.

21.4.3 Calibration for Inorganic Analyses

EPA Method 7000 from EPA SW-846 is a general introduction to the quality control requirements for metals analysis. For inorganic methods, quality control measures set out in the individual methods and in the *Standard Methods for the Examination of Water and Wastewater* (20th Edition) may also be included. Standard Operating Procedures for the analysis and the quality control documentation measures are kept in the analyst group's reference binders, as well as posted on the network at L:\QA\Read\SOPs\ESOPs.

In general, inorganic instrumentation is calibrated with external standards. Some exceptions would be Inductively Coupled Plasma (ICP), Inductively Coupled Plasma Mass Spec (ICPMS), and Ion Chromatography Mass Spec (ICMS). These analyses may use an internal standard to compensate for viscosity or other matrix effects. While the calibration procedures are much the same for inorganics as they are for organics, CF's or RF's are not used. The calibration model in 21.4.2.6 is generally used for most methods, however in some instances the model from section 21.4.2.7 may be used. A correlation coefficient (r) of 0.995 or greater must be used to accept a calibration curve generated for an inorganic procedure. Correlation coefficients are determined by hand-held scientific calculators or by computer programs and documented as part of the calibration raw data. Coefficients of calibration curves used for quantitation must be documented as part of the raw data. Curves are not allowed to be stored in calculator memories and must be written on the raw data for the purposes of data validation.

21.4.3.1 "Calibrations" for titrimetric analyses are performed by standardizing the titrants against a primary standard solution. See specific methods in *Standard Methods for the Examination of Water and Wastewater* (20th Edition) for more information.

21.4.3.2 Spreadsheets that are used for general chemistry calculations must have all cells containing calculations locked to prevent accidental changes to the calculations.

21.4.3.3 Instrument technologies (e.g. ICP) with validated techniques from the instrument manufacturer or other methods using a zero point and single point calibration require the following:

21.4.3.3.1 The instrument is calibrated using a zero point and a single point calibration standard.

21.4.3.3.2 The linear range is established by analyzing a series of standards, one at the reporting limit (RL).

21.4.3.3.3 Sample results within the established linear range do not need to be qualified.

21.4.3.3.4 The zero point and single standard is run daily with each analytical batch.

21.4.3.3.5 A standard at the RL is analyzed daily with each analytical batch and must meet established acceptance criteria.

21.4.3.3.6 The linearity is verified at a frequency established by the manufacturer or method. See SOP DV-MT-0012, *ICP Analysis for Trace Metals by Methods 6010 and 200.7.*

21.4.4 Calibration Verification

The calibration relationship established during the initial calibration must be verified at periodic intervals as specified in the laboratory method SOPs in accordance with the referenced analytical methods and NELAC (2003) standard, Section 5.5.5.10. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models.

Note: The process of calibration verification referred to is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration, and is not appropriate nor permitted in SW-846 chromatographic procedures for trace environmental analyses.

21.4.4.1 Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample or standard that can be injected within 12 hours of the beginning of the shift.

21.4.4.2 A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements see specific SOPs. Most Inorganic methods require the CCV to be analyzed after ever 10 samples.

21.4.4.3 The acceptance limits for calibration verifications can be found in each method SOP. As a rule of thumb: GCMS $\pm$ 20%, GC and HPLC $\pm$ 15%, Inorganics: $\pm$ 10 or 15%. Actual methods may have wider or tighter limits; see the method SOP for specifics.

21.4.4.4 If the response (or calculated concentration) for an analyte is within the acceptance limits of the response obtained during the initial calibration, then the initial calibration is considered still valid, and the analyst may continue to use the CF, RF or % drift values from the initial calibration to quantitate sample results.

21.4.4.5 If the response (or calculated concentration) for any analyte varies from the mean response obtained during the initial calibration by more than the acceptance criteria, then the initial calibration relationship may no longer be valid. If routine corrective action procedures fail to produce a second consecutive (immediate) calibration verification within acceptance criteria, then either the laboratory has to demonstrate performance after corrective action with two consecutive successful calibration verifications, or a new initial instrument calibration must be performed. However, sample data associated with an unacceptable calibration verification may be reported as qualified data under the following special conditions:

21.4.4.5.1 When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the

unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

21.4.4.5.2 When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, for some methods a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit specific details for utilizing this option are described in SOP DV-QA-27P, *Standardized CCV Criteria for GC and HPLC.*

21.4.4.6 Verification of Linear Calibrations

Calibration verification for linear calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. Use the equations below to calculate % Drift or % Difference, depending on the procedure specified in the method SOP. Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

The Percent Difference is calculated as follows:

$$\% \text{ Difference} = \frac{(CF(v) \text{ or } RF(v)) - (\text{Avg. CF or RF})}{(\text{Avg. CF or RF})} \times 100$$

Where: CF(v) or RF(v) = CF or RF from verification standard

Avg. CF or RF = Average CF or RF from Initial Calibration.

The Percent Drift is calculated as follows:

$$\% \text{ Drift} = \frac{\text{Result} - \text{True Value}}{\text{True Value}} \times 100$$

The Percent Recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{\text{Result}}{\text{True Value}} \times 100$$

21.4.4.7 Verification of a Non-Linear Calibration

Calibration verification of a non-linear calibration is performed using the percent drift or percent recovery calculations described in 21.4.4.6 above.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

21.5 POLICY ON TENTATIVELY IDENTIFIED COMPOUNDS (TICS) – GC/MS ANALYSIS

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it will not be reported as a TIC. If the compound is reported on the same form as true TICs, it must be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

21.5.1 Use the following guidelines for making tentative identifications

21.5.1.1 Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.

21.5.1.2 The relative intensities of the major ions should agree within ± 20%. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30 and 70%).

21.5.1.3 Molecular ions present in the reference spectrum should be present in the sample spectrum.

21.5.1.4 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

21.5.1.5 Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or coeluting peaks. Data system library reduction programs can sometimes create these discrepancies.

The concentration of any non-target analytes identified in the sample (see above) should be estimated. The same formulae as calibrated analytes should be used with the following modifications: The areas A_x and A_{is} should be from the total ion chromatograms, and the RF for the compound should be assumed to be 1.

The resulting concentration should be reported indicating: (1) that the value is an estimate, and (2) which internal standard was used to determine concentration. Use the nearest internal standard free of interferences.

Note: The above guidelines above are from EPA SW846 III edition, method 8260B.
For general reporting if TICs are requested, the ten (10), largest non-target analyte peaks whose area count exceeds 10% of the nearest internal standard will be termed “Tentatively Identified Compounds” (TICs). More or fewer TICs may be identified based on client requirements.

21.5.2 TIC Reporting Limits

In general Reporting limits cannot be specified because of the unknown nature of the TIC. Any reporting limit that is reported can only be evaluated as an estimate as the quantitation is based on the assumption that the TIC responds exactly as the IS responds which is most likely not the case. In general, it is not recommended to set a Reporting limit at too low of a concentration as it gives a false impression.

21.6 POLICY ON GC/MS TUNING

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

21.6.1 The concentration of the BFB or DFTPP must be at or below the concentrations that are referenced in the analytical methods. Part of the purpose of the tune is to demonstrate

sensitivity and analyzing solutions at higher concentrations does not support this purpose. Tune failures may be due to saturation and a lower BFB/DFTPP concentration may be warranted.

21.6.2 Tune evaluations usually utilize the "Autofind" function and are set up to look at the apex +/- 1 scan and average the three scans. Background correction is required prior to the start of the peak but no more than 20 scans before. Background correction cannot include any part of the target peak.

21.6.3 **Other Options or if Auto Tune Fails**:

21.6.3.1 Sometimes the instrument does not always correctly identify the apex on some peaks when the peak is not perfectly shaped. In this case, manually identify and average the apex peak +/- 1 scan and background correct as in 21.6.4 above. This is consistent with EPA 8260 and 8270.

21.6.3.2 Or the scan across the peak at one half peak height may be averaged and background corrected. This is consistent with Standard Methods 6200, EPA 624 and EPA 625.

21.6.3.3 Adjustments such as adjustments to the repeller and ion focus lenses, adjusting the EM Voltage, etc. may be made prior to tune verification as long as all of the subsequent injections in the 12 hour tune cycle are analyzed under the same MS tune settings and it is documented in the run sequence log and/or maintenance log that an adjustment was made. Excessive adjusting (more than 2 tries) without clear documentation is not allowed. Necessary maintenance is performed and documented in instrument log.

21.6.3.4 A single scan at the Apex (only) may also be used for the evaluation of the tune. For SW 846 and EPA 600 series methods, background correction is still required.

21.6.3.5 Cleaning the source or other maintenance may be performed and then follow steps for tune evaluation above. Note: If significant maintenance was performed, see methods 8000B or 8000C then the instrument may require recalibration prior to proceeding.

21.6.4 Tune evaluation printouts must include the chromatogram and spectra as well as the Tune evaluation information. In addition, the verifications must be sent directly to the printer or pdf file (no screen prints for DFTPP or BFB tunes). This ability should be built into the instrument software.

21.6.5 All MS tune settings must remain constant between running the tune check and all other samples. It is recommended that a separate tune method not be used, however a separate method may be used as long as the MS conditions between the methods are the same as the sample analysis method and tracked so any changes that are made to the analysis method are also made to the tune method.

Table 21-1.

TestAmerica Denver Equipment and Instrumentation

Instrument Type	Manufacturer	Model	Purchase Date	Auto-sampler	Method Performed
ICP	Thermo Fischer (025) S/N 20062004	ICP 6500	2006	Yes	6010B, 200.7
	Thermo Fischer (026) S/N 20063207	ICP 6500	2006	Yes	6010B, 200.7
ICP/MS	Agilent ICP-MS (024) S/N JP51201530	7500 ce	2006	Yes	6020, 200.8
	Perkin Elmer SCIEX (004) S/N 305970360	ELAN 6000	1996	Yes	6020, 200.8
Mercury Analyzer	Cetac CVAA (023) S/N 030504QTA	M-7500	2005	Yes	7470, 7471A, 245.1, 245.2
	Perkin Elmer (019) S/N 4025	FIMS	1996	Yes	7471A, 7470, 245.1, 245.2
Ion Chromatograph	Dionex (IC3) S/N 98040510	DX-120	1997	Yes	300.0, 9056
	Dionex (IC4) S/N 056537	N/A	2000	Yes	Hydrazine, MMH, UDMH
	Dionex (IC5) S/N 0106180	N/A	2002	Yes	300.0, 314.0, 9056
	Dionex (IC6) S/N 03100162	ICS 2000	2003	Yes	300.0, 9056
	Dionex (IC7) S/N 03100161	ICS 2000	2003	Yes	300.0, 314.0, 9056
TOC	LECO (LEC) S/N 3097	C632 (Solid)	2007	Yes	415.1, 9060
	Shimadzu (SHI3) S/N H52104301585	TOC-V_{CPN}	2005	Yes	415.1, 9060
	Shimadzu (SHI2) S/N 414445340	TOC-VCSH	2004	Yes	415.1, 9060
TKN Digestion System	Tecator System 2040 S/N 662	1000-3454	1985	No	351.2, 351.3

Instrument Type	Manufacturer	Model	Purchase Date	Auto-sampler	Method Performed
TOX	MCI S/N 43F30588	TSX-10	1987	No	9020B, 9021, 9023
	Thermo Euroglass S/N 993752	1200	1997	Yes	9020B, 9021, 9023
	Thermo Euroglas S/N 993728	ECS 1200	2004	Yes	9020B, 9021, 9023
PH Meter	Corning S/N 5707	140	1987	No	9040B, 9045C, 150.1
Dissolved Oxygen Meter	YSI (BOD2)	5100	2002	No	405.1
	YSI S/N 02F0863	5000		No	405.1
UV/VIS	Milton Roy (301) S/N 3800107006	Spectronic 301	1985	No	7196A, 353.2, 354.1, 376.2, 9065, 410.1, 410.4,
	Alpkem (Alp1) S/N 908893427	A002393	1997	Yes	325.2, CN, Phenol
	Alpkem (Alp2) S/N 917893398	A002393	1997	Yes	353.2, NH_3/TKN, 351.2, 351.3
	Konelab S/N P0518697	Model 20	2003	Yes	365.3, 375.4
	Astoria Pacific Analyzer S/N 200052	Astoria 2	2005	Yes	351.2, 353.2, 365.1
Ion Analyzer	Orion Research S/N PX94A	EA940	1985	No	340.2, RedOx Potential
Autotitrator (pH, Alkalinity, Conductance)	Man-Tech (AT2)	PC – Titrate PC-1000	2000	Yes	9040B, 9045C, 150.1, 2320B, 310.1, 310.2, 2510B, 9050A, 120.1
Turbidimeter	HF Scientific	Micro 100	2001	No	180.1
Automated Distillation Apparatus	Westco S/N 1028	483-W001-01 Easy Dist	1997	No	4500-CN-E, 9012A, 335.1, 335.3
COD	HACH S/N 1105524	DRB 200		No	410.4
	Intermatic		2004	No	410.4

Instrument Type	Manufacturer	Model	Purchase Date	Auto-sampler	Method Performed
GC/MS Semivolatiles	Hewlett-Packard (B) S/N US00007283	6890 – GC 5973 – MSD	1999	Yes	8270C, 625
	Hewlett-Packard (D) S/N US00007319	6890 – GC 5973 – MSD	1996	Yes	8270C, 625
	Hewlett-Packard (F) S/N US00036181	6890 – GC 5973 – MSD	1996	Yes	8270C SIM
	Agilent Technologies (K) S/N CN10332028	6890N – GC 5973 – MSD	2003	Yes	8270C, 8270C SIM, 625
	Agilent Technologies (G2) S/N CN10421078	6890N – GC 5973 – MSD	2004	Yes	8270C Best Practice
	Hewlett-Packard (G4) S/N CN10438087	6890N – GC 5973 – MSD	2004	Yes	8270C Best Practice
	Hewlett-Packard (Q) (S/N US0000021949	6890 – GC 5973 – MSD	2001	Yes	8270C, 625
	Hewlett-Packard (Y) S/N US00007291	6890 – GC 5973 – MSD	1996	Yes	8270C, 625
GC/MS Volatiles	Agilent Technologies (C) S/N US00007315	6890N – GC 5973 – MSD	2002	Yes	8260B
	Hewlett-Packard (E) S/N 3336A60699	5890II – GC 5972 – MSD	1997	Yes	8260B-Water
	Hewlett-Packard (H) S/N 3336A60700	5890II – GC 5972 – MSD	1994	Yes	8260B-Waters
	Hewlett Packard (P) S/N US00007321	6890N - GC 5973 – MSD	1999	Yes	8260B
	Hewlett-Packard (G) S/N 3336A56276	5890 - GC 5972 - MSD	1996	Yes	8260B
	Hewlett-Packard (J) S/N 3336A60701	5890II – GC 5972 – MSD	1994	Yes	8260B
	Hewlett-Packard (R1) S/N 3336A52245	5890II - GC 5972 – MSD	1994	Yes	8260B/524
	Hewlett-Packard (R2) S/N 336A53965	5890II - GC 5972 – MSD	1995	Yes	8260B
	Hewlett-Packard (S) S/N 3336A60702	5890II – GC 5972 – MSD	1994	Yes	8260B/624
	Hewlett-Packard (Z) S/N 3336A60013	5890II – GC 5972 – MSD	1996	Yes	8260B-Waters, 524
	Agilent Technologies (GC/MS1) S/N CN10420009	6890N – GC 5973 – MSD	2004	Yes	8260B Waters

Instrument Type	Manufacturer	Model	Purchase Date	Auto-sampler	Method Performed
GC Volatiles	Hewlett-Packard (B) S/N 3019A28634	5890II PID / FID	1990	Yes	8021 GRO
	Hewlett-Packard (H) S/N 2750A16573	5890A Dual PID Single FID	1988	Yes	8015, 8021B Aromatics, 8021B GRO
	Hewlett-Packard (K) S/N 2843A19497	5890A Dual PID Single FID	1988	Yes	8015, 8021B Aromatics, 8021B GRO
	Hewlett-Packard (L) S/N 2336A00164	5890A FID	1988	Yes	8015B GRO
	Hewlett-Packard (P) S/N 2518A05337	5890A Dual PID Single FID	1990	Yes	8015B, 8021B Aromatic, 8021B GRO
	Agilent Technologies (S-1) S/N US10341120	6890 Dual PID/ Dual ELCD	2003	Yes	8021B

Instrument Type	Manufacturer	Model	Purchase Date	Auto-sampler	Method Performed
GC Semivolatiles	Hewlett-Packard (C) S/N US00029514	6890 Dual ECD	1999	Yes	608, 8081A
	Hewlett-Packard (E) S/N 3121A35858	5890II Dual ECD	1992	Yes	504.1, 8011
	Hewlett-Packard (M) S/N US00024143	6890 Dual ECD	1999	Yes	615, 8151A
	Agilent Technologies (P1) S/N US10418019	6890N Dual ECD	2004	Yes	8081A
	Agilent Technologies (P2) S/N US10418024	6890N Dual ECD	2004	Yes	8081A
	Agilent Technologies (P3) S/N US10418023	6890N Dual ECD	2004	Yes	8082
	Hewlett-Packard (R) S/N 3336A55030	5890II Dual ECD	1994	Yes	608, 8081A
	Hewlett-Packard (U) S/N US00063217	5890II Single FID	1999	Yes	8015B DRO
	Hewlett-Packard (W) S/N 3126A36250	5890II Dual ECD	1990	Yes	8082
	Hewlett-Packard (Z2) S/N 2623A08097	5890 Dual FID	1990	Yes	8015B DRO
HPLC	Hewlett-Packard (G) S/N DE91609974 (Quat Pump)	1100 Multiple wavelength UV/ Fluorescence detectors	1999	Yes	8310, 8330
	Hewlett-Packard (Q) S/N DE11114412 (Quat Pump)	1100 Multiple wavelength UV/ Fluorescence detectors	2001	Yes	8310, 8330
	Agilent Technologies (X3) S/N DE33224964 (Quat Pump)	1100 Multiple wavelength UV/ Fluorescence detectors	2004	Yes	8330

Instrument Type	Manufacturer	Model	Purchase Date	Auto-sampler	Method Performed
HPLC/MS/MS	Micromass/Waters 2790 HPLC Inlet (LCMS1) plus Dionex DX600 Inlet S/N VB118	Quattro Ultima	2000	Yes	8321A, 6860
	Micromass/Waters Acquity UPLC Inlet (LCMS3) plus Dionex DX600 Inlet S/N VAA188	Quattro Premier	2004	Yes	8321A
	Micromass/Shimadzu 10 Avp HPLC Inlet (LCMS2) plus Dionex DX600 Inlet S/N VB304	Quattro Ultima	2001	Yes	8321A
	Micromass/Waters 2695 HPLC Inlet (LCMS4) plus Dionex DX600 Inlet S/N QAA632	Quattro Micro	2006	Yes	8321A
GCMS	Agilent Technologies (GCMS3) S/N CN10438076	6890N-GC 5973-MSD	2004	Yes	Custom
CI/MS/MS	Varian (CIMS1) S/N 1200-680	1200L	2004	Yes	Low Level NDMA

Table 21-2.

Example: Schedule of Routine Instrument Maintenance

Instrument	Procedure	Frequency
Cetak and Perkin Elmer Mercury Analyzers	• Check silica gel in drying tube • Change Lamp • Clean cell and aspirator in aqua regia • Check pump tubing and pump flow • Check Waste Container • Fill reductant bottle with 10% Stannous Chloride and check acid reagent	As needed As needed Monthly Daily Daily Daily
ICP	• Check pump tubing • Fill Argon humidifier with water • Check fluid level in waste container • Clean or replace air filters • Check torch for residue • Check nebulizer flow • Clean nebulizer and drain chamber • Fill rinse solution/ IS solution • Replace capillary tubing/sipper probe • Check internal fluid reservoir • Change internal cooling fluid	Daily Weekly Daily As needed Daily Daily As needed Daily As needed Monthly Yearly
ICP MS	• Change pump tubing • Check level of tuning solution • Check waste container • Load printer with paper • Check air filters • Replace coolant on chiller • Clean or change nebulizer • Clean or replace torch • Replace capillary tubing • Change oil in vacuum pumps • Remove and clean cones	Daily Daily Daily Daily Monthly Bi-annually As needed As needed As needed As needed As needed
UV-Vis Spectrophotometer	• Clean ambient flow cell • Precision check/alignment of flow cell • Wavelength verification check	As required As required Semi-annually
Colorimetric Analyzer	• Clean detector • Clean filters • Check tubing • Clean sample probe shaft • Clean pump, diluter, and XYZ sampler. • Lubricate pump roller	Daily Daily Daily Daily Monthly Semi-annually

Instrument	Procedure	Frequency
Ion Chromatograph	• Check plumbing for leaks • Check gases • Check pump pressure • Checkeluent level • Check conductivity meter • De-gas pump head when flow is erratic • Change analytical columns and bed supports guard • Check and replace any damaged/dis-colored tubing • Clean conductivity cell • Lubricate left hand position	Daily Daily Daily Daily Daily As needed As needed As needed As needed As needed
Total Organic Halide Analyzer	• Check electrodes/polish if needed • Replace dehydrating fluid /electrolyte fluid • Clean quartz boat • Perform cell performance check • At the end of each day of use, wash out the absorption module, empty the electrolyte and fill chamber with DI water, empty dehydrator tube • Clean or replace pyrolysis tube • Clean titration cell • Replace reference electrode fluid • Change quartz wool • Replace o-rings and seals	Daily Daily Daily Daily Daily As needed As needed As needed As needed As needed
Hewlett Packard GC/MS	• Check inlet pressure • Check temperature of inlet, detector, verify temperature program • Check Septa and clean injection port • Check carrier gas supply • Check tune parameters • Check oil levels in mechanical pumps and the diffusion pump if the vacuum is unsufficient • Replace electron multiplier • Clean Source • Replace filaments • Change rough pump oil and exhaust filters • Relubricate the turbomolecualr pump-bearing wick	Daily Daily Daily Daily Daily As needed As needed As needed Annually Annually
Gas Chromatograph	• Check carrier gas supply • Check temperatures of inlet, detectors, verify temperature program • Check septa clean injection port or replace injection port liner and cut column if needed • Reactivate carrier gas drying agents • Replace or repair flwo controllers if constant flow cannot be mainatined	Daily Daily As needed As needed As needed

Instrument	Procedure	Frequency
Electron Capture Detector (ECD)	• Detector wipe test (Ni-63) • Detector cleaning	Semi-annually As needed
Flame Ionization Detector (FID)	• Detector cleaning	As needed
Nitrogen Phosporus Detector (NPD)	• Replace bead • Replace ceramic rings	As needed As needed
Photoionization Detector (PID)	• Change O-rings • Clean lamp window	As needed As needed
HPLC	• Check level of eluent vessels • Check gas supply • Change pump seals • Change the column frit • Change fuses in power supply • Filter all samples • Change autosampler rotor or oil autosampler slides • Change or backflush columns	Daily Daily Semi-annually or as required As needed As needed Daily As needed As needed
APCI/ESI LC/MS/MS	• Check solvent reservoirs • Verify that pump is primed and operating pulse free • Verify temperatures for capillary heater/vaporizer heater • Verify pressure of manifold/fore-pump • Verify that corona and multiplier are functional • Clean Lenses • Clean skimmer • Replace column • Oil autosampler • Change autosampler filters • Replace sample inlet tube • Replace fused silica tubing at ESI interface • Replace rough pump oil • Replace turbo pump oil • Vaccum system components including fans and fan covers	Daily Daily Daily Daily Daily As needed As needed As needed As needed As needed As needed As needed Semi-annually Annually Annually
Balances	• Class “S” traceable weight check • Clean pan and check if level • Field service	Daily, when used Daily At least Annually
Sonicator	• Inspect probe for etching/pitting • Tune sonicator assembly • Dissasemble and clean probe tips	Daily Weekly As needed
Conductivity Meter	• Standardize with KCL • Conductivity cell cleaning • Check probes and cables	Daily As needed As needed

Instrument	Procedure	Frequency
Flash Point Tester	• Check stirrer • Check tubing • Check gas supply • Check thermometer against NIST thermometer	Daily Daily Daily Daily, when used
Digestion Block	• Check with NIST thermometer	Annually
Turbidimeter	• Check light bulb • Inspect cells • Clean housing	Daily, when used Monthly Monthly
Deionized/Distilled Water	• Conductivity check • System cleaning • Replace cartridge & large mixed bed resins	Daily As needed As needed
Drying Ovens	• Temperature monitoring • Temperature adjustments	Daily As required
Refrigerators/ Freezers	• Temperature monitoring • Temperature adjustment • Defrosting/cleaning	Daily As required As required
pH/Specific Ion Meter	• Calibration/check slope • Clean electrode	Daily As required
BOD Incubator	• Temperature monitoring • Coil and incubator cleaning	Daily Monthly
Centrifuge	• Check brushes and bearings	Every 6 months or as needed
Water baths	• Temperature monitoring • Water replaced	Daily Monthly or as needed

Table 21-3.

Periodic Calibration

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Analytical Balance	Accuracy determined using A2LA-accredited NIST weights. Minimum of 3 weights bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually.	Daily	± 0.2%	Clean, check level, insure lack of drafts, and that unit is warmed up, recheck. If fails, call service.
Top Loading Balance	Accuracy determined using A2LA-accredited NIST weights. Minimum of 2 weights bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually.	Daily	± 0.5%	Clean. Replace.
A2LA-accredited NIST Weights	Accuracy determined by accredited weights and measurement laboratory.	1 year	As per certificate.	Replace.
NIST-Traceable Thermometer	Accuracy determined by A2LA-accredited weights and measurement laboratory.	5 years	As per certificate.	Replace.
Thermometer	Against NIST-traceable thermometer	Yearly at appropriate temperature range for intended use	± 1.2°C	Replace
Minimum-Maximum Thermometers	Against NIST-traceable thermometer	Yearly	± 1.5°C	Replace

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
InfraRed Temperature Guns	Against NIST-traceable thermometer	Quarterly at appropriate temperature range for intended use.	± 1.5°C	Repair/replace
Dial-type Thermometers	Against NIST-traceable thermometer	Quarterly at appropriate temperature range for intended use.	± 1.5°C	Replace
Refrigerator	Temperature checked using NIST-traceable thermometer.	Daily. If out of range, check again in two hours.	2.7 ± 1.7°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify supervisor.
Freezer	Temperature checked using NIST-traceable thermometer	Daily. If out of range, check again in two hours.	(-10)-(-20)°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify supervisor.
Oven	Temperature checked using NIST-traceable thermometer.	When in use.	104 ± 1°C (drying) 180 ± 2°C (TDS)	Adjust. Replace.
Incubator	Temperature checked using NIST-traceable thermometer.	When in use. For microbi-ology, twice daily when in use.	BOD: 20 ± 1.0°C Micro: 35 ± 0.5°C	Adjust. Replace.
Water Bath	Temperature checked using NIST-traceable thermometer.	When in use.	± 2°C	Adjust. Replace.
Volumetric Dispensing Devices (Eppendorf ® pipette, automatic dilutor or dispensing devices)	One delivery by weight. Using DI water, dispense into tared vessel. Record weight with device ID number.	Monthly	± 2% Calculate accuracy by dividing weight by stated volume times 100 for percent.	Adjust. Replace.

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Glass Microliter Syringes	None	Accuracy must be initially de-monstrated if syringe was not received with a certifi-cate attesting to established accuracy.	± 2%	Not applicable.
Conductivity Meter	Cell impedance calibrated with three KCl standards.	Each use.	$r \geq 0.99$	Recalibrate.
Deionized Water	Check in-line conductivity meter on system with conductivity meter in Inorganics Department.	Weekly	<10 µmhos/cm^2	Record on log. Report discrepancies to QA Director.

Table 21-3
Preventive Maintenance Procedures
For Laboratory Equipment

Instrument/ Equipment Type	Maintenance	Frequency
Gas Chromatograph	Replace Gas line dryers and filters	As needed*
	Replace Gas cylinders	As needed*
	Check or adjust column gas flow and/or detector make-up flow	As needed*
	Replace Injection port Septa	Daily*
	Replace Injection port liners/re-silonize liners	GC(MSVOA); GC/MS SVOC, Daily*
	Replace injection port liner o-ring	GC, As needed; GC/MS, Daily*
	Replace inlet seal and ring	GC, As needed, GC/MS, Daily*
	Replace column ferrules	GC, As needed; *
	Clip column (injector and detector end)	GC, As needed; GC/MS, Daily*
	Replace syringes on autosamplers	As needed*
	Replace heated-zones heaters and sensors	As needed*
	Replace inlet assembly	As needed*
	Empty solvent rinse and solvent waste vials (on autosampler tower)	Daily or as needed
	Replace column	As needed*
Flame Ionization Detector (FID)	Clean/replace jet	As needed*
	Clean collector	As needed*
	Check and/or adjust gas flows	As needed*
Photoionization Detector (PID)	Clean window	As needed*
	Replace o-ring seat	As needed*
	Replace Lamp	As needed*
	Check and/or adjust gas flows	As needed*
	Adjust Lamp power supply intensity	As needed*
Mass Spectrometer (MS)	Clean source, replace source parts, replace filaments	As needed*
	Clean analyzer	As needed*
	Replace electron multiplier	As needed*
	Clean or replace glass jet separator, replace transfer line from jet separator to MS	As needed*
	Change rough pump oil	After each source cleaning
	Refill calibration compound (PFTBA) vial	As needed
Purge and Trap Equipment	Refill rinse water supply/Empty rinse water waste	Weekly or as needed
	Refill spiking solutions vials	As needed
	Rinse sparge tubes	Daily
	Clean or replace 6-port valve	As needed*
	Replace Transfer lines (from Autosampler to LSC and from LSC to GC)	As needed*
	Adjust gas flows and pressures	As needed
	Perform leak check	As needed

Table 21-3
Preventive Maintenance Procedures
For Laboratory Equipment
(cont.)

Instrument/ Equipment Type	Maintenance	Frequency
Inductively Coupled Plasma, Atomic Emission Spectrometer (ICP-AES)	Replace Peristaltic pump tubing	As needed*
	Clean autosampler, change tubing	As needed*
	Clean nebulizer and torch assembly	As needed*
	Replace nitrogen and argon tanks	As needed*
	Refill rinse water receptacle	Daily
	Empty waste receptacle	Daily
	Check for internal standard and sample flow through peristaltic pump tubing	As often as possible
	Replace internal standard solution receptacle	As needed
	Operate and check vents	Daily
	Perform Hg alignment	Daily*
	Check water level and water filter on recirculating-cooling unit, refill and replace filter	Check daily, refill and replace as needed
	Check purge windows	Daily, replace as needed
	Replace nebulizer and o-rings	As needed*
	Replace torch	As needed*
	Drain air compressor	Weekly
	Replace mixing chambers	As needed*
	Clean or replace air filters	Weekly
	Check pneumatic filters	Weekly, replace as needed
	Perform wave calibration (UV and Vis)	Quarterly*
	Calibrate Detector	Quarterly*
High Pressure Liquid Chromatography (HPLC)	Replace pre-column filter	As needed*
	Refill Solvent reservoirs	Daily or as needed
	Reverse column and rinse with solvents	Daily or as needed*
	Replace column	As needed*
	Clean solvent reservoir filters	As needed*
	Replace ball-valve cartridges on high pressure pump	As needed*
	Replace DAD flow cell windows	As needed*
	Check system solvent pressure	Daily
pH Meters	Clean or replace electrode	As needed
	Refill electrode electrolyte	As needed

Table 21-3
Preventive Maintenance Procedures
For Laboratory Equipment
(cont.)

Instrument/ Equipment Type	Maintenance	Frequency
Balance	Clean pan and platform	After each use
	Check Level bubble	Daily
	Check calibration	Daily
	Cleaning and calibration by authorized service	Annually
Conductivity Meter	Clean probe	As needed
Dissolved Oxygen Meter	Replace membrane	As needed
	Clean probe	As needed
ZHE vessels	Replace o-rings and screens	As needed
ZHE and TCLP Tumblers	Check Rotation Rate	Yearly
Spectrophotometers	Clean and check tubing	As needed
Burettes and Pipets	Clean and check calibration	Monthly
Thermometers	Check calibration	Annually, Quarterly for Digitals and IR Thermometer*
Ovens	Check and/or adjust temperature, record temperature on log sheet	Daily
Refrigerators and Freezers	Check and/or adjust temperature, record temperature on log sheet	Daily
	Defrost freezers	As needed
OI Alpkem/Astoria, Flow Injection Analyzer	Replace tubes on autodilutor	As needed*
	Clean autosample surfaces	As needed
	Spray silicone on cloth and rub on pump rollers	As needed
	Clean or replace o-rings and ports on valves	As needed*
	Clean union and T's on manifold and replace o-rings on manifold	As needed
	Dry and clean detector surfaces	As needed
	Replace flow cell o-rings and flares	As needed*
	Replace manifold tubing	As needed*
	Adjust pump timing	As needed
APCI/ESI LC/MS/MS	Change filters in Autosampler	As needed*
	Change Pump Seals	As needed*
	Rinse Capillary with MeOH	As needed*
	Rinse and clean corona needle	As needed*
	Replace fused silca tubing at ESI interface	As needed*
	Replace sample inlet tube in APCI	As needed*
	Clean lenses	As needed*

*Date and maintenance performed are recorded in Maintenance Log of the instrument/equipment

SECTION 22

MEASUREMENT TRACEABILITY
(NELAC 5.5.6)

22.1 OVERVIEW

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. With the exception of Class A Glassware (including glass microliter syringes that have a certificate of accuracy), at a minimum, quarterly accuracy checks are performed for all mechanical volumetric devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. The following definitions are provided by the American Association for Laboratory Accreditation (A2LA):

"Traceability is the property of a measurement result whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons, each step in the chain having stated uncertainties." There are six essential elements:

- An unbroken chain of comparison
- A calculated measurement uncertainty for each step in the chain to allow for an overall uncertainty calculation
- Documentation of each step in each calibration report
- All steps in the chain are performed by individuals with evidence of technical competence and accredited by a recognized accreditation body
- Reference to International Standard (SI) units
- Recalibration at appropriate intervals to preserve traceability

Calibration is defined as "determining and documenting the deviation of the indication of a measuring instrument (or the stated value of a material measure) from the conventional 'true' value of the measurand."

Uncertainty is defined as "a parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measurand." Measurement of Uncertainty is discussed is Section 20 of this QA Manual.

22.2 NIST-TRACEABLE WEIGHTS AND THERMOMETERS

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), APLAC (Asia-Pacific Laboratory Accreditation Cooperation), or EA (European Cooperation for Accreditation). A certificate and scope of accreditation is kept on file at the laboratory. Refer to Section 21 for calibration of weights and thermometers.

Calibration laboratory's policy for achieving measurement traceability is defined and includes the subsequent elements of uncertainty.

The uncertainty calculations of the calibration laboratory are supported by uncertainty budgets and are represented by expanded uncertainties typically using a coverage factor of k=2 to approximate the 95% confidence level. This explanation accompanies the measurement result and the associated uncertainty.

The tolerance uncertainty ratio (TUR) is calculated using the expanded uncertainty of the measurement, not the collective uncertainty of the measurement standards. A statement to this effect accompanies the TUR along with the coverage factor and confidence level.

The calibration report or certificate submitted to TestAmerica Denver contains, in a well designed format, a traceability statement, the conditions under which the calibrations were made in the context of any potential influence, a compliance statement with an identified metrological specification and the pertinent clauses, a clearly identified record of the quantities and functional test results before and after re-calibration, and no recommendation on the calibration interval. Opinions and interpretations of results are presented along with the basis upon which they were made and identified as such. The report may be submitted by facsimile or other electronic means as long as the requirements of the International Standard are achieved. If significant amendments are made to a calibration certificate, a supplemental certificate for the serial-number-specified piece of equipment is so identified. When a new certificate is offered, it uniquely identifies and references the one it replaces. All calibration reports are filed in the QA Office.

The calibration laboratory supports in-house calibration systems: documented procedures for in-house calibrations, evidence by a report, certificate, or sticker, for an appropriate amount of time; training records of calibration personnel; certificates from accreditation services demonstrating traceability to national or international standards of measurement; procedures for evaluating measurement uncertainty; timely and documented recalibration of reference standards. When subcontracting to a calibration laboratory, TestAmerica Denver does not use a firm who subcontracts the work.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibrations are checked each day of use. All mercury thermometers are calibrated annually

against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

22.3 REFERENCE STANDARDS / MATERIALS

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared standard materials are purchased from vendors accredited by A2LA, NVLAP, and ISO/IEC with an accompanying Certificate of Analysis that documents the standard purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. (Refer to Section 9 for additional information on purchasing). The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, such as IDA analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to Table 9-1 in Section 9 for general storage requirements and SOP DV-QA-0015 for additional storage information. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

22.4 DOCUMENTATION AND LABELING OF STANDARDS, REAGENTS, AND REFERENCE MATERIALS

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. Refer to SOP No. CA-Q-S-001, Solvent and Acid Lot Testing and Approval.

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained by the appropriate group until they are permanently archived by QA. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed

information on documentation and labeling, please refer to method specific SOPs and SOP DV-QA-0015, Verification and Storage of Calibration Standards.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material.

22.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's Standards software, and are assigned a unique identification number. The following information is typically recorded in the electronic database within the Standards program.

- Standard ID
- Description of Standard
- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

22.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date
- Standard ID – assigned in the Standards log software.
- Special Health/Safety warnings if applicable

22.4.3 In addition, the following information may be helpful:

- Date of receipt for commercially purchased items or date of preparation for laboratory prepared items
- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include a preparation date, expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and raw data.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods; and 3) according to requirements in SOP DV-QA-0015, Verification and Storage of Calibration Standards.

SECTION 23.0

SAMPLING
(NELAC 5.5.7)

23.1 OVERVIEW

TestAmerica Denver does not provide sampling services. The laboratory's responsibility in the sample collection process lies in supplying the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory. On occasion, the lab will supply personnel to assist with the duties mentioned above. In that case,the laboratory staff must adhere to the site specific health and safety plan as provided by the client.

23.2 SAMPLING CONTAINERS

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Any certificates of cleanliness that are provided by the supplier are maintained at the laboratory.

23.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

23.2.2 Preparing Container Orders

When new containers arrive at the laboratory, the date of receipt is recorded on the packing list received with them for retained documentation. Periodically, containers are evaluated for cleanliness based upon their intended parameter sample analysis. Upon request, the containers are then sent to clients for use in collecting samples. The shipping date, type and number of containers are maintained on file by the lab. Shipping personnel insure that container stock is rotated so that "first in" is "first out." When a client requests containers, a client services representative creates a container request in LIMS; it is then stored permanently in LIMS with a unique container order number. Copies of the container request are printed for the shipping department. One copy goes to the client with the containers; one copy is filed in the shipping department.

The laboratory also provides EnCore, TerraCore or other soil sampling devices when requested.

If containers are provided directly to the client from the manufacturer or from other sources, the laboratory will not be responsible for any of the above records.

23.3 FIELD QUALITY CONTROL (QC)

Common field quality control samples are defined in the following paragraphs. The frequency of field quality control samples should be specified in the site specific Quality Assurance Project Plan (QAPP) or by the client. TestAmerica provides trip blanks for VOC analysis with the sample containers for all volatile organic analyses. Blanks generated in the field will be analyzed along with the field samples (exception soil samples where the blank is aqueous).

23.3.1 Equipment Blank / Rinsate Blank - The equipment blank, sometimes referred to as a rinsate blank, is a sample of the water used to decontaminate sampling equipment. The source water should be as free of target analytes as possible. An aliquot of this water is poured over or through the sample collection device after decontamination, collected in a sample container, preserved with appropriate reagents, and returned to the laboratory. This serves as a check on sampling device cleanliness, and will also be affected by the site and sample handling conditions evaluated by the other types of blanks. The sampling time for the equipment blank should begin when the equipment is rinsed and the water is collected.

23.3.2 Field Blank - The field blank is water that is as free of target analytes as possible and from the same source as the equipment blank. The water is poured into a sampling container at the sampling site, preserved with the appropriate reagents, and returned to the laboratory. This serves as a check on reagent and environmental contamination. The sampling time for the field blank should be when the blank is prepared in the field.

23.3.3 Trip Blank - The trip blank pertains to volatile analysis only. This serves as a check on sample contamination originating from sample transport, sample container contamination, shipping and storage, or from certain site conditions. Trip blanks are often referred to as travel blanks. They are prepared using pre-cleaned sample containers. They are filled with organic-free water (the source of the organic free water is the same source of water used to prepare volatile standards, method blanks, LCS and sample dilutions), sealed and taken into the field with the empty containers which will be used for sampling. The recommended frequency is one trip blank per cooler (in duplicate or triplicate), per volatiles method. Unless otherwise specified, the sampling time for the trip blank is the time of receipt at the laboratory (When the “Trip” ends).

23.3.4 Field Duplicates - Field duplicates are replicate samples collected from the same sampling point or location during a field collection event. This control sample is used to demonstrate the ability of both the sampling and analytical process to generate data of acceptable precision.

23.4 DEFINITION OF HOLDING TIME

The date and time of sampling documented on the chain-of-custody (COC) form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in “days” (e.g 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in “hours” (e.g. 6 hours, 24 hours, etc.) are measured from date and time zero. The first day of holding time ends twenty-four hours after sampling. Holding times for analysis include any necessary reanalysis. However there are some programs that determine holding time compliance based on the

date and specific time of analysis compared to the time of sampling regardless of how long the holding time is.

23.4.1 Semi-Volatile - Holding times for sample preparation for semi-volatile organics are measured from the sampling date (and time where applicable) until the day (and time where applicable) solvent contacts the sample. Holding times for analysis are measured from the date (and time where applicable) of initiation of extraction to the time of injection into the gas chromatograph.

23.4.2 Volatiles - Holding times for volatile organics are measured from the date (and time where applicable) of sampling to the date and time of injection into the gas chromatograph.

23.4.3 Inorganics - For inorganic and metals analysis, the preparation/digestion/distillation must be started within the maximum holding time as measured from the sampling date (and time where applicable).

23.5 SAMPLING CONTAINERS, PRESERVATION REQUIREMENTS, HOLDING TIMES

The preservation and holding time criteria specified in the following tables are derived from the source documents for the methods. If method required holding times (refer to Tables 23-1 to 23-3) or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

23.6 SAMPLE ALIQUOTS / SUBSAMPLING

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis. In that regard the following guidelines apply to analysts:

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Refer to SOPs DV-QA-0023, *Subsampling* and SOPs DV-OP-0013 and DV-OP-0014.

23.6.1 For multiphasic samples, the client should instruct the laboratory as to the intent of the testing and how to handle the sample. If the entire sample is to be accounted for, and the phases do not mix easily with inversion/stirring, such that a representative aliquot can be taken, the analyst should record the percent by volume of each phase. The analysis must be conducted on each phase separately; the final results can either be reported separately or combined mathematically, weighting the individual phase results by volume. One exception to this procedure is the situation addressed in the TCLP and SPLP methods for wastes containing free liquids. However, if the leachate and final filtrate are not miscible, it is necessary to combine mathematically the concentrations of the two (or more) solutions by volume.

Tables 23-1 to 23-3 detail holding times, preservation and container requirements, and sample volumes for SDWA and NPDES methods. The sample volumes are intended to be a minimal amount to perform the method, the containers that are used may be of larger size.

Note: the holding times are program specific and different programs may have different holding times for equivalent methods (e.g., there are difference in Holding times for many Organic analytes between SDWA and NPDES. RCRA methods may also be different.)

Table 23-1.

Inorganic Sample Containers, Preservatives, and Holding Times

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Acidity	Water	100 mL	2310 B	250 mL plastic or glass, Cool, 4°C, 14 days	---	Not Applicable
	Solid[5]	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Alkalinity	Water	100 mL	2320B	250 mL plastic or glass, Cool, 4°C, 14 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Ammonia	Water	400 mL	350.1	500 mL plastic or glass, Cool, 4°C H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Biochemical Oxygen Demand (BOD)	Water	200 mL	5210 B	1000 mL plastic or glass, Cool, 4°C 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Bromide	Water	100 mL	300.0[7]	250 mL plastic or glass, No preservative required, 28 days	9056	Cool, 4°C, analyze ASAP after collection
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not	---	Not Applicable	---	Not Applicable

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
		Applicable				
Chemical Oxygen Demand (COD)	Water	100 mL	410.4	250 mL glass or plastic, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Chloride	Water	50 mL	300.0[7] 4500-Cl C,E	250 mL plastic or glass, No preservative required, 28 days	9056	Method 9056: Cool, 4°C, analyze ASAP after collection.
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Chromium (Cr^{+6})	Water	100 mL	3500 Cr-D	Method 218.4: 200 mL plastic or glass, Cool, 4°C, 24 hours Method 3500 Cr-D: 200 mL quartz, TFE, or polypropylene HNO_3 to pH <2 Cool, 4°C Analyze ASAP after collection	7196A	200 mL plastic or glass, Cool, 4°C, 24 hours
	Solid	Not Applicable	---	Not Applicable	7196A	250 mL plastic or glass, 30 days to digestion, 96 hours after digestion
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable

Table 23-1.
Inorganic Sample Containers, Preservatives, and Holding Times – con't

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Color	Water	100 mL	2120 B	250 mL plastic or glass, Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Conductivity	Water	100 mL	120.1	200 mL glass or plastic, Cool, 4°C, 28 days	9050A	200 mL glass or plastic, Cool, 4°C, 24 hours
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Cyanide (Amenable)	Water	IL	335.4	1 liter plastic or glass, NaOH to pH >12 0.6g ascorbic acid[6] Cool, 4°C, 14 days unless sulfide is present. Then maximum holding time is 24 hours	9010B/ 9012A	1 liter plastic or glass, NaOH to pH >12 0.6g ascorbic acid[6] Cool, 4°C, 14 days
	Solid	50g	---	Not Applicable	9010B/ 9012A	Not Specified
	Waste	50g	---	Not Applicable	9010B/ 9012A	Not Specified
Cyanide (Total)	Water	IL	335.4	1 liter plastic or glass, NaOH to pH >12 0.6g ascorbic acid[6] Cool, 4°C, 14 days unless sulfide is present. Then maximum holding time is 24 hours	9010B/ 9012A	1 liter plastic or glass, NaOH to pH >12 0.6g ascorbic acid[6] Cool, 4°C, 14 days
	Solid	50g	--	Not Applicable	9010B 9012A	8 or 16 oz glass Teflon-lined lids, Cool, 4°C, 14 days

Table 23-1.
Inorganic Sample Containers, Preservatives, and Holding Times – con't

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Cyanide (Total) (continued)	Waste	50g	--	Not Applicable	9010B/ 9012A	8 or 16 oz glass Teflon-lined lids, Cool, 4°C
Flashpoint (Ignitability)	Liquid	Not Applicable	---	Not Applicable	1010	No requirements, 250 mL amber glass, Cool, 4°C is recommended
	Solid	Not Applicable	--	Not Applicable	---	Not Applicable
	Waste	Not Applicable	--	Not Applicable	---	Not Applicable
Fluoride	Water	300 mL	300.0[7] 4500-F C, C-97	500 mL plastic, No preservation required, 28 days	9056	Cool, 4°C, analyze ASAP after collection
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Hardness (Total)	Water	50 mL	2340B	250 mL glass or plastic, HNO_3 to pH < 2, 6 months	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Iron (Ferrous)	Water	100 mL	3500-Fe D	1 liter glass or polyethylene container, 6 months **This test should be performed in the field.**	-	Not Applicable
	Solid	Not Applicable	-	Not Applicable	-	Not Applicable
	Waste	Not Applicable	-	Not Applicable	-	Not Applicable

Table 23-1.
Inorganic Sample Containers, Preservatives, and Holding Times – con't

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Methylene Blue Active Substances (MBAS) (Surfactant)	Water	100 mL	5540-C-00	250 mL plastic or glass, Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Nitrate	Water	100 mL	300.0[7] 353.2	Method 300.0: 250 mL plastic or glass, Cool, 4°C, 48 hours. Method 352.1: 250 mL plastic or glass, Cool, 4°C, 48 hours.	9056	Method 9056: Cool, 4°C, analyze ASAP after collection Method 9210: Cool, 4°C Preserve by adding 1 mL of 1M boric acid solution per 100 mL of sample
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	9210	Not Specified
Hydrazines	Water	100 mL	---	Preserve at lab to pH =2 within 48 hours of collection. Hold time 28 days.	---	Preserve at lab to pH =2 within 48 hours of collection. Hold time 28 days.
	Solid	10 grams	---	4 oz jar Cool, 4°C	---	4 oz jar Cool, 4°C
Nitrite	Water	50 mL	300.0[7] 353.2	250 mL plastic or glass Cool, 4°C, 48 hours	9056	Cool, 4°C, analyze ASAP after collection
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable

Table 23-1.
Inorganic Sample Containers, Preservatives, and Holding Times – con't

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Nitrate-Nitrite	Water	100 mL	4500-NO3 F	250 mL plastic or glass, H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Ortho-phosphate	Water	50 mL	300.0[7] 365.3	100 mL plastic or glass, Filter on site Cool, 4°C, 48 hours	9056	Cool, 4°C, analyze ASAP collection
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
pH	Water	50 mL	150.1 4500-H^+ B	100 mL plastic or glass. Analyze immediately. **This test should be performed in the field.**	9040B	100 mL plastic or glass. Analyze immediately. **This test should be performed in the field.**[8]
	Solid	Not Applicable	---	Not Applicable	9045C	4 oz glass or plastic, Cool, 4°C, Analyze as soon as possible.[8]
	Waste	Not Applicable	---	Not Applicable	9045C	4 oz glass or plastic, Cool, 4°C, Analyze as soon as possible.[8]
Phenolics	Water	100 mL	420.4	500 mL glass, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	9066	1 liter glass recommended, Cool, 4°C, H_2SO_4 to pH < 4, 28 days
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	9065	Not Specified

Table 23-1.
Inorganic Sample Containers, Preservatives, and Holding Times – con't

Analytical		Minimum Sample	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
Parameters	**Matrix**	**Size[1]**	**Method**	**Requirements**	**Method**	**Requirements**
Phosphate	Water	50 mL	365.3	Not Applicable	9056	Cool, 4°C, analyze ASAP collection
	Solid	Not Applicable	---	Not Applicable	9056	Not Applicable
	Waste	Not Applicable	---	Not Applicable	9056	Not Applicable
Phosphorus (Total)	Water	50 mL	365.3	100 mL plastic or glass, H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Reactivity (Cyanide and Sulfide)	Liquid	10 g	---	Not Applicable	Chapter 7 Section 7.3.3.2 and 7.3.4.2	10 oz amber glass, Cool, 4°C, no headspace, analyze as soon as possible.
	Solid	10 g	---	Not Applicable	Chapter 7 Section 7.3.3.2 & 7.3.4.2	10 oz amber glass, Cool, 4°C, no headspace, analyze as soon as possible.
	Waste	10 g	---	Not Applicable	Chapter 7 Section 7.3.3.2 and 7.3.4.2	10 oz amber glass, Cool, 4°C, no headspace, analyze as soon as possible.
Settleable Solids	Water	1000 mL	2540 F	1000 mL plastic or glass, Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Specific Conductance	Water	50 mL	2510 B	250 mL plastic or glass, Cool, 4°C, 24 hours	9050A	250 mL plastic or glass, Cool, 4°C, 28 days

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Specific Conductance – Con't	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Sulfate (SO_4)	Water	100 mL	300.0[7] 375.2	100 mL plastic or glass, Cool, 4°C, 28 days	9056 9038	Method 9056: Cool, 4°C, analyze ASAP collection Method 9038: 200 mL plastic or glass, Cool, 4°C, 28 days
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	100 mL	---	Not Applicable	9038	200 mL plastic or glass, Cool, 4°C, 28 days
Sulfide	Water	100 mL	4500-S2 D-00	500 mL plastic or glass, Cool, 4°C, Add 2 mL zinc acetate plus NaOH to pH > 9, 7 days	9030B/ 9034	500 mL plastic, no headspace, Cool, 4°C, Add 4 drops of 2N zinc acetate per 100 mL of sample, adjust the pH to > 9 with 6 N NaOH solution, 7 days
	Solid	50 g	---	Not Applicable	9030B 9034	Cool, 4°C, fill surface of solid with 2N Zinc acetate until moistened, store headspace-free
	Waste	50 g	---	Not Applicable	9030B 9034	Cool, 4°C, fill surface of solid with 2N Zinc acetate until moistened, store headspace-free

Table 23-1.
Inorganic Sample Containers, Preservatives, and Holding Times – con't

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Sulfite (SO_3)	Water	100 mL	4500-SO3 B-00	100 mL plastic or glass, No preservative required, analyze immediately **This test should be performed in the field.**	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Dissolved Solids (Filterable)	Water	100 mL	2540 C	250 mL plastic or glass, Cool, 4°C, 7 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Kjeldahl Nitrogen (TKN)	Water	500 mL	4500-N	500 mL plastic or glass, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Organic Carbon (TOC)	Water	100 mL	5310-B,C,D	100 mL plastic or glass, Cool, 4°C, H_2SO_4 to pH < 2, 28 days	9060	100 mL glass or 40 mL VOA vials, Cool, 4°C, H_2SO_4 or HCl to pH < 2, 28 days
	Solid	Not Applicable	---	Not Applicable	9060	Not Specified
	Waste	Not Applicable	---	Not Applicable	9060	Not Specified

Table 23-1.
Inorganic Sample Containers, Preservatives, and Holding Times – con't

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method	Requirements
Total Organic Halides (TOX)	Water	100 mL	---	Method 5320B: 500 mL amber glass, Teflon®-lined lid, Cool, 4°C, HNO_3 to pH <2, no headspace, 14 days Method 450.1: 500 mL amber glass, Teflon®-lined lid, Cool, 4°C, HNO_3 to pH <2, no headspace, 28 days	9020B	500 mL amber glass, Teflon®-lined lid, Cool, 4°C, H_2SO_4 to pH < 2, no headspace, 28 days
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Solids	Water	100 mL	2540 B	250 mL plastic or glass, Cool, 4°C, 7 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Total Suspended Solids (Nonfilterable)	Water	100 mL	2540 D	250 mL plastic or glass, Cool, 4°C, 7 days	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable
Turbidity	Water	50 mL	180.1	250 mL plastic or glass, Cool, 4°C, 48 hours	---	Not Applicable
	Solid	Not Applicable	---	Not Applicable	---	Not Applicable
	Waste	Not Applicable	---	Not Applicable	---	Not Applicable

Table 23-1.
Inorganic Sample Containers, Preservatives, and Holding Times – con't

Analytical		Minimum Sample	NPDES[2], [3], [7]		RCRA (SW846)[3], [4]	
Parameters	**Matrix**	**Size[1]**	**Method**	**Requirements**	**Method**	**Requirements**
Volatile Solids	Water	100 mL	160.4	250 mL plastic or glass, Cool, 4°C, 7 days ---	Not Applicable	Water
Water Content	Solid	NA	---	Not Applicable	---	Not Applicable
	Waste	NA	---	Not Applicable	---	Not Applicable
	Water	NA	---	Not Applicable	---	Not Applicable
	Solid	10 g	---	Refer to specific method used	---	Refer to specific method used
	Waste	10 g	---	Refer to specific method used	---	Refer to specific method used
Metals (excludes Hg)	Water	100 mL	200 series	1 liter glass or polyethylene container, HNO_3 to pH $\leq$ 2, 6 months	6010B, 6020	1 liter glass or polyethylene container, HNO_3 to pH $\leq$ 2, 6 months
	Solid	200 g	200 series	8 or 16 oz glass or polyethylene container storage at 4 °C	6010B, 6020	8 or 16 oz glass or polyethylene container, storage at 4°C, 6 months
	Waste	200 g	200 series	Not Applicable	6010B, 6020	8 or 16 oz glass or polyethylene container, storage at 4°C, 6 months
Mercury (CVAA)	Water	100 mL	245.1	1 liter glass or polyethylene container, HNO_3 to pH $\leq$ 2, 28 days	7470A	1 liter glass or polyethylene container, HNO_3 to pH $\leq$ 2, 28 days
	Solid	200 g	245.5	8 or 16 oz glass or polyethylene container, Cool, 4°C, 28 days	7471A	8 or 16 oz glass or polyethylene container, Cool, 4°C, 28 days (CORP-MT-0007)
	Waste	200 g	--	Not Applicable	7471A	8 or 16 oz glass or polyethylene container, Cool, 4°C, 28 days (CORP-MT-0007)

Footnotes

(1) Minimum sample size indicates sample amount needed for a single analysis. Matrix spikes or duplicates will require an additional sample amount of at least this amount for each additional QC sample aliquot required.
(2) National Pollutant Discharge Elimination System - MCAWW, March 1983.
(3) Holding times are calculated from date of collection.
(4) Resource Conservation and Recovery Act, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (SW-846), Third Edition, September 1986. Contains Final Update I (July 1992), Final Update IIA, (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996).
(5) Solid matrix type includes soil, sediment, sludge and other solid materials not classified as waste.
(6) Samples to be analyzed for cyanide should be field-tested for residual chlorine. If residual chlorine is detected, ascorbic acid should be added.
(7) Method not listed in 40 CFR Part 136.
(8) If not done in the field (ASAP) per the method and requested by client, analyze in lab within 48 hours.

Table 23-2

Organic Sample Containers, Preservatives, and Holding Times

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Aromatic Volatiles	Water	40 mL	602	40 mL glass, VOA vial (in triplicate) with Teflon®-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 7 days with pH > 2, 14 days with pH ≤ 2	8021B	40 mL glass, VOA vial (in triplicate) with Teflon®-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 1:1 HCl to pH ≤ 2, 14 days with pH ≤ 2
	Solid[5]	5 g or 25 g	--	Not Applicable	8021B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis. Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate).Cool, 4°C (See Note 12 Page 136 for holding time.)
	Waste	5 g or 25 g	--	Not Applicable	8021B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis.

Table 23-2

Organic Sample Containers, Preservatives, and Holding Times – con't

Analytical Parameters	Matrix	Minimum Sample Size[1]	Method	NPDES[2], [3]		RCRA (SW846)[3], [4]
				Requirements	Method[6]	Requirements
Aromatic Volatiles (continued)	Waste	5 g or 25 g	--	Not Applicable	8021B	Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate). Cool, 4°C. (See Note 12 Page 136 for holding time.)
Halogenated Volatiles By GC	Water	40 mL	601	Not Applicable	8021B	40 mL glass, VOA vial (in triplicate) with Teflon®-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 1:1 HCl to pH ≤ 2, 14 days
	Solid[5]	5 g or 25 g	601		8021B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis. Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate). Cool, 4°C. (See Note 12 Page 136 for holding time.)

Table 23-2

Organic Sample Containers, Preservatives, and Holding Times – con't

Analytical		Minimum Sample	NPDES[2], [3]		RCRA (SW846)[3], [4]	
Parameters	**Matrix**	**Size[1]**	**Method**	**Requirements**	**Method[6]**	**Requirements**
Nitrosamines	Water	1L	607 [10]	1 liter amber glass with Teflon®-lined lid, Sodium thiosulfate or ascorbic acid if residual chlorine present, Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction	8070A	1 liter amber glass with Teflon®-lined lid. If residual chlorine present, add 3 mL sodium thiosulfate per gallon. Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction
Nitrosamines	Soil	30 g	--		8070A	4 or 8 oz glass widemouth with Teflon®-lined lid, Cool 4 °C, Extraction, 14 days Analysis, 40 days of the start of the extraction
Herbicides	Water	1L	615 [10]	1 liter amber glass with Teflon®-lined lid, Sodium thiosulfate or ascorbic acid if residual chlorine present, Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction	8151A	1 liter amber glass with Teflon®-lined lid. If residual chlorine present, add 3 mL sodium thiosulfate per gallon. Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction
	Solid	50 g	--	Not Applicable	8151A	4 or 8 oz glass widemouth with Teflon®-lined lid, Cool 4 °C, Extraction, 14 days Analysis, 40 days of the start of the extraction
Nitroaromatics	Water	0.5L	--	Not Applicable	8330	1 liter amber glass with Teflon®-lined lid. If residual chlorine present, add 3 mL sodium thiosulfate per gallon. Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction
	Solid	25 g	---	Not Applicable	8330	4 or 8 oz glass widemouth with Teflon®-lined lid Cool, 4°C, Extraction, 14 days Analysis, 40 days of the start of the extraction

Table 23-2

Organic Sample Containers, Preservatives, and Holding Times – con't

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Nitroaromatics (continued)	Waste	25 g	---	Not Applicable	8330	4 or 8 oz glass widemouth with Teflon®-lined lid Cool, 4 °C, Extraction, 14 days Analysis, 40 days of the start of the extraction
Organo-phosphorus Pesticides	Water	1L	---	Not Applicable	8141A	1 liter amber glass with Teflon®-lined lid. If residual chlorine present, add 3 mL sodium thiosulfate per gallon. Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction
	Solid	30 g	---	Not Applicable	8141A	4 or 8 oz glass widemouth with Teflon®-lined lid Cool, 4°C, Extraction, 14 days Analysis, 40 days of the start of the extraction
	Waste	30 g	---	Not Applicable	8141A	4 or 8 oz glass widemouth with Teflon®-lined lid, Cool, 4°C, Extraction, 14 days Analysis, 40 days of the start of the extraction
PAHs by GC and HPLC	Water	1L	610	1 liter amber glass with Teflon®-lined lid, Adjust pH to 5-9 if extraction not to be done within 72 hours of sampling. Add sodium thiosulfate if residual chlorine present. Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction	8310	1 liter amber glass with Teflon®-lined lid, If residual chlorine present, add 3 mL sodium thiosulfate per gallon, Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction

Table 23-2

Organic Sample Containers, Preservatives, and Holding Times – con't

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
PAHs by GC and HPLC (continued)	Solid	30 g	---	Not Applicable	8310	4 or 8 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction, 14 days Analysis, 40 days of the start of the extraction
	Waste	30 g	---	Not Applicable	8310	4 or 8 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C Extraction, 14 days Analysis, 40 days of the start of the extraction
Pesticides/ PCBs	Water	1L	608	1 liter amber glass with Teflon®-lined lid, Adjust pH to 5-9 if extraction not to be done within 72 hours of sampling. Add sodium thiosulfate if residual chlorine present and aldrin is being determined. Cool, 4°C, Extraction, 7 days Analysis, 40 days after extraction	8081A 8082	1 liter amber glass with Teflon®-lined lid, If residual chlorine present, add 3 mL 10% sodium thiosulfate per gallon, Cool, 4°C, Extraction, 7 days Analysis, 40 days of the start of the extraction
	Solid	30 g	---	Not Applicable	8081A 8082	4 or 8 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction, 14 days Analysis, 40 days of the start of the extraction
	Waste	30 g	---	Not Applicable	8081A 8082	4 or 8 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C Extraction, 14 days Analysis, 40 days of the start of the extraction

Table 23-2

Organic Sample Containers, Preservatives, and Holding Times – con't

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Petroleum Hydrocarbons/Oil and Grease	Water	1L	413.1 413.2 418.1	1 liter glass, Cool, 4°C, HCl to pH <2, 28 days	9070	1 liter glass with Cool, 4°C, HCl to pH <2, 28 days
	Solid	---	---	Not Applicable	9071A	8 oz. glass with Teflon®-lined lid, Holding Time not specified
	Waste	---	---	Not Applicable	9071A	8 oz. glass with Teflon®-lined lid, Holding Time not specified
	Water	1 L	1664[7]	1 liter glass, Cool, 0-4°C HCl or H_2SO_4 to pH <2 28 days	---	---
	Solid	30 g	1664[7]	8 or 16 oz. wide mouth glass jar, Cool, 0-4°C, 28 days	---	---
	Waste	---	---	Not Applicable	---	---

TABLE 23-2

Organic Sample Containers, Preservatives, and Holding Times – Con't

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Semivolatiles	Water	1L	625	1 liter amber glass with Teflon®-lined lid, Cool, 4°C, Extraction, 7 days Analysis, 40 days	8270C	1 liter amber glass with Teflon®-lined lid, If residual chlorine present, add 3 mL sodium thiosulfate per gallon, Cool, 4°C, Extraction, 7 days Analysis, within 40 days of extraction
	Solid	30 g	---	Not Applicable	8270C	8 or 16 oz glass wide mouth with Teflon-lined lid, Cool, 4°C, Extraction, 14 days Analysis, within 40 days of extraction
	Waste	30 g	---	Not Applicable	8270C	8 or 16 oz glass wide mouth with Teflon®-lined lid, Cool, 4°C, Extraction, 14 days Analysis, within 40 days of extraction
Volatile Organics	Water	40 mL	624	40 mL glass, VOA vial (in triplicate) with Teflon®-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 7 days with pH > 2, 14 days with pH ≤ 2[8]	8260B	40 mL glass, VOA vial (in triplicate) with Teflon®-lined septa without headspace, Cool, 4°C, Add sodium thiosulfate if residual chlorine, 1:1 HCl to pH ≤ 2, 14 days with pH ≤ 2[9]

TABLE 23-2

Organic Sample Containers, Preservatives, and Holding Times – Con't

Analytical Parameters	Matrix	Minimum Sample Size[1]	NPDES[2], [3]		RCRA (SW846)[3], [4]	
			Method	Requirements	Method[6]	Requirements
Volatile Organics (continued)	Solid[5]	5 g or 25 g	--	Not Applicable	8260B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis. Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate). Cool, 4°C. (See Note 12 Page 136 for holding time.)
	Waste	5 g or 25 g	--	Not Applicable	8260B	4 or 8 oz glass with Teflon®-lined lid, Cool 4 °C, 14 days. Field preserved with sodium bisulfate solution for low level analysis, or with methanol for medium level analysis. Soil sample can also be taken by using the EnCore™ sampler and preserved in the lab within 48 hours of sampling. Maximum holding time for Encore Sampler is 48 hours (before the sample is added to methanol or sodium bisulfate). Cool, 4°C. (See Note 12 Page 136 for holding time.)

TABLE 23-2

Organic Sample Containers, Preservatives, and Holding Times Footnotes

Footnotes

(1) Minimum sample size indicates sample amount needed for a single analysis. Matrix spikes or duplicates will require an additional sample amount of at least this amount for each additional QC sample aliquot required.

(2) National Pollutant Discharge Elimination System - 40 CFR Part 136, Appendix A.

(3) Holding times are calculated from the date of collection.

(4) Resource Conservation and Recovery Act, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition, September 1986. Contains Final Update I (July 1992), Final Update IIA (August 1993), Final Update II (September 1994), Final Update IIB (January 1995), and Final Update III (December 1996).

(5) Solid matrix type includes soil, sediment, sludge or other solids not classified as waste.

(6) Only one determination method is listed when separate methods are required for preparation and analysis.

(7) **Method 1664 was promulgated by the EPA with an effective date of June 14, 1999.**

(8) **For acrolein and acrylonitrile the pH should be adjusted to 4-5. This pH adjustment is not required if acrolein is not measured. Samples requiring analysis of acrolein that received no pH adjustment must be analyzed within three days of sampling.**

(9) **For acrolein and acrylonitrile the pH should be adjusted to 4-5.**

(10) Method not listed in 40 CFR Part 136.

(11) Should only be used in the presence of residual chlorine.

(12) Depending on regulatory programs, EnCore™ samplers may be preserved for up to 14 days from sampling by freezing at -5 to -12°C until analysis. Alternatively the EnCore™ sample may be transferred to a 40-ml VOA vial and preserved by freezing at -5 to -12°C until analysis. Some regulatory agencies may require 4 or 8 oz glass with Teflon®-lined lid, Cool 4°C, 14 days. This technique is not recommended, but will be supported where required. (Preservation and holding times are subject to client specifications.)

TABLE 23-3
Sample Containers, Preservatives, and Holding Times for TCLP[1] and SPLP[2]

Analytical Parameters	Matrix	Minimum Sample Size[3]	TCLP Method 1311 and SPLP Method 1312 Requirements	
			From Field Collection to TCLP/SPLP Extraction	From TCLP/SPLP Extraction to Analysis
Mercury	Liquid Solid Waste	1L	1L glass, Cool, 4°C, 28 days	Glass or polyethylene 28 days
Metals (except mercury)	Liquid Solid Waste	1L	1L glass, Cool, 4°C, 180 days	Glass or polyethylene 180 days
Semivolatiles	Liquid Solid Waste	1L	1L glass, Cool 4°C, 14 days	1L glass Extraction of leachate within 7 days of TCLP extraction, Analyze extract within 40 days
Volatiles	Liquid Solid Waste	6 oz	4 oz glass, Cool 4°C, 14 days	40 mL glass, 14 days

Footnotes

(1) TCLP = Toxicity Characteristic Leaching Procedure
(2) SPLP = Synthetic Precipitation Leaching Procedure
(3) Smaller sample size is adequate for solid samples or individual fractions. A combined volume of 32 oz. is recommended for semivolatiles and metals. A separate 4 oz. container should always be used for the volatile fraction. Volatile fractions should be stored with minimal headspace.

SECTION 24

HANDLING OF SAMPLES
(NELAC 5.5.8)

Sample management procedures at TestAmerica Denver ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

24.1 CHAIN OF CUSTODY (COC)

The COC form is the written documented history of any sample and can be initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 24-1.

24.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 24-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

The samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. Samples are only considered to be received by lab when personnel at the laboratory have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The receipt from the courier is stored in log-in by date; it lists all receipts each date.

24.1.2 Legal / Evidentiary Chain-of-Custody

All samples are tracked through the sample utility software program "STU" to ensure internal chain of custody and cradle to grave tracking of each sample container. If samples are identified for legal/evidentiary purposes on the COC, login will complete the custody seal (Figure 24-2), retain the shipping record with the COC, and an internal COC for analysts to fill out and sample disposal record from STU (Figures 24-3 and 24-4) will be included in the data package.

24.2 SAMPLE RECEIPT

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections. Refer to SOP DV-QA-0003, *Sample Management and Chain of Custody*.

24.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on Condition Upon Receipt Anomaly Form (CUR Figure 24-6) and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

24.2.1.1 Inspection of samples include a check for (see Figure 24-5):

- Complete documentation to include sample identification, location, date and time of collection, collector's name, preservation type, sample type and any additional comments concerning the samples.
- Complete sample labels to include unique identification in indelible ink.
- Use of appropriate sample containers (see Section 23)

- Adherence to holding times as specified in the test method and/or summarized in Section 23.
- Adequate sample volume for required analyses (see Section 23).
- Damage or signs of contamination to sample container. Volatile vials are also inspected for headspace

24.2.1.2 Using the infrared temperature gun, check and record the temperature of the samples (use temperature blanks if present) to verify appropriate thermal preservation. Record the temperature on both the chain of custody (Figure 24-1) and the sample receiving checklist (Figure 24-5).

- Samples shall be deemed acceptable if arrival temperature is just above freezing and less than or equal to 6.0° C, or ≥ -20° C if shipped frozen (encores). Samples that are hand-delivered immediately after collection may not be at the required temperatures; however, if there is evidence that the chilling process has begun, such as the arrival on ice, the samples shall be considered acceptable. This will be documented on the CUR (Figure 24-6).

- If the samples were shipped in ice and solid ice is still present and in direct contact with samples, report the samples as "received on ice." Direct contact means samples must be surrounded by ice cubes or crushed ice. Ice present in a plastic bottle or other container does not constitute direct contact. Samples shipped with only “blue ice” may not be reported as “received on ice”.

24.2.1.3 Verify sample preservation as specified in the test method. Check for correct pH as specified in the test method. The results are documented on the CUR form (Figure 24-5). In the case of volatiles it is recorded after analysis on the instrument run log. Chlorine is checked on samples requiring extractable organics, BOD, TOX, cyanide, fluoride, ammonia, TKN, CBOD and Nitrate; presence or absence is recorded. The need for a residual chlorine check is noted on the sample receiving checklist by the project manager during the cooler greeting process.

24.2.1.4 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

24.2.1.5 If samples are received without a COC, TestAmerica will provide a generic COC form to be completed by the client when the samples are brought to the laboratory. The client is always provided with a copy of the completed COC form for their records.

24.2.1.6 If analyses with short holding times are requested, the dates and times are inspected to ensure that holding times have not already expired.

24.2.1.7 Only department of transportation (DOT) trained staff may receive samples, so it is imperative that samples are dropped during normal working hours, or special arrangements are made with the project manager. If an attempt is made to drop

samples after hours without arrangements to have DOT trained staff available, the laboratory staff will be unable to accept them.

24.2.1.8 Any deviations from the checks described in Section 24.2.1 that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance criteria (Section 24.3) are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or
- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Note: North Carolina requires that they be notified when samples are processed that do not meet sample acceptance criteria.

24.2.2 Sample Log-in

All samples that are received by the laboratory are logged into the LIMS and the Sample Transfer Utility program (STU) to allow the laboratory to track and evaluate sample progress. Each group of samples that are logged in together (typically one project from a given client/sampling event) is assigned a unique job number. Within each job, each sampling point (or sample) receives a unique number. Sample numbers are generated sequentially over time, and are not re-assigned. A sample may be composed of more than one bottle since different preservatives may be required to perform all analyses requested. Even if multiple containers are received for a single sample, each container is uniquely identified with an 6-digit workorder number added to the sample number. The LIMS generates sample labels that are attached to each bottle for a given sample.

Each job/set of samples is logged into LIMS with a minimum of the following information:

- Client Name, Project Name, Address, Phone, Fax, Report to information, invoice to information (most of this information is “default information” that is stored in the LIMS).
- Date and time sampled;
- Date and time received;
- Job and/or project description, sample description;
- Sample matrix, special sample remarks;
- Reporting requirements (i.e., QC level, report format, invoicing format);
- Turn-around-time requirements;
- Parameters (methods and reporting limits or MDLs are default information for a given parameter)

24.3 SAMPLE ACCEPTANCE POLICY

The laboratory has a written sample acceptance policy (Figure 24-5) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- Cooler seals intact;
- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method;
- sample holding times must be adhered to;
- all samples submitted for water/solid Volatile Organic analyses must have a Trip Blank submitted at the same time;
- the project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined. A copy of the sample acceptance policy is provided to each client prior to shipment of samples.

24.4 SAMPLE STORAGE

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators suitable for the sample matrix, except metals sample containers which may be stored unrefrigerated. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator, document the transfer of containers in STU and place them on carts, analyze the sample, and return the remaining sample to the refrigerator from which it originally came, documenting the return in STU. Empty containers are stored in the sample archive area until disposal, this transfer is documented in STU. All samples are kept in the refrigerators until the project is invoiced. At this time, the samples will be retained for an additional thirty days, either in the refrigerators, or in the sample archive area. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues. Upon disposal, the drum number used for disposal is logged into STU.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

24.5 HAZARDOUS SAMPLES AND FOREIGN SOILS

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples are stored in a designated area. For any sample that is known to be hazardous at the time of receipt or, if after completion of analysis the result exceeds the acceptable regulatory levels, the analyst will notify login staff so the hazardous sample is properly labeled as such. The sample itself is clearly marked with a label reading “HAZARDOUS”, “PCBs” or “FOREIGN SOIL”. All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm. All foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility, refer to SOP DV-QA-0019, *Quarantine Soils Procedure* for more detail.

24.6 SAMPLE SHIPPING

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses. The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

24.7 SAMPLE DISPOSAL

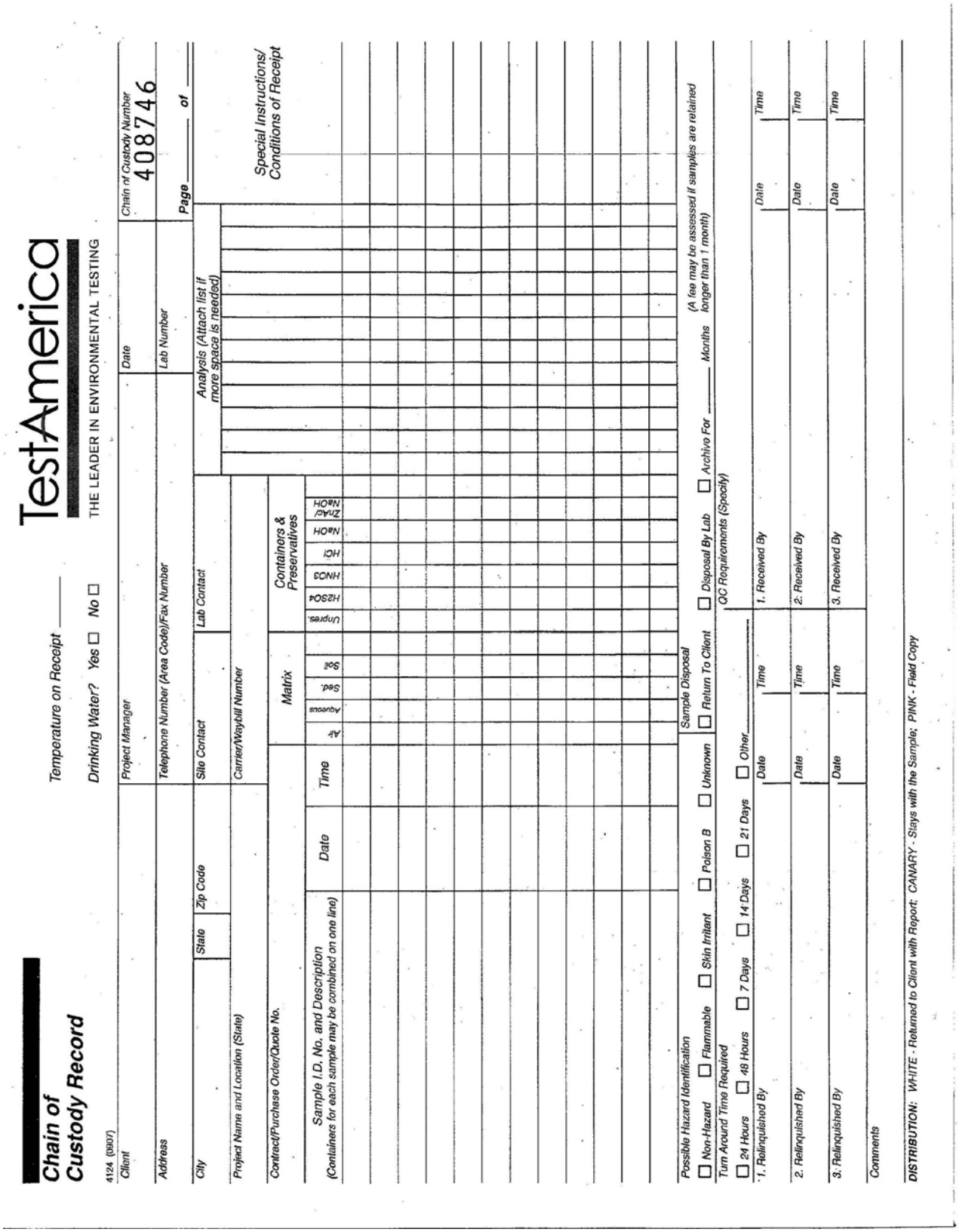
Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory’s waste disposal procedures (SOP: *DV-HS-0005, Excess Sample Material Management.* All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than six weeks from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

All documentation and correspondence concerning the disposal of samples is kept on file. The STU software allows tracking for each sample container from the time of sample receipt through the disposal process, including such detail as the identifying number of the waste drum used for disposal. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Hazardous Waste Manifest will be prepared to document the

disposal of each drum, see Figure 24-7 for labeling of drums for disposal. Additional detail is in SOP DV-HS-0004, *Hazardous Waste Manifesting*.

Figure 24-1.

TestAmerica Denver: Chain of Custody (COC)



Chain of Custody Record

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

4124 (0907)

Temperature on Receipt _____

Drinking Water? Yes ☐ No ☐

Chain of Custody Number 408746

Page _____ of _____

Client | Project Manager | Date

Address | Telephone Number (Area Code)/Fax Number | Lab Number

City | State | Zip Code | Site Contact | Lab Contact

Project Name and Location (State) | Carrier/Waybill Number

Contract/Purchase Order/Quote No.

Matrix: Air, Aqueous, Sed., Soil

Containers & Preservatives: Unpres., H2SO4, HNO3, HCl, NaOH, ZnAc/NaOH

Analysis (Attach list if more space is needed)

Special Instructions/ Conditions of Receipt

Sample I.D. No. and Description (Containers for each sample may be combined on one line) | Date | Time

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 1 month)

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

QC Requirements (Specify)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

1. Relinquished By | Date | Time | 1. Received By | Date | Time

2. Relinquished By | Date | Time | 2. Received By | Date | Time

3. Relinquished By | Date | Time | 3. Received By | Date | Time

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Figure 24-2.

Example: Custody Seal

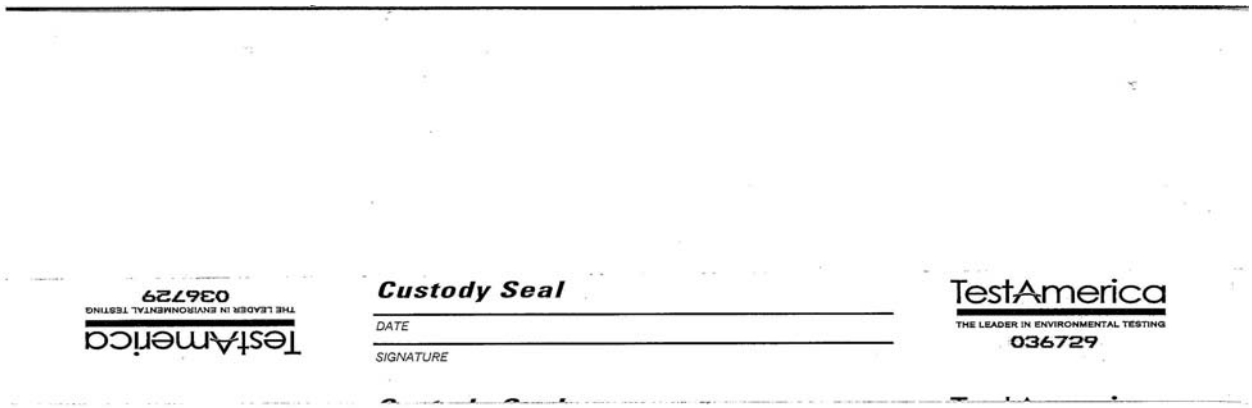


Figure 24-3.
Example: Internal Chain of Custody

Internal Chain-of-Custody ***TestAmerica Denver***

TestAmerica Lot #	**Initial Receipt Date**	**Sample Custodian Initials**
	Samples Stored in Sample Receiving Walk-In	
Sample #s	Location in Walk-In (or Satellite area for strict internal COC samples)	Matrix

Sample #s	Department	Test(s)	Matrix	Date/Time Out	Analyst Initials	Date/Time In	Analyst Initials

Satellite Area Sample Transfers

Satellite Area		**Sample Numbers**	**Transfer Date**	**Storage Location**	**Received by**	**2nd Transfer Date**	**2nd Storage Location**	**Archive Date**	**Archived By**
Aquatic Toxicology									
Metals (aqueous, non-AFCEE)									
GC Volatiles	Water								
	Solid								
MS Volatiles	Water								
	Solid								

C=Comsumed, B=Broken, T=Transfer, LA=Liter Amber, LP=Liter Poly, MDP=Multiple Day Preparation

Figure 24-4.
Example: Disposal Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Transfer Audit Report

Test America - Denver
4955 Yarrow Street
Arvada, CO 80002

LotID	ClientSampID	ContainerID	EventID	ClientName	ClientCd	Quote	TranferType	TransferTime	UserName	StorageLoc	DrumNewLoc	ContType
D7J2302212-001	TF2-MW-01	J9L8R-001	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-001	TF2-MW-01	J9L8R-001	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-001	TF2-MW-01	J9L8R-002	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-001	TF2-MW-01	J9L8R-002	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-001	TF2-MW-01	J9L8R-003	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-001	TF2-MW-01	J9L8R-003	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-002	TF2-MW-02	J9L8W-001	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-002	TF2-MW-02	J9L8W-001	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-002	TF2-MW-02	J9L8W-002	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-002	TF2-MW-02	J9L8W-002	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-002	TF2-MW-02	J9L8W-003	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-002	TF2-MW-02	J9L8W-003	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-003	TF2-MW-03	J9L8X-001	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-003	TF2-MW-03	J9L8X-001	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-003	TF2-MW-03	J9L8X-002	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-003	TF2-MW-03	J9L8X-002	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-003	TF2-MW-03	J9L8X-003	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-003	TF2-MW-03	J9L8X-003	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-004	TF2-MW-06	J9L81-001	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-004	TF2-MW-06	J9L81-001	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-004	TF2-MW-06	J9L81-002	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-004	TF2-MW-06	J9L81-002	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-004	TF2-MW-06	J9L81-003	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-004	TF2-MW-06	J9L81-003	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-005	TF2-MW-10	J9L85-001	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-005	TF2-MW-10	J9L85-001	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-005	TF2-MW-10	J9L85-002	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-005	TF2-MW-10	J9L85-002	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-005	TF2-MW-10	J9L85-003	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-005	TF2-MW-10	J9L85-003	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-006	TF2-MW-11M	J9L86-001	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-006	TF2-MW-11M	J9L86-001	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-006	TF2-MW-11M	J9L86-002	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-006	TF2-MW-11M	J9L86-002	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-006	TF2-MW-11M	J9L86-003	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	
D7J2302212-006	TF2-MW-11M	J9L86-003	57366		404697	55443	Relocate	12/05/2007 14:11	Chavez, Lawrence	NF	A09	
D7J2302212-006	TF2-MW-11M	J9L86-004	51414		404697	55443	Login	10/23/2007 13:07	Bindel, Aaron	NF	NA	

12/12/2007 18:50 Page 1 of 2

Figure 24-5. Sample Receiving Checklist Page 1

Lot #:_____ Date/Time Received:_____

Company Name & Sampling Site:_____

PM to Complete This Section: *Yes* *No* *Yes* *No*
Residual chlorine check required:❑ ❑ Quarantined : ❑ ❑

Quote #:

Special Instructions:

Time Zone:
• EDT/EST • CDT/CST • MDT/MST • PDT/PST • OTHER

Unpacking Checks:

Cooler #(s): _____ _____ _____ _____ _____ _____ _____ _____

Temperatures (°C): _____ _____ _____ _____ _____ _____ _____ _____

N/A	*Yes*	*No*		*Initials*
❑	❑	❑	1. Cooler seals intact? (N/A if hand delivered) If no, document on CUR.	_____
	❑	❑	2. Chain of custody present? If no, document on CUR.	
	❑	❑	3. Bottles broken and/or are leaking? If yes, document on CUR.	
	❑	❑	4. Multiphasic samples obvious? If yes, document on CUR.	
	❑	❑	5. Proper container & preservatives used? (ref. Attachment D of SOP# DEN-QA-0003) If no, document on CUR.	
❑	❑	❑	6. pH of all samples checked and meet requirements? If no, document on CUR.	
	❑	❑	7. Sufficient volume provided for all analysis requested? (ref. Attachment D of SOP# DEN-QA-0003) If no, document on CUR, and contact PM before proceeding.	
	❑	❑	8. Did chain of custody agree with labels ID and samples received? If no, document on CUR.	
❑	❑	❑	9. Were VOA samples without headspace? If no, document on CUR.	
❑	❑	❑	10. Were VOA vials preserved? Preservative ❑HCl ❑4±2°C ❑Sodium Thiosulfate ❑ Ascorbic Acid	
	❑	❑	11. Did samples require preservation with sodium thiosulfate?	
❑	❑	❑	12. If yes to #11, did the samples contain residual chlorine? If yes, document on CUR.	
❑	❑	❑	13. Sediment present in dissolved/filtered bottles? If yes, document on CUR.	
❑	❑	❑	14. Is sufficient volume provided for client requested MS, MSD or matrix duplicates? If no, document on CUR, and contact PM before proceeding.	
	❑	❑	15. Receipt date(s) > 48 hours past the collection date(s)? If yes, notify PA/PM.	
	❑	❑	16. Are analyses with short holding times requested?	
	❑	❑	17. Was a quick Turn Around (TAT) requested?	

Figure 24-5. Sample Receiving Checklist Page 2

Lot #_____

Login Checks: *Initials*

N/A *Yes* *No* _____

❑ ❑ 18. Sufficient volume provided for all analysis requested? (ref. Attachment D of SOP# DEN-QA-0003) If no, document on CUR, and contact PM before proceeding.

❑ ❑ ❑ 19. Is sufficient volume provided for client requested MS, MSD or matrix duplicates? If no, document on CUR, and contact PM before proceeding.

❑ ❑ 20. Did the chain of custody includes "received by" and "relinquished" by signatures, dates, and times?

❑ ❑ ❑ 21. Were special log in instructions read and followed?

❑ ❑ ❑ 22. Were AFCEE metals logged for refrigerated storage?

❑ ❑ 23. Were tests logged checked against the COC? Which samples were confirmed? _____

❑ ❑ ❑ 24. Was a Rush form completed for quick TAT?

❑ ❑ ❑ 25. Was a Short Hold form completed for any short holds?

❑ ❑ 26. Were special archiving instructions indicated in the General Comments? If so, what were they?

_____

Labeling and Storage Checks: *Initials*

_____

❑ ❑ ❑ 28. Was the subcontract COC signed and sent with samples to bottle prep?

❑ ❑ 29. Were sample labels double-checked by a second person?

❑ ❑ ❑ 30. Were sample bottles and COC double checked for dissolved/filtered metals by a second person?

❑ ❑ 31. Did the sample ID, Date, and Time from label match what was logged?

❑ ❑ ❑ 32. Were stickers for special archiving instructions affixed to each box and to the ICOC? See #27

❑ ❑ ❑ 33. Were AFCEE metals stored refrigerated?

Document any problems or discrepancies and the actions taken to resolve them on a Condition Upon Receipt Anomaly Report (CUR).

FIGURE 24-6 CONDITION UPON RECEIPT ANOMALY REPORT (CUR)

TestAmerica Denver
Condition Upon Receipt Anomaly Report (CUR)

Lot No : _____ Date/Time:_____

Client : _____ Initiated by: _____

Affected Samples COC#_____

Client ID	Lab ID	Analyses Requested

CONDITION/ANOMALY/VARIANCE (CHECK ALL THAT APPLY):

❑COOLERS
- ❑Received, No Chain of Custody (COC)
- ❑Not Received but COC(s) Available
- ❑Leaking
- ❑Other: _____

❑ TEMPERATURE (greater than 6° C)
- ❑Cooler Temp_____
- ❑Temperature Blank _____

❑CONTAINERS
- ❑Leaking
- ❑Broken
- ❑Extra
- ❑Without Labels
- ❑VOA Vials with Headspace _____mm
- ❑Other: _____

❑CUSTODY SEALS (COOLER(S)/CONTAINER(S)
- ❑None
- ❑ Not Intact
- ❑Other: _____

❑CHAIN OF CUSTODY (COCs)
- ❑Not relinquished by Client; No date/time Relinq.
- ❑ Incomplete Information
- ❑Other: _____

❑ CONTAINER LABELS
- ❑Not the same ID/info as in COC
- ❑ Incomplete

❑ID COLLECTION ❑Time ❑Date ❑PRESERVATIVE

- ❑ Markings/Info smeared or illegible
- ❑Torn
- ❑Other: _____

❑ SAMPLES

❑Samples NOT RECEIVED but listed on COC ------ ❑will be noted on COC ❑Client to send samples with new COC
- ❑Samples received but NOT LISTED on COC
- ❑Logged based on Label Information
- ❑Logged based on info from other samples on COC
- ❑ Logged according to Work Plan
- ❑Logged on HOLD UNTIL FURTHER NOTICE
- ❑ Other: _____ _____

- ❑ Trip Blank received, not on COC, _____vials received
- ❑ Mislabeled as to tests, preservatives, etc.
- ❑Holding time expired
- ❑ Improper container used
- ❑Not preserved / Improper preservative used
- ❑ Improper pH _____ ❑ Lab to preserve sample
- ❑ Insufficient quantities for analysis

Comments:_____
_____
_____

Corrective Action:
- ❑ Client Informed: verbally on: _____By: _____: In writing on: _____ By: _____
- ❑ Sample(s) processed "as is". _____
- ❑ Sample(s) on hold until: _____ If released, notify: _____

Sample Control Supervisor Review: _____ Date: _____

Project Management Review: _____ Date: _____

FIGURE 24-7 Labeling for Waste Disposal

Shipping Label Requirements for Waste

Waste Code	Waste Stream	Drum Type	Label information	DOT Label
A	**Expired Extract Vials**	**Steel- 0pen Head**	**RQ WasteSolids containing Flammable Liquids, n.o.s (Hexane, Acetone, Methanol), 4.1, UN3175, PGII, (D001)**	**Flammable Solid, Class 4.1**
B	**Waste Dichlormethane**	**Steel- Bung Top**	**Waste Dichloromethane, 6.1, UN1593, PG III, (Methylene Chloride), F002**	**Toxic, Class 6.1**
C	**Flammable Solvent**	**Steel-Bung Top**	**RQ Waste Flammable Liquids, n.o.s. (Hexane, Acetone), 3, UN1993, PG II, (D001)**	**Flammable Liquid, Class 3**
D	**Sodium Sulfate**	**Steel-Open Head**	**Non DOT Regulated Material, (Sodium Sulfate)**	**None**
E	**Aqueous Alkaline**	**HDPE-Bung Top**	**RQ, Waste Corrosive Liquids, basic, Inorganic, n.o.s. (Sodium Hydroxide), 8, UN3266, PG II, (D002)**	**Corrosive, Class 8**
F	**Aqueous Acidic**	**HPDE-Bung Top**	**RQ Waste Corrosive Liquid, Acidic, Inorganic, n.o.s. (Sulfuric Acid, Hydrochloric Acid), 8, UN3264, PG II (D002)**	**Corrosive, Class 8**
G	**Aqueous Acidic**	**HDPE-Bung Top**	**Pending Characterization/Process Knowledge**	**Pending Characterization/process knowledge**
H	**Aqueous Acidic**	**HDPE-Bung Top**	**RQ Waste Corrosive Liquid, Acidic, Inorganic, n.o.s. (Sulfuric Acid, Hydrochloric Acid), 8, UN3264, PG II (D002)**	**Corrosive, Class 8**
I	**COD Vials**	**HDPE- Open Head**	**RQ Waste Sulfuric Acid Solution (Sulfuric acid, Chromium, Mercury, Silver) 8, UN1830, PG II, (D002,D007,D009,D011)**	**Corrosive, Class 8**
J	**Aqueous Acidic**	**HDPE-Bung Top**	**Pending Characterization/Process Knowledge**	**Pending Characterization/process knowledge**
M	**Miscellaneous Waste**	**Variable**	**Pending Characterization/process knowledge**	**Pending Characterization/process knowledge**
O	**Used Pump Oil**	**HDPE-Bung Top**	**Non-RCRA Regulated Material, (Pump Oil)**	**None**
P	**Solid Laboratory Waste**	**Steel- Open Head**	**Environmentally Hazardous Substances, Solid, n.o.s. 9, UN3077, PG III, (Soil, Anhydrous, Rubber Gloves)**	**Miscellaneous Dangerous Goods, Class 9**

Shipping Label Requirements for Waste

Waste Code	Waste Stream	Drum Type	Label information	DOT Label
S	**Excess Sample – Solid**	**Steel- Open Head**	**Non DOT Regulated Material, (Soil Samples)**	**Pending Characterization/process knowledge**
W	**Excess Sample – Aqueous**	**HDPE-Bung Top**	**Pending Characterization/process knowledge**	**Pending Characterization/process knowledge**
RAD followed by the Waste Code Listed Above	**Radioactive (RAD) –Could Apply to Any of the Waste Streams Listed Above**	**Per 49 CFR 171 –173 and TSDF**	**Per 49 CFR 171 –173 and TSDF**	**Per 49 CFR 171-173 and TSDF**

Note: If characterization determines a waste is hazardous, labeling shall meet the requirements of 49 CFR 171-180. This table does not supersede 49 CFR 171-180.

SECTION 25.0

ASSURING THE QUALITY OF TEST RESULTS
(NELAC 5.5.9)

25.1 OVERVIEW

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 21, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

25.2 CONTROLS

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

25.3 NEGATIVE CONTROLS

25.3.1 **Method Blanks** are used to assess preparation and analysis for possible contamination during the preparation and processing steps.

25.3.2 The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples.

25.3.3 The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).

25.3.4 The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.

25.3.5 Evaluation criteria and corrective action for method blanks is defined in the specific standard operating procedure for each analysis. Generally, corrective action is taken if the concentration of a target analyte in the blank is at or above the reporting limit.

- The source of contamination is investigated

- Measures are taken to minimize or eliminate the source of the contamination
- Affected samples are reprocessed or the results are qualified on the final report.

25.3.6 **Calibration Blanks** are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.

25.3.7 **Instrument Blanks** are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

25.3.8 **Trip Blanks** are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses. Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples. Trip Blanks are also sometimes referred to as Travel Blanks.

25.3.9 **Field Blanks** are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)

25.3.10 **Equipment Blanks** are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)

25.3.11 **Holding Blanks**, also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory (refer to section 24.4 and SOP DV-QA-0013, *Refrigerator Blank and Trip Blank Monitoring*).

25.3.12 **Field blanks**, equipment blank and trip blanks, when received, are analyzed in the same manner as other field samples. When known, blanks should not be selected for matrix QC, as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB".

25.3.13 Negative Controls for Microbiological Methods

Microbiological Methods utilize a variety of negative controls throughout the process to ensure that false positive results are not obtained. These controls are critical to the validity of the microbiological analyses. Some of these negative controls are: Sterility checks of media are analyzed for each lot of pre-prepared media, ready-to-use media and for each batch of medium prepared by the laboratory.

25.3.13.1 Filtration blanks are run at the beginning and end for each sterilized filtration unit used in a filtration series.

25.3.13.2 Sterility checks on sample containers are performed on at least one container per lot of purchased, pre-sterilized containers. Container sterility checks are performed using non-selective growth media.

25.3.13.3 Sterility checks are performed on each batch of pre-prepared dilution water. All checks are performed using non-selective growth media.

25.3.13.4 Sterility checks are also performed on at least one filter from each new lot of membrane filters using non-selective growth media.

25.3.13.5 Negative culture controls demonstrate that a media does not support the growth of non-target organisms and ensures that there is not an atypical positive reaction from the target organisms. Prior to the first use of the media, each lot of pre-prepared selective media or batch of laboratory prepared selective media is analyzed with at least one known negative culture control as appropriate to the method.

25.4 POSITIVE CONTROLS

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS), or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

25.4.1 Method Performance Control - Laboratory Control Sample (LCS)

25.4.1.1 The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

25.4.1.2 The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard may reported as the LCS.

25.4.1.3 Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

25.4.1.4 As stated in the opening of this section, the LCS goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).

25.4.1.5 The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

25.4.1.6 If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

25.4.1.6.1 For methods that have 1-10 target analytes, spike all components.

25.4.1.6.2 For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.

25.4.1.6.3 For methods with more than 20 target analytes, spike at least 16 components.

25.4.1.6.4 Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.

25.4.1.6.5 Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

25.4.1.7 **Accuracy Calculation**: Percent Recovery (%R) Calculation (applies to LCS, CCV, Surrogates, and Matrix Spikes.

$$\%R = \frac{AV}{TV} \times 100$$

Where: AV = Analyzed Value
TV = True Value

25.4.2 **Positive Controls for Microbiological Methods**

Prior to the first use of the media, each lot of pre-prepared media is tested with at least one pure culture of known positive reaction.

25.5 **SAMPLE MATRIX CONTROLS**

25.5.1 **Matrix Spikes (MS)**

25.5.1.1 The Matrix spike is used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used.

25.5.1.2 An MS is essentially a sample fortified with a known amount of the test analyte(s). At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects.

25.5.1.3 If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, a representative number of the listed components (see LCS analytes 25.4.1.6 above) may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit-specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

25.5.1.4 The percent recovery calculation for matrix spikes is essentially the same as the calculation shown in 25.4.1.7 except that:

AV = Sp – Sa

Where: Sp = Spike result

Sa = Sample result

25.5.2 Surrogate Spikes

25.5.2.1 Surrogate Spikes are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.

25.5.2.2 Surrogate compounds are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method (also refer to Section 25.5). Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.

25.5.3 Duplicates

25.5.3.1 For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure. Duplicate samples are usually analyzed with methods that do not require matrix spike analysis. LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

25.5.3.2 Precision Calculation (Relative Percent Difference - RPD)

$$RPD = \frac{|S - D|}{\frac{(S + D)}{2}} \times 100$$

Where: S=Sample Concentration
D=Duplicate Concentration

25.5.4 Internal Standards

25.5.4.1 In most organic analyses, internal standards are spiked into all environmental and quality control samples (including the initial calibration standards). An internal standard is also used with some metals analyses. It is typically added to sample extracts after the extraction (post-prep). The acceptance criteria in most methods are 50% to 200% of the responses in the mid-point of the corresponding calibration curve. Consult the method-specific SOPs for details on the internal standard compounds, calculations and acceptance criteria.

25.5.4.2 When the internal standard recoveries fall outside these limits, if there are not obvious chromatographic interferences, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets internal standard recovery criteria, the second run is reported (or both are reported if requested by the client).

25.6 ACCEPTANCE CRITERIA (CONTROL LIMITS)

25.6.1 Each individual analyte in the LCS, MS, or Surrogate Spike are evaluated against the control limits as published in the test method. Where there are no established acceptance criteria, the laboratory calculates control limits with the use of control charts or, in some cases, utilizes client project specific or regulatory mandated control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

25.6.2 Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating (e.g. EPA SW846 8000 series methods). Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

25.6.2.1 The lab should consider the effects of the spiking concentration control limits, and to avoid censoring of data. The acceptance criteria for recovery and precision are often a function of the spike concentration used. Therefore, caution must be used when pooling data to generate control limits.

25.6.2.2 Not only should the results all be from a similar matrix, but the spiking levels should also be approximately the same (within a factor of 2). Similarly, the matrix spike and surrogate results should all be generated using the same set of extraction, cleanup and analysis techniques. For example, results from solid samples extracted by ultrasonic extraction are not mixed with those extracted by Soxhlet.

25.6.2.3 The laboratory should try and avoid discarding data that do not meet a preconceived notion of acceptable performance. This results in a censored data set, which, when used to develop acceptance criteria, will lead to unrealistically narrow criteria. For a 99% confidence interval, 1 out of every 100 observations likely will still fall outside the limits. For methods with long analyte lists this may mean occasional failures every batch or two. While professional judgment is important in evaluating data to be used to develop acceptance criteria, specific results are not discarded simply because they do not meet one's expectations. However, data points shall be discarded if they were the result of human or mechanical error or sample concentration exceeded spike level by > 4x.

25.6.3 Laboratory generated % Recovery acceptance (control) limits are generally established by taking ± 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

25.6.3.1 Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

25.6.3.2 In-house limits cannot be any wider than those mandated in a regulated analytical method.

25.6.3.3 The lowest acceptable recovery limit will be 10% (the analyte must be detectable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable.

25.6.3.4 The maximum acceptable recovery limit will be 150%.

25.6.3.5 The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

25.6.3.6 If either the high or low end of the control limit changes by ≤ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

25.6.3.7 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. Refer to SOP DV-QA-003P for details.

25.6.4 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 13) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

25.6.4.1 The analyte results are below the reporting limit and the LCS is above the upper control limit.

25.6.4.2 If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

25.6.4.3 Or, for NELAC and Department Of Defense (DOD) work, there are an allowable number of Marginal Exceedances (ME):

- <11 analytes – 0 marginal exceedances are allowed.
- 11 – 30 Analytes – 1 marginal exceedance is allowed
- 31-50 Analytes – 2 marginal exceedances are allowed
- 51-70 Analytes – 3 marginal exceedances are allowed

- 71-90 Analytes – 4 marginal exceedances are allowed
- > 90 Analytes – 5 marginal exceedances are allowed

25.6.4.3.1 Marginal exceedances are recovery exceedances between 3 SD and 4 SD from the mean recovery limit (NELAC).

25.6.4.3.2 Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken. The laboratory has a system to monitor marginal exceedances to ensure that they are random.

25.6.4.3.3 Though marginal excedences may be allowed, the data must still be qualified to indicate it is outside of the normal limits.

25.6.5 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in Appendix 4 and in Section 13.

25.6.6 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

25.7 METHOD DETECTION LIMITS (MDLs)

MDLs, calculated as described in Section 20.7, are updated or verified annually, or more often if required by the method.

25.8 ADDITIONAL PROCEDURES TO ASSURE QUALITY CONTROL

25.8.1 The laboratory has written procedures to assure the accuracy of the test method including calibration (see Section 21), use of certified reference materials (see Section 22) and use of PT samples (see Section 16).

25.8.2 A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 20.

25.8.3 Use of formulae to reduce data is discussed in the method standard operating procedures and in Section 21.

25.8.4 Selection of appropriate reagents and standards is included in Section 9 and 22.

25.8.5 A discussion on selectivity of the test is included in Section 5.

25.8.6 Constant and consistent test conditions are discussed in Section 19.

25.8.7 The laboratories sample acceptance policy is included in Section 24.

25.8.8 A listing of the type of test result correlations that are looked at during report review (e.g. Total Chromium should be greater or equal to Hexavalent Chromium) is included in Section 20.13.4.5.

SECTION 26.0

REPORTING RESULTS
(NELAC 5.5.10)

26.1 OVERVIEW

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is a conflict between the client requested formats and accreditation requirements or data usability information, accreditation requirements and data usability information will take precedence over client requests. A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

Review of reported data is included in Section 20.

26.2 TEST REPORTS

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

26.2.1 A report title (e.g. Analytical Report For Samples) with a “sample results” column header.

26.2.2 The report cover page is printed on company letterhead, which includes the laboratory name, address and telephone number.

26.2.3 A unique identification of the report (e.g. lot number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: The total number of pages is indicated at the front of each report.

26.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.

- Any additional addenda to the report must be treated in a similar fashion so it is a recognizable part of the report and cannot accidentally get separated from the report (eg. Sampling information).

26.2.5 The name and address of client and a project name/number, if applicable.

26.2.6 Client project manager or other contact

26.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

26.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

26.2.9 Date reported or date of revision, if applicable.

26.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

26.2.11 Reporting limits.

26.2.12 Method detection limits (if requested)

26.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

26.2.14 Sample results.

26.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits.

26.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 26.2.4 – Item 3 regarding additional addenda).

26.2.17 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

26.2.18 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

26.2.19 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Signatories are appointed by the Lab Director.

26.2.20 When NELAC accreditation is required, the lab shall certify that the test results meet all requirements of NELAC or provide reasons and/or justification if they do not. For Example:

"The results included in this report have been reviewed for compliance with the laboratory QA/QC plan and meet all requirements of NELAC. All data have been found to be compliant with laboratory protocol and any exceptions are noted below. "

26.2.21 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

26.2.22 When Soil samples are analyzed, a specific identification as to whether soils are reported on a "wet weight" or "dry weight" basis.

26.2.23 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

26.2.24 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report "partial report", and that a complete report will follow once all of the work has been completed.

26.2.25 Any out of network subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All in-network subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

26.3 REPORTING LEVEL OR REPORT TYPE

TestAmerica Denver offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level I is a report with the features described in Section 26.2 above.
- Level II is a Level I report plus summary information, including results for the method blank reported to the laboratory MDL, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. All faxed reports are followed by hardcopy. Procedures used to ensure client confidentiality are outlined in Section 26.7.

26.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services. TestAmerica Denver offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), New Agency Standard (NAS), Format A, Excel, SEDD, NWIS, Dbase, GISKEY, Text Files, and a number of client specific formats.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

26.4 SUPPLEMENTAL INFORMATION FOR TEST

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report. Refer to Appendix 7 for a list of the laboratory's standard footnotes and qualifiers.

26.4.1 Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

26.4.2 Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications, including identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature.

26.4.3 Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

26.4.4 Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

26.5 ENVIRONMENTAL TESTING OBTAINED FROM SUBCONTRACTORS

If TestAmerica Denver is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in Section 8.

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of the TestAmerica network are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

26.6 CLIENT CONFIDENTIALITY

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

26.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone at the 1-800-765-0980 (or for e-mails: please notify us immediately by e-mail or by phone (1-800-765-0980) and delete this material from any computer).

26.7 FORMAT OF REPORTS

The format of reports are designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

26.8 AMENDMENTS TO TEST REPORTS

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 13). Refer to SOP DV-QA-019P, *Result and Report Revisions*.

When the report is re-issued, a notation of "revised report ", is placed on the cover/signature page of the report *or at the top of the narrative page* with a brief explanation of reason for the revision. *For Example*: *Report was revised on 11/3/07 to include toluene in sample NQA1504 per client's request*

26.9 POLICIES ON CLIENT REQUESTS FOR AMENDMENTS

26.9.1 Sample Reanalysis Policy

Because there is a certain level of uncertainty with any analytical measurement a sample reanalysis may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g. sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. Client specific arrangements for reanalysis protocols can be established.

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Department Manager or Laboratory Director if unsure.

26.9.2 Policy on Data Omissions or Reporting Limit Increases

Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.

- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

26.9.3 Multiple Reports

TestAmerica does not issue multiple reports for the same workorder where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1.

TESTAMERICA
ETHICS POLICY No. CA-L-P-001

Refer to CA-L-P-001 for complete policy.

TestAmerica
EMPLOYEE ETHICS STATEMENT

I understand that TestAmerica is committed to ensuring the highest standard of quality and integrity of the data and services provided to our clients. I have read the Ethics Policy of the Company.

- *With regard to the duties I perform and the data I report in connection with my employment at the Company, I agree that:*
- *I will not intentionally report data values that are inconsistent with the actual values observed or measured.*
- *I will not intentionally report the dates, times, sample or QC identifications, or method citations of data analyses that are not the actual dates, times, sample or QC identifications, or method citations.*
- *I will not intentionally misrepresent another individual's work as my own or represent my own work as someone else's.*
- *I will not intentionally misrepresent any data where data does not meet Method or QC requirements. If it is to be reported, I will report it with all appropriate notes and/or qualifiers; I shall not modify data (either sample or QC data) unless the modification can be technically justified through a measurable analytical process, such as one deemed acceptable to the laboratory's Standard Operating Procedures, Quality Assurance Manual or Technical Director. All such modifications must be clearly and thoroughly documented in the appropriate laboratory notebooks/worksheets and/or raw data and include my initials or signature and date.*
- *I shall not make false statements to, or seek to otherwise deceive, members of Management or their representatives, agents, or clients/customers. I will not, through acts of commission, omission, erasure, or destruction, improperly report measurement standards, quality control data, test results or conclusions.*
- *I shall not compare or disclose results for any Performance Testing (PT) sample, or other similar QA or QC requirements, with any employee of any other laboratory, including any other TestAmerica laboratory, prior to the required submission date of the results to the person, organization, or entity supplying the PT sample.*
- *I shall immediately inform my supervisor or other member of management regarding any intentional or unintentional reporting of my own inauthentic data. Such report shall be given both orally and in writing to the supervisor or other member of management contacted and to the local Quality Assurance Manager. The Quality Assurance Manager will initial and date the information and return a copy to me. I shall not condone any accidental or intentional reporting of inauthentic data by other employees and will immediately report its occurrence. If I have actual knowledge of such acts committed by any other employees, and I do not report such information to designated members of Management, it shall be considered as serious as if I personally committed the offense. Accordingly, in that event, I understand that I may be subject to immediate termination of employment.*
- *I understand that if any supervisor, manager, or representative of TestAmerica management instructs, requests, or directs me to perform any of the aforementioned improper laboratory practices, or if I am in doubt or uncertain as to whether or not such laboratory practices are proper, I will not*

comply. In fact, I must report such event to all appropriate members of Management including, but not limited to, the Lab Director, all supervisors and managers with direct line reporting relationship between me and the Lab Director, and the local Quality Assurance representative, excluding such individuals who participated in such perceived improper instruction, request, or directive. In addition, I may contact Corporate Quality Assurance / Ethics Compliance Officer(s) for assistance.

- *I understand the critical importance of accurately reporting data, measurements, and results, whether initially requested by a client, or retained by TestAmerica and submitted to a client at a later date, or retained by TestAmerica for subsequent internal use;*
- *I will not share the pricing or cost data of Vendors or Suppliers with anyone outside of the TestAmerica family of companies.*
- *I shall not accept gifts of a value that would adversely influence judgment.*
- *I shall avoid conflicts of interest and report any potential conflicts to the management (e.g. employment or consulting with competitors, clients, or vendors).*
- *I shall not participate in unfair competition practices (e.g. slandering competitors, collusion with other labs to restrict others from bidding on projects).*
- *I shall not misrepresent certifications and status of certifications to clients or regulators.*
- *I shall not intentionally discharge wastes illegally down the drain or onto the ground.*
- *I understand that any attempt by management or an employee to circumvent these policies will be subject to disciplinary action.*

As a TestAmerica employee, I understand that I have the responsibility to conduct myself with integrity in accordance with the ethical standards described in the Ethics Policy. I will also report any information relating to possible kickbacks or violations of the Procurement Integrity Act, or other questionable conduct in the course of sales or purchasing activities. I will not knowingly participate in any such activity and will report any actual or suspected violation of this policy to management.

I understand that if my job includes supervisory responsibilities, I shall not instruct, request, or direct any subordinate to perform any laboratory practice which is unethical or improper. Also, I shall not discourage, intimidate, or inhibit an employee who may choose to appropriately appeal my supervisory instruction, request, or directive which the employee perceives to be improper, nor retaliate against those who do.

The Ethics Policy has been explained to me by my supervisor or at a training session, and I have had the opportunity to ask questions if I did not understand any part of it. I understand that any violation of this policy subjects me to disciplinary action, which can include termination of my employment. In addition, I understand that any violation of this policy which relates to work under a government contract or subcontract could also subject me to the potential for prosecution under federal law.

EMPLOYEE SIGNATURE _____ Date _____

Supervisor/Trainer: _____ Date _____

TestAmerica
CONFIDENTIALITY AND PROPRIETARY INFORMATION AGREEMENT

TestAmerica and their predecessors, in their businesses, have developed and use commercially valuable technical and non-technical information and to guard the legitimate interests of TestAmerica and its clients, it is necessary to protect certain information as confidential and proprietary.

I, _____ , understand and acknowledge that during the term of my employment by TestAmerica, I will be privy to and entrusted with certain confidential information and trade secrets of TestAmerica and its clients.

Confidential information and trade secrets include, but are not limited to: customer and client lists; price lists; marketing and sales strategies and procedures; operational and equipment techniques; standard operating procedures; business plans and systems; quality control procedures and systems; special projects and technological research, including projects, research and reports for any government entity or client; client's plans and processes; client's manner of operation; the trade secrets of clients; client's data; vendor or supplier pricing; employee lists and personal information, and any other records, data, files, drawings, inventions, discoveries, applications, or processes which are not in the public domain.

I agree as follows:

1. I will not in any way, during the term of my employment, or at any time thereafter, except as authorized in writing by the Legal Department of TestAmerica or the client where client data is involved, disclose to others, use for my own benefit, remove from TestAmerica's premises (except to the extent off-site work is approved by my supervisor), copy or make notes of any confidential information and/or trade secrets of TestAmerica or its clients, excepting only that information which may be public knowledge. Technical and business information of any previous employer or other third party which I may disclose to TestAmerica shall be limited to that which was acquired legitimately and disclosed to me without restriction as to secrecy.

2. I agree that all inventions (whether or not patentable) conceived or made by me during the period of my employment by TestAmerica shall belong to TestAmerica, provided such inventions grow out of my work for TestAmerica and are related to the business of TestAmerica. I agree to disclose and assign such inventions to TestAmerica. In California, this provision shall not apply to any invention which qualifies fully under Section 2870 of the California Labor Code.

3. On termination of my employment from TestAmerica, I will deliver to TestAmerica all documents, records, notes, data, memoranda, files, manuals, equipment and things of any nature which relate in any way to confidential information and/or trade secrets of TestAmerica or its clients and which are in my possession or under my control.

4. I agree that during the period of my employment and for one (1) year from and after the termination (for any reason) of my employment with TestAmerica, I shall not directly or indirectly (without first obtaining the written permission of TestAmerica), recruit for employment, or induce to terminate his or her employment with TestAmerica, any person who is an active employee of TestAmerica on the last day of my employment with TestAmerica.

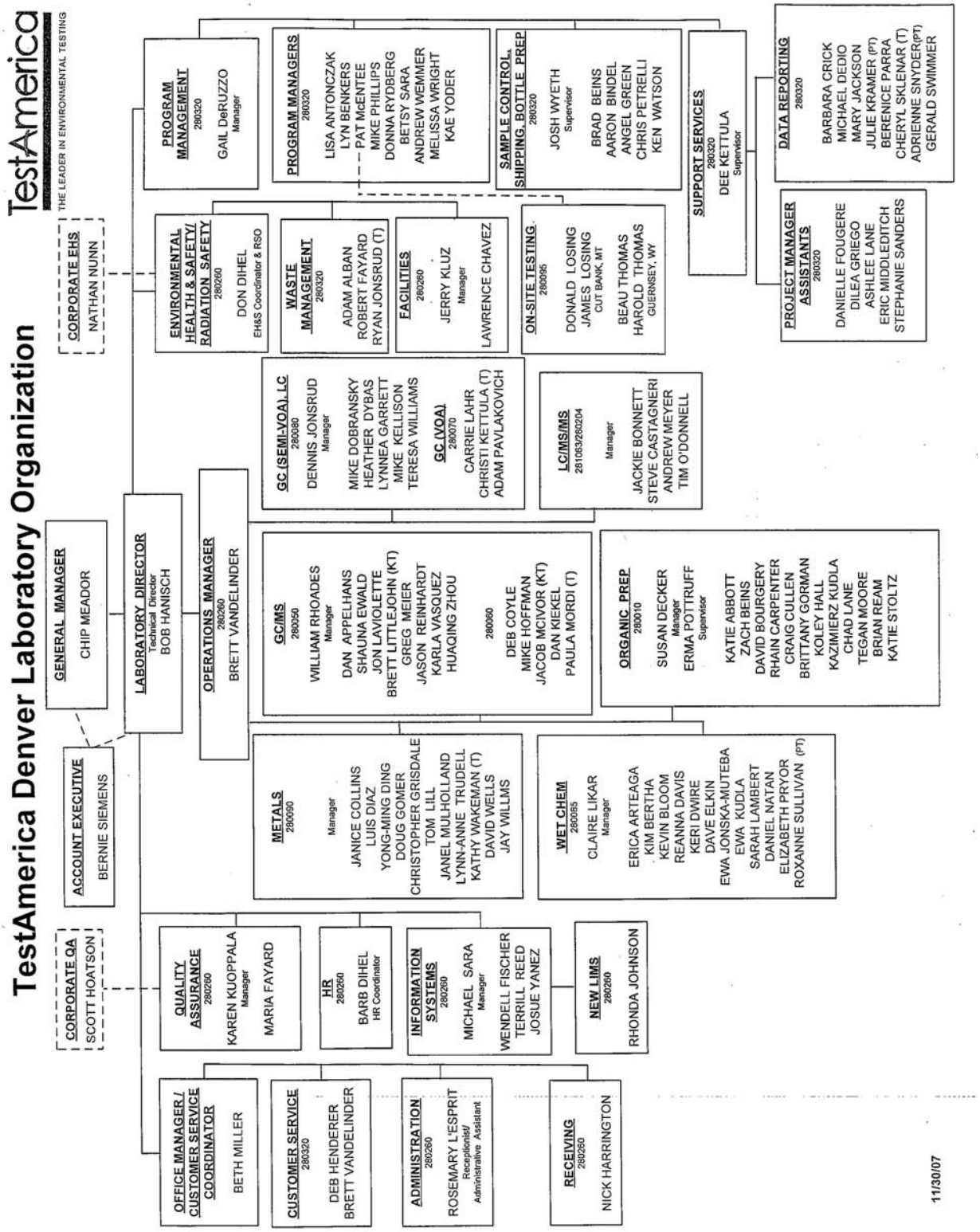
5. I acknowledge that if I were to breach any provision of this Confidentiality Agreement, money damages will be inadequate, and I hereby agree that TestAmerica shall be entitled, where appropriate, to specific performance and/or injunctive relief (i.e. to require me to comply with this Agreement). I further acknowledge that the willingness of TestAmerica to hire me or to continue my employment constitutes full and adequate consideration for the agreements, and obligations to which I have agreed as set forth in this document.

I have executed this Agreement, intending to be legally bound.

_____	_____	_____
Printed Name	*Signature*	*Date*

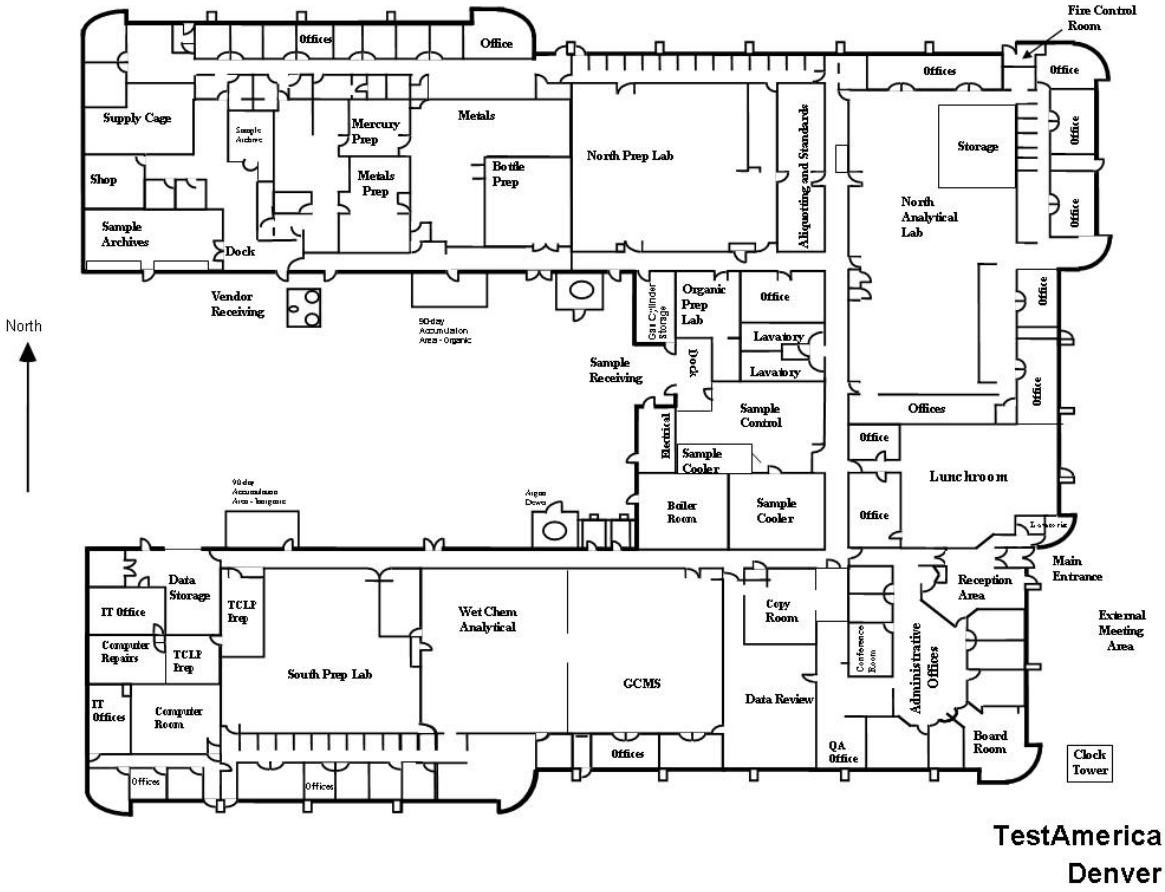
Appendix 2.

Example Laboratory Organization Chart



Appendix 3.

Laboratory Floor Plan



Criteria in Appendix 4 are to be used for general guidance. Method or Program specific criteria take precedence.
For methods not listed (SW6020, SW8321, SW6860, Hydrazine) refer to the analytical SOPs.

Appendix 4: Summary of Calibration and QC Procedures for GC Organics

Method	QC Check	Frequency	Acceptance Criteria[3]	Corrective Action[4]
SW8081 SW8082 SW8141 SW8151	Minimum five-point initial calibration for all target analytes[2]	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	Linear regression correlation coefficient $r^2 \geq 0.99$, $r \geq 0.995$. RSD of CF ≤ 20%	Correct problem then repeat initial calibration
	Initial calibration verification (ICV) must be from a 2nd source	Once immediately following initial calibration	All target analytes within 15% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 15% of expected value and within the RT Window[7].	Correct problem then repeat initial CCV (re-calibrate if necessary) and re-analyze all samples since last successful CCV.
	Breakdown check (Endrin and DDT)[1]	Before sample analysis	Degradation ≤15% for either Endrin or DDT.	Inlet/column maintenance; repeat breakdown check and re-analyze all samples since last successful breakdown check.
	Method blank	One per analytical prep batch, not to exceed 20 samples in a batch.	No analytes detected ≥ RL	Correct problem then re-prep[6] and analyze method blank and all samples processed with the contaminated blank
	LCS	One per prep batch, not to exceed 20 samples in a batch.	See Control Limits in LIMS or Clouseau	Re-prep[6] and analyze the LCS and all samples in the affected analytical batch
	Surrogate(s)	Every sample, spike, standard, and method blank	See Control Limits in LIMS or Clouseau	Check system, re-inject, re-extract[6]
	MS/MSD	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	See Control Limits in LIMS or Clouseau	None (LCS is used to determine if data is acceptable).
	Second-column confirmation	100% for all positive results Only applies to 8082 for specific programs (see SOP DV-QA-024P for federal program Requirements)	Same as for initial or primary column analysis	Same as for initial or primary column analysis. If the relative % difference of results between the 2 columns is greater than 40%, a comment should be placed in LIMS.
	Retention time window calculated for each analyte (see section 9 for how to calculate RTWs).	System set-up, with each new column or major instrument maintenance. Update the mid-RTW at the start of the run or daily.	Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW.	Correct the problem and re-process or re-analyze samples. If questions, see the supervisor or technical director.
	MDL verification	Quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 --8081A only
2 – Method 8082, a five-point calibration is only analyzed for Aroclors 1016 and 1260.
3 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information.
4 - All abnormalities must be noted in a NCM.
6 - If unable to re-extract the samples because of insufficient sample volume or holding time has expired a NCM must be generated.
7 - The mean of all calibrated compounds may be used, but all compounds above the 15% must be documented in a NCM.

Appendix 4: Summary of Calibration and QC Procedures for GC Organics

Method	QC Check	Frequency	Acceptance Criteria[3]	Corrective Action[4]
EPA608 EPA615	Minimum three-point (preferably five) initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	**RSD of CF ≤ 10%** Linear regression - correlation coefficient r ≥ 0.99, r ≥ 0.995.	Correct problem then repeat initial calibration
	Initial calibration verification (ICV) must be from a 2nd source.	Immediately following initial calibration	All analytes within 15% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	Before sample analysis, and at the end of the analysis sequence	All analytes within **15% of expected value** and within the RTW.	Correct problem then repeat initial CCV (re-calibrate if necessary) and re-analyze all samples since last successful CCV.
	Breakdown check (Endrin and DDT)[1]	Before sample analysis	Degradation ≤15% for either Endrin or DDT.	Inlet/column maintenance; repeat breakdown check and re-analyze all samples since last successful breakdown check.
	Method blank	One per analytical prep batch, **not to exceed 10 samples in a batch**.	No analytes detected ≥ RL	Correct problem then re-prep[7] and analyze method blank and all samples processed with the contaminated blank
	LCS all analytes	One per prep batch, **not to exceed 10 samples in a batch.**	See Control Limits in LIMS or Clouseau	Re-prep[7] and analyze the LCS and all samples in the affected analytical batch
	Surrogate(s)	Every sample, spiked sample, standard, and method blank	See Control Limits in LIMS or Clouseau	Check system, re-inject, re-extract[7]
	MS	One per batch per matrix, 10%, if insufficient sample for MS, then an additional LCS will be analyzed.	See Control Limits in LIMS or Clouseau	All target compounds should be reported, and any compounds that are outside criteria must be within criteria in the LCS.
	Second-column confirmation	100% for all positive results	Same as for initial or primary column analysis	Same as for initial or primary column analysis. If the relative % difference of results between the 2 columns is greater than 40%, a comment should be placed in LIMS.
	Retention time window calculated for each analyte (see section 9 for how to calculate RTWs).	System set-up, with each new column or major instrument maintenance. Update the mid-RTW at the start of the run or as needed.	Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW.	Correct the problem and re-process or re-analyze samples. If questions, see the supervisor or technical director.
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

3 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information.
4 - All abnormalities must be documented in a NCM.
6 - Report all target compounds identified in the method blank above the MDL.
7 - If unable to re-extract the samples because of insufficient sample volume or holding time has expired, then a NCM must be generated

Appendix 4: Summary of Calibration and QC Procedures for GC/MS Organics

Method	QC Check	Frequency	Acceptance Criteria[2]	Corrective Action[3]
SW8260 SW8270	Check of mass spectral ion intensities[1], i.e., Tune	Prior to initial calibration or Continuing calibration verification, every 12 hours	Refer to criteria listed in the method SOP for Tune criteria, including DDT, Benzidine and Pentachlorophenol requirements for 8270.	Retune the instrument and verify (instrument maintenance may be needed).
SW8260	Minimum five-point initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	SPCCs average RF ≥ 0.30 or 0.1 depending on the compound and %RSD for RFs for CCCs ≤ 30% and all other target analytes %RSD for RF ≤ 15%.	Correct problem then repeat initial calibration
SW8270			SPCCs average RF ≥ 0.050 and %RSD for RFs for CCCs ≤ 30% and all other target analytes %RSD for RF ≤ 15%.	Correct problem then repeat initial calibration
			option (if %RSD is > 15%)–linear regression $r^2 \geq 0.99$, r ≥ 0.995.	If the calibration is not considered linear by either %RSD or linear regression, then correct the problem and re-calibrate.
SW8260 SW8270	Initial calibration verification (ICV) must be from a 2nd source.	Immediately following five-point initial calibration	All analytes within 25% of expected value	Correct problem then repeat initial calibration
	Relative Retention time window	Each sample	Relative retention time (RRT) of the analyte within 0.06 RRT units of the RRT of the internal standard	Correct problem then reprocess or re-analyze all samples analyzed since the last retention time check
SW8260	Continuing calibration verification (CCV)	Daily, before sample analysis and every 12 hours of analysis time	SPCCs average RF ≥ 0.30 or 0.1 depending on the compound; and	Correct problem then repeat initial calibration and re-analyze all samples since last successful CCV.
SW8270			SPCCs average RF ≥ 0.050; and	
SW8260 SW8270	Continuing calibration check		CCCs: ≤20% difference (when using RFs) or drift (when using least squares regression). **All other target compounds ≤20%, up to 5 non-CCC target compounds, may fail this requirement provided the % difference is ≤ 40%.**	
SW8260 SW8270	Method blank	One per analytical prep batch	No analytes detected ≥ RL	Correct problem then re-prep[5] and analyze method blank and all samples processed with the contaminated blank

Method	QC Check	Frequency	Acceptance Criteria[2]	Corrective Action[3]
SW8260 SW8270	Internal Standards	Every sample/standard and blank	Retention time ±30 seconds from retention time of the mid-point std. in the CCV/ICAL (sample/standard). EICP area within -50% to +100% of ICAL mid-point std for the CCV and –50% to +100% of the prior CCV for the samples. (See federal programs SOP DV-QA-024P for program specific requirements)	Inspect mass spectrometer and GC for malfunctions; mandatory re-analysis of samples analyzed while system was malfunctioning (dilution of the sample may be required, see the supervisor or the technical director for advice).
	LCS	One per prep batch, not to exceed the 20 samples in a batch.	See Control Limits in LIMS or Clouseau	Correct problem then re-prep[5] and analyze the LCS and all samples in the affected analytical batch
	MS/MSD	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	See Control Limits in LIMS or Clouseau	None (the LCS is used to evaluate to determine if the batch is acceptable).
	Surrogate(s)	Every sample, spike, standard, and blank	See Control Limits in LIMS or Clouseau	Check system, re-analyze, re-prep[5]
SW8260	pH check	All 8260 water samples.	pH ≤2.	If the pH is > 2, then a NCM must be generated
SW8260	Residual chlorine check (North Carolina samples only)	Each sample.	Residual chlorine should be negative.	If the residual chlorine is positive, then document in a NCM.
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 – SW8260B requires BFB; SW8270C requires DFTPP
2 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information.
3 - All abnormalities must be documented in a NCM.
4 - Report all target compounds identified in the method blank above the MDL.
5 - If unable to re-prep samples because of insufficient sample volume or the holding time has expired, then a NCM must be generated.

Appendix 4: Summary of Calibration and QC Procedures for GC/MS Organics

Method	QC Check	Frequency	Acceptance Criteria[2]	Corrective Action[3]
EPA624 EPA625	Check of mass spectral ion intensities[1] (i.e. Tune)	Prior to initial calibration or Continuing calibration verification every 12 hours.	Refer to criteria listed in the method SOP for Tune requirements including DDT, Benzidine and Pentachlorophenol criteria for 625.	Retune instrument and verify instrument maintenance may be needed.
	Five- point initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	%RSD < 35%, if %RSD is > 35% then linear regression is used (for linear regression $r^2 \geq 0.99$), $r \geq 0.995$.	If the calibration is not considered linear by either %RSD or linear regression, then correct problem then repeat initial calibration
	Initial calibration verification (ICV), 20 ug/L, must be from a 2nd source. May be the same as the LCS.	Immediately following initial calibration	See analytical SOP.	Correct problem then repeat initial calibration
	Relative Retention time window	Each sample	Retention time (RT) of the analyte within 30 seconds of the RT (± 0.25 min. RTW is used) of the target.	Correct problem then reprocess or re-analyze all samples analyzed since the last retention time check
EPA625	Continuing calibration verification (CCV)	Daily, before sample analysis and every 12 hours of analysis time.	All calibration analytes within 20% of expected value	Correct problem then repeat initial calibration and re-analyze all samples since last successful CCV.
EPA624 EPA625	Method blank	One per prep batch (not to exceed 20 samples per batch).	No analytes detected ≥ RL	Correct problem then re-prep[5] and analyze method blank and all samples processed with the contaminated blank
	LCS for all analytes.	One per prep batch (not to exceed 10 samples per batch) or daily.	See Control Limits in LIMS or Clouseau	Correct problem then re-prep[5] and analyze the LCS and all samples in the affected analytical batch
	MS	One per batch of 10 per matrix, if insufficient sample for MS, then a-duplicate LCS will be analyzed.	See Control Limits in LIMS or Clouseau	All target compounds should be reported, and any compound that is outside criteria must be within criteria in the LCS.
	Surrogate(s)	Every sample, spiked sample, standard, and method blank	See Control Limits in LIMS or Clouseau	Correct problem then re-prep[5] and analyze sample
EPA624 EPA625	Internal Standards	Every sample/standard	Retention time ±30 seconds from retention time of the mid-point std. in the CCV/ICAL (sample/standard). EICP area within -50% to +100% of ICAL mid-point std for the CCV and –50% to +100% of the prior CCV for the samples.	Inspect mass spectrometer and GC for malfunctions; mandatory re-analysis of samples analyzed while system was malfunctioning (dilution of the sample may be required, see the supervisor or the technical director for advice).
EPA624	pH check	All 624 samples after analysis	pH should be ≤ 2.	If the pH is > 2, then document in a NCM.
EPA624	Residual chlorine check (North Carolina samples only)	All samples after analysis	Residual chlorine should be negative.	If the residual chlorine is positive, then document in a NCM.

Method	QC Check	Frequency	Acceptance Criteria[2]	Corrective Action[3]
	MDL verification	Quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 – 624 requires BFB; 625 requires DFTPP
2 - This is summary of the acceptance criteria, refer to the method SOP for specific or more information.
3 - All abnormalities must be documented in a NCM
4 - Report all target compounds identified in the method blank above the MDL.
5 - If unable to re-prep samples because of insufficient sample volume or holding time has expired, then generate a NCM

Appendix 4: Summary of Calibration and QC Procedures for Method SW8310

Method	QC Check	Frequency	Acceptance Criteria[1]	Corrective Action[2]
SW8310	Minimum five-point initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	CF RSD for each analyte ≤20% or mean RSD for all analytes ≤20%, with all compounds above 20% commented in LIMS with each sample. linear – $r^2 \geq 0.99$, $r \geq 0.995$.	Correct problem then repeat initial calibration
	Initial calibration verification (ICV) must be from a 2nd source.	Immediately following initial calibration	All analytes within 15% of expected value	Correct problem then repeat initial calibration
	Retention time verification	Update at start of run or daily	All standards within window	Correct problem then re-analyze all samples analyzed since the last retention time check
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 15% of expected value	Correct problem then reprocess or repeat initial CCV and re-analyze all samples since last successful CCV.
	Method blank	One per prep batch (not to exceed more than 20 samples per batch).	No analytes detected ≥ ½ RL	Correct problem then re-prep[4] and analyze method blank and all samples processed with the contaminated blank
	LCS	One per prep batch (not to exceed more than 20 samples per batch).	See Control Limits in LIMS or Clouseau	Correct problem then re-prep[4] and analyze the LCS and all samples in the affected analytical batch
	Surrogate	Every sample, spike, standard, and method blank	See Control Limits in LIMS or Clouseau	Check system, re-inject, re-extract[4]
	MS/MSD	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	See Control Limits in LIMS or Clouseau	None (LCS is used to determine if the batch is acceptable).
	Confirmation	100% for all positive results (use response of both detectors)	Same as for initial or primary analysis. Comment LIMS if >40% difference in compound response between detectors.	Same as for initial or primary analysis.
	MDL verification	Quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - This is a summary of the acceptance criteria, refer to the method SOP for specific information or more information.

2 - All abnormalities must be documented in a NCM.

3 - Report all target compounds identified in the method blank above the MDL.

4- If unable to re-extract because of insufficient sample volume or the holding time has expired, then a NCM must be generated.

Appendix 4: Summary of Calibration and QC Procedures for Method EPA610 (HPLC)

Method	QC Check	Frequency	Acceptance Criteria[1]	Corrective Action[2]
EPA610 (HPLC)	Minimum five-point initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	RSD of CF of each analyte **<10%,** $r^2 \geq$ 0.99, r ≥ 0.995, or linear regression.	Correct problem then repeat initial calibration
	Initial calibration verification (ICV) must be from a 2nd source.	Immediately following initial calibration	All analytes within 15% of expected value	Correct problem then repeat initial calibration
	Retention time verification	Update at start of run or daily	All standards within window	Correct problem then reprocess or re-analyze all samples analyzed since the last retention time check
	Continuing calibration verification (CCV)	Before sample analysis and at the end of the analysis sequence	All analytes within 15% of expected value	Correct problem then repeat initial CCV and re-analyze all samples since last successful CCV.
	Method blank	One per prep batch **(not to exceed more than 10 samples per batch).**	No analytes detected ≥ ½ RL or MDL, whichever is greater[3]	Correct problem then re-prep[4] and analyze method blank and all samples processed with the contaminated blank
	LCS for all analytes	One per prep batch **(not to exceed more than 10 samples per batch).**	See Control Limits in LIMS or Clouseau	Correct problem then re-prep[4] and analyze the LCS and all samples in the affected analytical batch
	Surrogate	Every sample, spiked sample, standard, and method blank	See Control Limits in LIMS or Clouseau	Check system, re-inject, re-extract[4]
	MS	One per batch per matrix, if insufficient sample for MS, then an additional LCS will be analyzed.	See Control Limits in LIMS or Clouseau	All target compounds should be reported, and any compound that is outside criteria must be within criteria in the LCS.
	Confirmation	100% for all positive results (use response of both detectors)	Same as for initial or primary analysis. Comment LIMS if >40% difference in compound response between detectors.	Same as for initial or primary analysis
	MDL verification	Quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - This is a summary of the acceptance criteria, refer to the method SOP for specific information or more information.
2 - All abnormalities must be noted in a NCM.
3 - Report all target compounds identified in the method blank above the MDL.
4- If unable to re-extract because of insufficient sample volume or the holding time has expired, then a NCM must be generated.

Appendix 4: Summary of Calibration and QC Procedures for Method SW8330

Method	QC Check	Frequency	Acceptance Criteria[1]	Corrective Action[2]
SW8330	Five-point initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	RSD of CF of each analyte ≤20% or mean RSD for all analytes ≤20%, with all compounds above 20% commented in LIMS with each sample. linear – $r^2 \geq 0.99$, $r \geq 0.995$	Correct problem then repeat initial calibration
	Initial calibration verification (ICV) must be from a 2nd source.	Immediately following initial calibration	All analytes within 15% of expected value	Correct problem then repeat initial calibration
	Retention time verification	Update at start of run or daily	All standards within RT window	Correct problem then reprocess or re-analyze all samples analyzed since the last retention time check
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 15% of expected value	Correct problem then repeat initial CCV and re-analyze all samples since last successful CCV.
	Method blank	One per prep batch not to exceed more than 20 samples per batch.	No analytes detected ≥ ½ RL	Correct problem then re-prep[4] and analyze method blank and all samples processed with the contaminated blank
	LCS	One per prep batch (not to exceed more than 20 samples per batch).	See Control Limits in LIMS or Clouseau	Correct problem then re-prep[4] and analyze the LCS and all samples in the affected analytical batch
	Surrogate	Every sample, spike, standard, and blank	See Control Limits in LIMS or Clouseau	Check system, re-inject, re-extract[4]
	MS/MSD	One per batch per matrix	See Control Limits in LIMS or Clouseau	None (LCS is used to determine if the batch is acceptable).
	Confirmation	100% for all positive results; 2nd column (lunacolumn) confirmation	Same as for initial or primary analysis. Comment LIMS if >40% difference in compound response between detectors.	Same as for initial or primary analysis
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information.
2 - All abnormalities must be documented in a NCM.
3 - Report all target compounds identified in the method blank above the MDL.
4 - If unable to re-extract sample because of insufficient sample volume or expired holding time, then a NCM must be gnerated.

Appendix 4: Summary of Calibration and QC Procedures for GC Organics

Method	QC Check	Frequency	Acceptance Criteria[1]	Corrective Action[2]
EPA504.1 SW8011	Five-point initial calibration for all target analytes (calibration standards should be prepped as the samples).	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	RSD of CF of each analyte ≤ 20% **RSD of CF < 10% for Method 8011** Linear – $r^2 \geq 0.99$, $r \geq 0.995$	Correct problem then repeat initial calibration
	Initial calibration verification (ICV) must be from a 2nd source.	Immediately following initial calibration	All analytes within 15% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 15% of expected value and within the RTW.	Correct problem then repeat initial CCV (re-calibrate if necessary) and re-analyze all samples since last successful CCV.
	Method blank	One per analytical prep batch, not to exceed 20 samples in a batch.	No analytes detected ≥ RL	Correct problem then re-prep[4] and analyze method blank and all samples processed with the contaminated blank
	LCS	One per prep batch, not to exceed 20 samples in a batch.	See Control Limits Manual	Re-prep[4] and analyze the LCS and all samples in the affected analytical batch
	Surrogate	Every sample, spike, standard, and method blank	See Control Limits Manual	Check system, re-inject, re-extract[4]
	MS/MSD	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	See Control Limits Manual	None (LCS is used to determine if data is acceptable).
	Second-column confirmation	100% for all positive results	Same as for initial or primary column analysis	Same as for initial or primary column analysis. If the relative % difference of results between the 2 columns is greater than 40%, a comment should be placed in LIMS.
	Retention time window calculated for each analyte (see section 9 for how to calculate RTW's).	System set-up, with each new column or major instrument maintenance. Update the mid-RTW as the start of the run or daily.	Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW.	Correct the problem and re-process or re-analyze samples. For questions, see the supervisor or technical director.
	MDL check standard	Each week that samples are analyzed.	Detected	Correct problem and re-analyze samples.

1 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information.
2 - All abnormalities must be documented in a NCM.
3 - Report all target compounds identified in the method blank above the MDL.
4 - If unable to re-extract the samples because of insufficient sample volume or holding time has expired, then a NCM must be generated.

Appendix 4: Summary of Calibration and QC Procedures for GC Organics

Method	QC Check	Frequency	Acceptance Criteria[1]	Corrective Action[2]
SW8021 SW8015[5]	Five-point initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	RSD of CF ≤ 20% Linear – least squares regression r^2 ≥ 0.99, r ≥ 0.995	Correct problem then repeat initial calibration
	Initial calibration verification (ICV), must be from a 2nd source.	Immediately following five-point initial calibration	All analytes within 15% of expected value	Correct problem then repeat initial calibration
	LCS for all analytes must be from a 2nd source.	One per prep batch, not to exceed 20 samples in a batch.	See Control Limits Manual	Re-prep[4] and analyze the LCS and all samples in the affected analytical batch
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 15% of expected value and within the RTW.	Correct problem then repeat initial CCV (re-calibrate if necessary) and re-analyze all samples since last successful CCV.
	Method blank	One per analytical prep batch, not to exceed 20 samples in a batch.	No analytes detected ≥ RL	Correct problem then re-prep[4] and analyze method blank and all samples processed with the contaminated blank
	Surrogate	Every sample, spiked sample, standard, and method blank	See Control Limits Manual	Check system, re-analyze, re-prep[4]
	MS/MSD	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	See Control Limits Manual	None (LCS is used to determine if data is acceptable).
	GC/MS confirmation.	At the clients request or analyst judgment.		
	Retention time window calculated for each analyte (see section 9 for how to calculate RTWs).	System set-up, with each new column or major instrument maintenance. Update the mid-RTW as the start of the run or daily.	Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW.	Correct the problem and re-process or re-analyze samples. For questions, see the supervisor or technical director.
8021	pH Check	All water samples after analysis.	pH should be less than 2.	If pH is > 2, then place a comment on the benchsheet and in LIMS.
8021	Residual chlorine check (North Carolina samples only)	All water samples after analysis.	Residual chlorine should be negative.	If residual chlorine is positive, document in a NCM.
	MDL verification	Quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information. 2 - All abnormalities must be documented in a NCM.
3 - Report all target compounds identified in the method blank above the MDL.
4 - If unable to re-prep the samples because of insufficient sample volume or holding time has expired, then a NCM must be generated.
5 - For GRO and DRO, see state specific SOP/Method for acceptance criteria. If there is not a specific method for that state, then follow the acceptance criteria in this table.

Appendix 4: Summary of Calibration and QC Procedures for GC Organics

Method	QC Check	Frequency	Acceptance Criteria[1]	Corrective Action[2]
EPA601 EPA602	Minimum three-point (preferably five) initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	**RSD of CF < 10%** **RSD of RF < 10%** $r^2 \geq 0.99$, $r \geq 0.995$	Correct problem then repeat initial calibration
	Initial calibration verification (ICV), 20 ug/L, must be from a 2nd source. May be the same as the LCS.	Once immediately following initial calibration	Reference 601/602 table in Section 5 ("Q" in EPA method).	Correct problem then repeat initial calibration
	LCS for all analytes	One per prep batch, **not to exceed 10 samples in a batch.**	See Control Limits Manual	Re-prep[4] and analyze the LCS and all samples in the affected analytical batch
	Method blank	One per analytical prep batch, **not to exceed 10 samples in a batch.**	No analytes detected ≥ RL	Correct problem then re-prep[4] and analyze method blank and all samples processed with the contaminated blank
	Surrogate(s)	Every sample, spiked sample, standard, and method blank	See Control Limits in LIMS or Clouseau	Check system, re-analyze, re-prep[4]
	MS	One per batch of 10 per matrix, if insufficient sample for MS, then an additional LCS will be analyzed.	See Control Limits in LIMS or Clouseau	All target compounds should be reported, and any compound that is outside criteria must be within criteria in the LCS.
	GC/MS confirmation.	At clients request or analyst judgment.		
	Retention time window calculated for each analyte (see section 9 for how to calculate RTWs).	System set-up, with each new column or major instrument maintenance. Update the mid-RTW as the start of the run (or as needed).	Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW.	Correct the problem and re-process or re-analyze samples. For questions, see the supervisor or technical director.
	pH check	All samples after analysis.	pH should be ≤ 2.	If pH is> 2, then place a comment on the benchsheet, in the PIPE database, and in LIMS.
	Residual chlorine check (North Carolina samples only)	All samples after analysis.	Residual chlorine should be negative.	If residual chlorine is positive, document in a NCM.
	MDL verification	Quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 – This is a summary of the acceptance criteria, refer to the method SOP for specific or more information. 2 – All abnormalities must be noted on the data, the benchsheet, in the PIPE database, and in LIMS.
3 – Report all target compounds identified in the method blank above the MDL.
4 – If unable to re-prep the samples because of insufficient sample volume or holding time has expired, then a NCM must be generated.

Appendix 4: Summary of Calibration and QC Procedures for Method SW6010

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW6010	Initial calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis.	N/A	N/A
	Second-source calibration verification (ICV)	Daily after initial calibration	All analytes within 10% of expected value	Correct problem then repeat initial calibration
	Calibration blank (CB)	After every continuing calibration verification	Must be <3 times the IDL or the average of 3 CB must be <3 times the IDL.	Correct problem then analyze calibration blank and previous 10 samples
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 10% of expected value and RSD of replicate integrations <5%	Repeat calibration and re-analyze all samples since last successful calibration
	Method blank	One per prep batch	No analytes detected ≥ RL	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	Interference check solution (ICS)	At the beginning of an analytical run	Within 20% of expected value	Terminate analysis; correct problem; re-analyze ICS; re-analyze all affected samples
	LCS	One per prep batch	See Control Limits in LIMS or Clouseau	Correct problem then re-prep and analyze the LCS and all samples in the affected analytical batch
	MS/MSD	One per batch per matrix	See Control Limits in LIMS or Clouseau	None
	MDL verification	Quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.
	Dilution test	Each new sample matrix	1:5 dilution must agree within 10% of the original determination	Perform post digestion spike addition
	Post digestion spike addition	When dilution test fails	Recovery within 25% of expected results	Correct problem then re-analyze post digestion spike addition

1 – Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Method SW7196

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW7196	Initial calibration (minimum three standards and a blank)	Initial calibration prior to sample analysis.	$r^2 \geq 0.99$, $r \geq 0.995$ for linear regression	Correct problem then repeat initial calibration
	Second-source calibration verification (ICV)	Immediately following initial calibration	All analytes within 10% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	Beginning and after every 10 samples and at the end of the analysis sequence	All analytes within 20% of expected value	Correct problem then repeat initial calibration and re-analyze all samples since last successful calibration
	Verification check to ensure lack of reducing condition and/or interference	Once for every sample matrix analyzed	Spike recovery between 85-115%	If check indicates interference, dilute and re-analyze sample persistent interference indicates the need to use and alternate method
	Method blank	One per prep batch	No analytes detected $\geq$ RL	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	MS/MSD	One per 20 samples per matrix	See Control Limits in LIMS or Clouseau	none
	LCS	One per batch	See Control Limits in LIMS or Clouseau	Re-prep, re-analyze all affected samples.
	MDL verification	Quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Method SW7470/SW7471

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW7470 SW7471	Initial calibration (minimum 5 standards and a blank)	Daily initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	$r^2 \geq 0.99$, $r \geq 0.995$ for linear regression	Correct problem then repeat initial calibration. If calibration fails again, re-digest the entire digestion batch.
	Second-source calibration verification (ICV)	Immediately following initial daily calibration	Analytes within 10% of expected value	Correct problem then repeat initial calibration. If calibration fails again, re-digest the entire digestion batch.
	Calibration blank	Once per initial daily calibration	No analytes detected ≥ MDL	Correct problem then re-digest and re-analyze calibration and entire digestion batch
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	Analytes within 20% of expected value	Correct problem then repeat all QC and samples since last successful calibration. If the CCV fails again upon reanalysis, reprep the entire digestion batch.
	Method blank	One per prep batch	No analytes detected ≥ RL	Correct problem then re-prep and analyze method blank, all samples, and QC processed with the contaminated blank
	LCS	One per prep batch	See Control Limits in LIMS or Clouseau	Correct problem then re-prep and analyze the LCS, all samples, and QC in the affected analytical batch
	Dilution test; five-fold dilution test	Each preparatory batch	Five times dilution sample result must be ±10% of the undiluted sample result	Perform post digestion spike addition
	Recovery test	When dilution test fails	Recovery within 85-115% of expected results	Dilute the sample; re-analyze post digestion spike addition
	MS/MSD	One per batch per matrix	See Control Limits in LIMS or Clouseau	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Method SW9010/SW9012/SW9014

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW9010 SW9012 SW9014	Initial calibration (six standards and a calibration blank)	Initial daily calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	$r^2 \geq 0.99$, $r \geq 0.995$ for linear regression	Correct problem then repeat initial calibration
	Distilled standards (one high and one low)	Once per calibration	Analytes within 10% of true value	Correct problem then repeat distilled standards
	Second-source calibration verification (ICV)	Immediately following initial daily calibration	Analytes within 15% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	Beginning and after every 10 samples and at the end of the analysis sequence	Analytes within 15% of expected value	Correct problem then repeat initial Continuing calibration verification and re-analyze all samples since last successful Continuing calibration verification
	Method blank	One per prep batch	No analytes detected $\geq$ RL	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	LCS	One per batch per matrix	See Control Limits in LIMS or Clouseau	Re-prep, re-run affected samples
	MS/MSD	One per batch per matrix	See Control Limits in LIMS or Clouseau	None
	MDL verification	Quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

Appendix 4: Summary of Calibration and QC Procedures for Mercury

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA245.1	Initial calibration (minimum 5 standards and a blank)	Daily initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	$r^2 \geq 0.99$, $r \geq 0.995$ for linear regression	Correct problem then repeat initial calibration
	Second-source calibration verification (ICV)	Immediately following five-point initial calibration	Analyte within 5% of expected value	Correct problem then repeat initial calibration
	Calibration blank	Once per initial daily calibration	No analytes detected ≥ MDL	Correct problem then re-analyze calibration blank and all samples associated with blank
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	Analyte within 10% of true value	Correct problem then repeat calibration and re-analyze all samples and QC since last successful calibration
	LCS	One per prep batch	All analytes within 15% of expected value	Correct problem then re-prep and analyze the LCS, all samples, and QC in the affected analytical batch
	Matrix Spike/Matrix Spike Duplicate	One per batch or 10 samples	All analytes within 30% of expected value	None
	Method Blank	One per batch	No analytes > RL	Reprep
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for ICP Metals

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA200.7	Initial calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis.	N/A	N/A
	Second-source calibration verification (ICV)	Each calibration	Value of all analytes within 5% of expected value	Correct problem then repeat initial calibration
	Linear Dynamic Range	Once annually	All analytes within 10% of expected value	Calibration range lowered to meet LDR results
	Calibration blank	After every Continuing calibration verification	No analytes detected ≥ MDL	Correct problem then analyze calibration blank and previous 10 samples
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 10%	Repeat calibration and re-analyze all samples since last successful calibration
	Method blank	One per prep batch	No analytes detected ≥ RL	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	Interference check solution (ICS)	At the beginning of an analytical run, daily		Terminate analysis; correct problem; re-analyze ICS; re-analyze all affected samples
	LCS	One per prep batch	All analytes within 15% of expected value	Correct problem then re-prep and analyze the LCS and all samples in the affected analytical batch
	Dilution test	Each new sample matrix	1:5 dilution must agree within 10% of the original determination	Perform post digestion spike addition
	Post digestion spike addition	When dilution test fails	Recovery within 25% of expected results	Correct problem then re-analyze post digestion spike addition
	Matrix Spike/Matrix Spike Duplicate	One per batch of 20 samples	All analytes within 30% of expected value	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Gravimetric Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SM2540 C (TDS) SM2540 D (TSS) SM2540 B (TS) EPA160.4, SM2540E* (TVS)* ASTM D5057* (Density/ Specific Gravity)*	Verification standard– single standard (if available)	Each batch	±10%	Repeat
	Method blank	Each batch	No analytes detected ≥ RL	Repeat, rerun
	Duplicate	Each batch, less than 20	±20%	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

***Analysis is performed at TestAmerica Denver but does not have any check standard available.**

Appendix 4: Summary of Calibration and QC Procedures for Titrimetric Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SM2310B: Acidity. Alkalinity. SM2320: HCO3-, CO3-2. SM4500-CO2 C: CO2. SM4500SO3: Sulfite 4500S^2F, 9030\9034: Sulfide SM4500CL C: Chloride 2340B or C: Hardness	Verification standard– single standard (if available)	Each batch	±10%	Repeat, check
	Method blank	Each batch	No analyte detected ≥ report limit	Repeat batch
	Duplicate	Each batch	±20%	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

Appendix 4: Summary of Calibration and QC Procedures for Spectrophotometric Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA350.1: NH_3. EPA410.4: COD. SW7196, SM3500Cr: Cr+6 EPA335.4, 9010, 9012, SM4500CN : CN. SM4500S^{-2} D: Sulfide SM5310B,9060: TOC. SM4500NO_2B: Nitrite SM3500Fe D: Ferrous Iron SM4500CL E: Chloride EPA420.1, 420.4: Phenol EPA351.2: TKN EPA353.2: Nitrate, NO2+NO3 EPA365.1: Total Phos, O-Phos ASTMD516-02: Turb. Sulfate EPA180.1: Turbidity.	Calibration curve – minimum 5 point	Initial. Perform re-calibration once per year minimum.	RSD <10%, $r^2 \geq 0.99$, $r \geq 0.995$	Recalibrate
	Independent calibration verification – mid-level, second-source required (ICV)	Immediately following initial calibration.	±10%	Recalibrate
	Continuing calibration verification (CCV)	Beginning, every 10 samples, and at end of sequence	±10%	Correct, recalibrate
	Method blank	Each use	No analyte detected ≥ report limit	Reprep, rerun
	MS/MSD	Each batch, less than 20	±20% Or: historical or client specified where applicable	None
	LCS	Each batch	± 10% Or: historical or client specified where applicable	Rerun
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

Appendix 4: Summary of Calibration and QC Procedures for Electrometric Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SM5210B: BOD[1], CBOD[1]. SM2510B, SW9050: Cond. SW9023: EOX. SM4500F-C: Flouride. SM4500H$^+$B, SW9040/9045: pH. SM5310B, SW9020,9076: TOX. EPA365.3: ORP[1]	Calibration Curve – minimum of 5 standards	Initial Calibration. Perform re-calibration once per year minimum	±10%, $r^2 \geq 0.99$, $r \geq 0.995$.	Recalibrate
	Independent calibration verification (second source) (ICV)	Immediately after initial calibration	±10%	Recalibrate
	Continuing calibration verification (CCV)	Beginning, every 10 samples, and end of batch	±10%	Rerun
	Method blank NA for pH	Each batch	No analyte detected ≥ report limit	Reprep
	LCS	Each batch	±10% Or: historical or client specified where applicable	Rerun batch
	MS/MSD	Each batch	± 20% Or: historical or client specified where applicable	None
	Duplicate	When spike not available	±20%	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

[1]Calibration curve does not apply.

Appendix 4: Summary of Calibration and QC Procedures for Ion Chromatographic Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA300 & SW9056: Bromide Chloride Chlorate Fluoride Nitrate Nitrite Sulfate.	Calibration Curve – Minimum 5-point calibration	Initial calibration. Perform instrument re-calibration once per year minimum.	RSD ± 10%, $r^2 \geq 0.99$, $r \geq 0.995$.	Recalibrate
	Calibration verification (ICV), second source	Immediately following initial calibration	±10%	Recalibrate
	Continuing calibration verification (CCV)	Each use, beginning, every 10 samples, end of batch	± 10%	Rerun affected samples
	Method blank	Each batch	No analyte detected ≥ report limit	Rerun batch
	LCS	Each batch	±10% Or: historical or client specified where applicable	Rerun batch
	MS/MSD[1]	Each batch	±20% Or: historical or client specified where applicable	None, use LCS
	Duplicate	Each batch	±30%	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

[1]Only applies to EPA300, SW9056.

Appendix 4: Summary of Calibration and QC Procedures for Oil & Grease Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA1664 SW9070. SW9071.	Verification standard (NA for 1664)	Single standard	±10% PAR standard	Rerun
	Method blank	Each batch	No analyte detected ≥ report limit	Repeat batch
	LCS	Each batch	See Control Limits Manual	Repeat batch
	MS/MSD	Each batch	See Control Limits Manual	None, use LCS
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

Appendix 4: Summary of Calibration and QC Procedures for Physical Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW1010: Flash Point. SM2120B*: Color* SW9095*: Paint Filter*. SM2540F*: Settleable Solids*. .	Method blank	Each batch	No analyte detected ≥ report limit	Repeat, rerun
	Two standards for Flash Point 1 Known for Settleable Solids Method-specific standards for Color.	Each batch	Flashpoint LCS ± 2° F	Rerun batch
	Duplicate	Each batch	±20%	None
	MDL verification (NA for flashpoint and paint filter)	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

***Analysis is performed at TestAmerica Denver but does not have any check standard available.**

Appendix 4: Summary of Calibration and QC Procedures for Perchlorate

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA314.1: Perchlorate	Calibration Curve – Minimum 5-point calibration	Initial calibration. Perform instrument re-calibration once per year minimum.	r ≥ 0.995.	Recalibrate
	Calibration verification (ICV), second source	Immediately following initial calibration	±10%	Recalibrate
	Initial Performance Check (IPC)	Each batch	±20%	Recalibrate
	Initial Calibration Check Standard (ICCS)	Each batch	±25%	Recalibrate
	Initial Calibration Blank (ICB)	After initial calibration	No analyte detected ≥ report limit	
	Continuing calibration verification (CCV)	Each use, beginning, every 10 samples, end of batch	± 10%	Rerun affected samples
	Method blank	Each batch	No analyte detected ≥ report limit	Rerun batch
	LCS	Each batch	±15%	Rerun batch
	MS/MSD[1]	Each batch	±20% RPD 15%	Document in NCM
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

Appendix 5. Glossary/Acronyms

Glossary:

Acceptance Criteria:
Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation:

The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority:
The Territorial, State, or Federal Agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation (NELAC) [1.5.2.3]

Accuracy:
The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Aliquot, aliquant:
A measured portion of a sample taken for analysis.

Analyst:
The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

arithmetic mean

The arithmetic mean ($\bar{x}$) is the average of a set of values. It is equal to the sum of the observed values divided by the number of observations. Also called "average".

$$\overline{X} = \frac{\sum_{i=1}^{n} x_i}{n}$$

where: $\overline{X}$ = the mean
x_i = the i^{th} data value
n = number of data values

Assessment:
The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NELAC). (NELAC)

Assessment Criteria:
The measures established by NELAC and applied in establishing the extent to which an applicant is in conformance with NELAC requirements. (NELAC)

Assessment Team:
The group of people authorized to perform the on-site inspection and proficiency testing data evaluation required to establish whether an applicant meets the criteria for NELAP accreditation. (NELAC)

Assessor:
One who performs on-site assessments of accrediting authorities and laboratories' capability and capacity for meeting NELAC requirements by examining the records and other physical evidence for each one of the tests for which accreditation has been requested. (NELAC)

Audit:
A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch:
Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and /or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Benchmarking:
A step-by-step method of improving performance by identifying and studying best practices and comparing them to industry practices.

Bias:
A systematic (consistent) error in test results. Bias is expressed as the difference between the population mean and the true or reference value, or as estimated from sample statistics, the difference between the sample average and the reference value.

Blank:
A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Blind Sample:
A sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Calibration:
To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Curve:
The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

calibration factor (CF):
The ratio of the instrument response of an analyte to the amount injected. CFs are used in external standard calibrations.

$$CF = \frac{Total\ Area\ of\ Peak}{Mass\ Injected}$$

Calibration Method:
A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard:
A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM):
A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30–2.2)

Chain of Custody:
An unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples. (NELAC) [5.12.4]

Clean Air Act:
The enabling legislation in 42 U>S>C> 7401 et seq., Public Law 91-604, 84 Stat. 1676 Pub. L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended, empowering EPA to promulgate air quality standards, monitor and enforce them. (NELAC)

coefficient of variation (relative standard deviation)
A measure of precision (relative dispersion). It is equal to the standard deviation (*s*) divided by the mean ($\overline{X}$) and multiplied by 100 to give a percentage value.

$$\boldsymbol{CV\ (RSD)} = \left(\frac{s}{\overline{X}} \right) \times 100$$

collocated samples:
Independent samples collected in such a manner that they are equally representative of the variable(s) of interest at a given point in space and time. The results will indicate sampling as well as analytical variability.

Comparability:
Comparability is a measure of the confidence with which one data set can be compared to another. To ensure comparability, all laboratory analysts are required to use uniform procedures (i.e., SOPs) and a uniform set of units and calculations for analyzing and reporting environmental data.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/SUPERFUND):
The enabling legislation in 42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 et seq., to eliminate the health and environmental threats posed by hazardous waste sites. (NELAC)

Compromised Samples:
Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified. (NELAC)

completeness
Completeness is a measure of the percentage of measurements that are judged to be valid measurements. At a minimum, the objective for completeness of data is 90% for each constituent analyzed. It is usually expressed as a percentage:

$$\%Completeness = \frac{V}{n} \times 100$$

where: V = number of measurements judged valid
n = total number of measurements

composite

A sample composed of two or more increments.

Confidential Business Information (CBI):
Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. NELAC and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation:
Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

Second column confirmation
Alternate wavelength
Derivatization
Mass spectral interpretation
Alternative detectors or
Additional Cleanup procedures
(NELAC)

Conformance:
An affirmative indication or judgement that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Corrective Action:
The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

correlation coefficient
The correlation coefficient (r) is a determination of how closely data "fits" a straight line. It is a number between -1 and 1 that indicates the degree of linear relationship between two sets of numbers. A correlation coefficient of +1 (usually calculated to three decimal places or 1.000) means the data falls exactly on a straight line with positive slope. A correlation coefficient of -1 (or -1.000) means the data falls exactly on a straight line with negative slope.

Data Audit:
A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction:
The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

data quality objective (DQO)
Data quality objectives (DQOs) are qualitative and quantitative statements used to ensure the generation of the type, quantity, and quality of environmental data that will be appropriate for the intended application (EPA 1994). Typically, DQOs are identified during project scope and development of sampling and analysis plans. In this QA manual, however, we refer to only the analytical DQOs because laboratories generally do not have any authority over sample collection, shipment, or other field-related activities that may affect the data quality of the environmental sample before the sample is received in the laboratory. EPA has established six primary analytical DQOs for environmental studies: precision, accuracy, representativeness, completeness, comparability, and detectability.

Deficiency:
An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

degrees of freedom
The number of independent deviations used in calculating an estimate of the standard deviation.

Detection Limit:
The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

Document Control:
The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses:
The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Environmental Detection Limit (EDL):
The smallest level at which a radionuclide in an environmental medium can be unambiguously distinguished for a given confidence interval using a particular combination of sampling and measurement procedures, sample size, analytical detection limit, and processing procedure. The EDL shall be specified for the 0.95 or greater confidence interval. The EDL shall be established initially and verified annually for each test method and sample matrix. (NELAC Radioanalysis Subcommittee)

Equipment Blank:
Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)

error
The difference between an observed or measured value and its true value.

External Standard Calibration:
Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA):
The enabling legislation under 7 U.S.C. 135 et seq., as amended, that empowers the EPA to register insecticides, fungicides, and rodenticides. (NELAC)

Federal Water Pollution Control Act (Clean Water Act, CWA):
The enabling legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat 816, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance. (NELAC)

Field Blank:
Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Testing:
NELAC's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required to submit to only that portion of the accreditation process not previously addressed (see NELAC, section 1.9ff). (NELAC)

Finding:
An assessment conclusion that identifies a condition having a significant effect on an item or activity. As assessment finding is normally a deficiency and is normally accompanied by specific examples of the observed condition. (NELAC)

Holding Times (Maximum Allowable Holding Times):
The maximum times that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Inspection:
An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ASQC E4-1994)

Internal Standard:
A known amount of standard added to a test portion of a sample and carried through the entire measurement process as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (NELAC)

Internal Standard Calibration:

Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank:
A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Response:
Instrument response is normally expressed as either peak area or peak height however it may also reflect a numerical representation of some type of count on a detector (e.g. Photomultiplier tube, or Diode array detector) and is used in this document to represent all types.

Laboratory:
A defined facility performing environmental analyses in a controlled and scientific manner. (NELAC)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample):
A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), there is no LCS. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Note: NELAC standards allow a matrix spike to be used in place of this control as long as the acceptance criteria are as stringent as for the LCS. (NELAC)

Laboratory Duplicate:
Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Least Squares Regression (1st Order Curve):
The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit of Detection (LOD):
An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory dependent. (Analytical Chemistry, 55, p.2217, December 1983, modified) See also Method Detection Limit.

Manager (however named):
The individual designed as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

Matrix:
The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous Liquid: any organic liquid with < 15% settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: includes soils, sediments, sludges, and other matrices with .15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample):

Prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix spikes shall be performed at a frequency of one in 20 samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as, total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate):

A second replicate matrix spike is prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Matrix spike duplicates or laboratory duplicates shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. The laboratory shall document their procedure to select the use of an appropriate type of duplicate. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate. (QAMS)

measurement
The process or operation of ascertaining the extent, degree, quantity, dimensions, or capability with respect to a standard.

median
The middle value of a set of data when the data set is ranked in increasing or decreasing order.

Method Blank:
A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit:
The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

National Environmental Laboratory Accreditation Conference (NELAC):
A voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP):
The overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

Negative Control:
Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

NELAC Standards:
The plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the National Environmental Laboratory Accreditation Conference. (NELAC)

outlier

A result excluded from the statistical calculations due to being deemed "suspicious" when applying the "Grubbs Test" (or equivalent).

parameter
In statistical analysis, a constant or coefficient that describes some characteristic of a population (e.g., standard deviation, mean, regression coefficients). In analytical chemistry, a chemical or physical attribute of a sample that is being measured, i.e., an analyte (e.g., chemical concentration, temperature, pH, etc.).

percent difference
The difference between two values, expressed as a percent of the first value.

$$\%D = \frac{X_1 - X_2}{X_1} \times 100\%$$

where: %D = percent difference
X_1 = first value
X_2 = second value

percent recovery
A measure of accuracy determined from the comparison of a reported spike value to its true spike concentration.

$$\%R = \frac{\textbf{\textit{observed conc.} – \textit{sample conc.}}}{\textbf{\textit{true spike conc.}}} \times 100\%$$

Performance Audit:
The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS):
A set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

Positive Control:
Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision:
The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation:
Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Proficiency Testing:
A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Program:
The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Test Sample (PT):
A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Quality Assurance:
An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

Quality Assurance [Project] Plan (QAPP):
A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control:
The overall system of technical activities which purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample:
An uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (EPA-QAD)

Quality Manual:
A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System:
A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC (ANSI/ASQC-E-41994)

Quantitation Limits:
The maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user. (NELAC)

Range:
The difference between the minimum and the maximum of a set of values. (EPA-QAD)

Reagent Blank (method reagent blank):
A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Reference Material:
A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Method:
A method of known and documented accuracy and precision issued by an organization recognized as competent to do so. (NELAC)

Reference Standard:
A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.0-8)

Relative percent different (RPD)
Statistic for evaluating the precision of a replicate set. For replicate results:

$$RPD = \left[\frac{|X_1 - X_2|}{\left(\frac{X_1 + X_2}{2} \right)} \right] \times 100$$

where: X_1 = first observed concentration
X_2 = second observed concentration

Relative response factor (RRF)
A measure of the relative mass spectral response of a compound compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples. Because a RRF is the comparison of two responses, it is a unitless number. RRFs are determined by the following equation:

$$RRF = \frac{A_x}{A_{IS}} \times \frac{C_{IS}}{C_x}$$

where: A = area of the characteristic ion measured
C = concentration

IS = internal standard
x = analyte of interest

Replicate Analyses:
The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Reporting limit (RL)
One of two types of reporting limit conventions within STL Denver. The Reporting Limit (RL) is a uniform, STL-wide reporting limit based on an evaluation of the PQLs at STL laboratories and the expected method performance in routine water and soil matrices. Project Specific Reporting Limits (PSRLs) are reporting limits that are defined by project requirements.

Representativeness
Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, a variation in a physical or chemical property at a sampling point, or an environmental condition. Data representativeness is primarily a function of sampling strategy; therefore, the sampling scheme must be designed to maximize representativeness. Representativeness also relates to ensuring that, through sample homogeneity, the sample analysis result (concentration) is representative of the constituent concentration in the sample matrix. At each STL laboratory, every effort must be made to analyze an aliquot that is representative of the original sample, and to ensure the homogeneity of the sample before subsampling.

reproducibility
The precision, usually expressed as a standard deviation, measuring the variability among results of measurements of the same sample at different laboratories.

Requirement:
Denotes a mandatory specification; often designated by the term “shall”. (NELAC)

Resource Conservation and Recovery Act (RCRA):
The enabling legislation under 42 USC 321 et seq. (1976), that gives EPA the authority to control hazardous waste from the “cradle-to-grave”, including its generation, transportation, treatment, storage, and disposal. (NELAC)

Safe Drinking Water Act (SDWA):
The enabling legislation, 42 USC 300f et seq. (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations. (NELAC)

Sample Duplicate:
Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis. (EPA-QAD)

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument

response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity:
(Analytical chemistry) the capability of a test method or instrument to respond to a target substance of constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity:
The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Spike:
A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, a representative number (at a minimum 10%) of the listed components may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.. (NELAC)

Standard:
The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard addition
The procedure of adding known increments of the analyte of interest to a sample to cause increases in detection response to subsequently establish, by extrapolation of the plotted responses, the level of the analyte of interest present in the original sample.

Standard deviation
A measure of the dispersion about the mean of the elements in a population. The square root of the variance of a set of values:

$$s = \sqrt{\frac{\sum_{i=1}^{n}\left(x_i - \overline{X}\right)^2}{n-1}}$$

where: s = standard deviation
□ = sum of

X = observed values
n = number of observations

Standard Operating Procedures (SOPs):
A written document which details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Standardized Reference Material (SRM):
A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Supervisor (however named):
The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties, and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses. (NELAC)

Surrogate:
A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit):
A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Director:
Individuals(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

Test:
A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process, or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method:
An adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP. (NELAC)

Toxic Substances Control Act (TSCA):

The enabling legislation in 15 USC 2601 et seq., (1976) that provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture. (NELAC)

Traceability:
The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM-6.12)

Uncertainty:
A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

United States Environmental Protection Agency (EPA):
The Federal governmental agency with responsibility for protecting public health and safeguarding and improving the natural environment (i.e., the air, water, and land) upon which human life depends. (US-EPA)

Validation:
The process of substantiating specified performance criteria. (EPA-QAD)

Verification:
Confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell:
A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

Acronyms:

A2LA – American Association for Laboratory Accreditation
ASTM – American Society for Testing and Materials
BOD – Biological Oxygen Demand
BS – Blank Spike
BSD – Blank Spike Duplicate
CAR – Corrective Action Report
CCC – Calibration Check Compound
CCV – Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
COD – Chemical Oxygen Demand
CRS – Change Request Form
CUR – Condition Upon Receipt
DFTPP – Decafluorotriphenylphosphine
DOC – Demonstration of Capability
DOE – Department of Energy
DOT – Department of Transportation
DoD – Department of Defense
DQO – Data Quality Objectives
DU – Duplicate
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HDPE – High Density Polyethylene
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICS – Interference Check Sample
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
ISO – International Organization for Standardization
LCL – Lower Control Limit
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
MDL – Method Detection Limit
MS – Matrix Spike
MSA – Method of Standard Additions
MSD – Matrix Spike Duplicate
MSDS - Material Safety Data Sheet
NELAC - National Environmental Laboratory Accreditation Conference
NELAP - National Environmental Laboratory Accreditation Program
NCM – Non-conformance Memo
NIST – National Institute of Standards Technology
NPDES – National Pollutant Discharge Elimination System

Acronyms con't:

PAH – Polyanuclear Aromatic Hydrocarbon
PCB – Polychlorinated biphenyl
PDS – Post Digestion Spike
PM – Project Manager
PQL – Practical Quantitation Limit
PSRL – Project Specific Reporting Limit
PT – Performance Testing
QAM – Quality Assurance Manual
QAPP – Quality Assurance Project Plan
QAS – Quality Assurance Summary
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RCRA – Resource Conservation and Recovery Act
RF – Response Factor
RFP – Request for Proposal
RL – Reporting Limit
RPD – Relative Percent Difference
RRF – Relative Response Factor
RSD – Relative Standard Deviation
RSO – Radiation Safety Officer
SD – Standard Deviation
SDG – Sample Delivery Group
SOP - Standard Operating Procedure
SOW – Statement of Work
SPCC – System Performance Check Compound
SPLP – Synthetic Precipitation Leaching Procedure
SRM – Standard Reference Material
TCLP – Toxicity Characteristic Leaching Procedure
TIC – Tentatively Identified Compound
TAT – Turn-Around-Time
TKN – Total Kjeldahl Nitrogen
TOC – Total Organic Carbon
TOX – Total Organic Halides
UCL – Upper Control Limit
UPS – Uninterruptible Power Supply
USEPA – United States Environmental Protection Agency
VOA – Volatiles
VOC – Volatile Organic Compound
WS – Water Supply
WP – Water Pollution

Appendix 6.

Laboratory Certifications, Accreditations, Validations

TestAmerica Denver maintains certifications, accreditations, certifications, and validations with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

Organization	Certificate Number	Organization	Certificate Number
AFCEE	None	Nevada	CO0026
Alabama	40730	New Jersey	CO004
Alaska	UST-30	New Mexico	None
Arizona	AZ0713	North Carolina	358
Arkansas	88-0687	North Dakota	R-034
California	2513	Oklahoma	8614
Colorado	CO0026	Oregon	CO200001
Connecticut	PH-0686	Pennsylvania	68-00664
Florida	E87667	RAM License	Colorado 486-03
Georgia – DW	962	South Carolina	72002001
Georgia – NP & Soils	None	Tennessee	TN02944
Idaho	CO00026	USACE	Self Declared
Illinois	007726	USDA	S-60617
Iowa	370	Texas	T104704183
Kansas	E-10166	Utah	Quans5
Louisiana	02096	Washington	C1284
Maine	CO0002	Wisconsin	999615430
Maryland	268	West Virginia	354
Minnesota	11175AA		

The certificates and parameter lists (which may differ) for each organization may be found on the corporate web site, the laboratory's public server, the final report review table, and in the following offices: QA, marketing, and project management.

Claims of Accreditation Status

TestAmerica Denver has agreed to make only valid claims as to its accreditation/certification status by any authority by ensuring that the expiration dates are not exceeded and the method-specific scope or parameter lists are supportable, as required by each. Any false claims would be reported to that authority. The agreement covers the use of the authority's name, such as "Authority-Accredited," logo, or certificate number. The only valid proof of accreditation/certification is the current certificate and scope of the authority. It is the responsibility of the laboratory to make these documents available to all staff, and it is the staff's duty to reference only the current documents.

A report with scope and non-scope analytes may only be presented on the same report if the non-accredited results are clearly and unambiguously identified. No report with non-scope analytes may be associated with the logo, "Authority accredited" phrase, or the certificate number. Only the analytes specified by a unique method are valid within the scope. There shall be no intentional misleading of the users of the laboratory's services in this regard.

No opinions and/or interpretations based on results outside the laboratory's scope may be presented on a document referenced by "Authority-accredited, the logo, or the certificate number. If these are made, they must be written in a separate letter which is not endorsed by the authority.

The "Authority-accredited" logo may only be affixed to equipment calibrated by a laboratory that is accredited by the authority. If calibration labels contain the logo, they must also show the calibration laboratory's name or its certificate number, the instrument's unique identification, the date of the last calibration, and a cross-reference to the last calibration certificate.

Should the company decide to use the "Authority-accredited" logo in marketing activities, no misrepresentation may occur. Only reference to the accredited scope at a specific laboratory site is allowed. If any "Authority-accredited" language is used in proposals or quotations, any non-scope analytes must be clearly denoted as not accredited by that authority. The same is true for any use of laboratory letterhead with the "Authority-accredited" wording or logo. The logo may not be affixed to any material, item, product, part, or packaging, thereby implying accreditation status to that piece. In literature, any use of the logo must be positioned adjacent to the accredited laboratory's name and clearly state that the presence of the logo does not imply certification/approval of the products tested. At no time may the logo appear to suggest that a person is accredited. Misrepresentation of accreditation status is never allowed and must be reported if it occurs. If in doubt, the idea of the logo's use may be presented to the authority for approval.

If accreditation is terminated or suspended, the laboratory will immediately cease to use the "Authority-accredited" wording, the logo, or the certificate number reference in any way and inform clients impacted by the change.

Appendix 7. Data Qualifiers - Standard

Qualifier	Definition
*	Surrogate or Relative Percent Difference (RPD) is outside control limits.
A	Spiked analyte recovery is outside control limits.
B	Organics: Method blank contamination. The associated method blank contains the target analyte at a reportable level. Inorganics: Estimated result. Result is less than the RL
COL	More than 40% difference between the primary and confirmation detector results. The lower of the two results is reported.
DIL	The concentration is estimated or not reported due to dilution.
E	Estimated result. Result concentration exceeds the calibration range.
G	Inorganics: Elevated reporting limit. The reporting limit is elevated due to matrix interference.
J	Organics: Estimated result. Result is less than RL Inorganics: Method blank contamination. The associated method blank contains the target analyte at a reportable level.
L	Serial dilution of a digestate in the analytical batch indicates that physical and chemical interferences are present
N	Spiked analyte recovery is outside stated control limits.
NC	The recovery and/or RPD were not calculated.
ND	The analyte was not detected at the MDL concentration and with a measurable degree of confidence can be said not to be present at or above the RL concentration.
P	Relative percent difference (RPD) is outside stated control limits.
Q	Elevated reporting limit. The reporting limit is elevated due to high analyte levels.
V	General Chemistry: Elevated reporting limit due to limited sample volume.
Wa	Post digestion spike recovery fell between 40-85% due to matrix interference.
Wb	Post digestion spike recovery fell between 115-150% due to matrix interference.
I	Percent recovery is estimated since the results exceeded the calibration range.
T1	A tentatively identified compound that did not generate a spectral match of 80% or greater. Typically called “unknown”
T2	A tentatively identified compound with a spectral match of 80% or better
T3	A tentatively identified compound that was calibrated for by the lab, but not on the client target analyte list.
IC	Diluted due to high inorganic chloride.

This is not an exhaustive list of qualifiers. All qualifiers are defined on each data sheet. Client specific qualifiers may also be used, and would also be defined on the data sheet.

Appendix 7 con't. Data Qualifiers – AFCEE 4.0

Qualifier	Definition
J	The analyte was positively identified; the quantitation is estimated due to discrepancies in meeting certain analyte-specific quality control criteria.
U	The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
F	The analyte was positively identified but the associated numerical value is above the MDL and below the RL.
R	The data are rejected due to deficiencies in the ability to analyze the sample and meet QC criteria.
Q	One or more quality control criteria (for example, LCS recovery, surrogate spike recovery, etc.) failed.
B	The analyte was found in an associated blank, as well as in the sample.
M	A matrix effect was present.
NC, MSB	The recovery and RPD were not calculated because the sample amount was greater than four times the spike amount.
NC, DIL	The recovery was not calculated because the sample was diluted four times or greater.
N	Inorganics: Spiked analyte recovery is outside stated control limits.
A	Organics: Spiked analyte recovery is outside stated control limits.
*	Surrogate or LCS is outside control limits.
UJ	The analyte was not detected; however, the result is estimated due to discrepancies in meeting certain analyte specific quality control criteria.

Appendix 7 con't. Data Qualifiers – DoD QSM Version 3

Qualifier	Definition
U	Undetected at the limit of detection. The associated data value is the limit of detection, adjusted by any dilution factor used in the analysis.
J	Estimated: The analyte was positively identified; the quantitation is estimated (for example, matrix interference, outside the calibration range).
B	Blank contamination: The analyte was detected in the associated method blank at a concentration greater than one-half the reporting limit.
B	Metals Forms 3, 5B and 9 (ICB, CCB, Post-Digestion Spike and Serial Dilution): Analyte was detected above the method detection limit but below the reporting limit.
Q	One or more quality control criteria (for example, LCS recovery, surrogate recovery) failed. Data usability should be carefully assessed by the project team.
A	Spiked analyte recovery is outside control limit.
MSB	The recovery and RPD were not calculated because the sample amount was greater than four times the spike amount.
NC DIL	The recovery and RPD were not calculated due to dilution.
N	Inorganics: Spiked analyte recovery is outside stated control limits.
A	Organics: Spiked analyte recovery is outside stated control limits.
*	Surrogate or LCS is outside control limits.

Appendix C

Selected NDEP Guidance Documents

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION
Jim Gibbons, Governor
Allen Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

May 3, 2006

Mr. Mark Paris
Basic Remediation Company
875 West Warm Springs Road
Henderson, NV 89105

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, NV 89009

Mr. Sam Chamberlain
Pioneer Companies, Inc.
700 Louisiana St, Suite 4300
Houston, TX 77002

Mr. Joe Kelly
Montrose Chemical Corp of CA
600 Ericksen Ave NE, Suite 380
Bainbridge Island, WA 98110

Mr. George Crouse
Syngenta Crop Protection, Inc.
410 Swing Road
Greensboro, NC 27409

Mr. Craig Wilkinson
Titanium Metals Corporation
PO Box 2128
Henderson, NV 89009

Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
NDEP Guidance on Data Validation

Dear Sirs and Madam:

Attachment A contains the NDEP's guidance on the level of data verification and validation that is required for your respective projects. Please be advised that this applies to all historic data that is planned to be used for any purpose as well as all data collected in the future. Your respective project schedules should reflect this effort and all companies are requested to initiate this effort as soon as possible. The NDEP is willing to meet with each company individually to discuss your specific questions and concerns.

If you have any questions, do not hesitate to contact me.

Sincerely,

Brian A. Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions

BAR:s

CC: Jim Najima, NDEP, BCA, Carson City
Marysia Skorska, NDEP, BCA, Las Vegas

Shannon Harbour, NDEP, BCA, Las Vegas
Brian Rakvica, NDEP, BCA, Las Vegas (7 copies total)
Barry Conaty, Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1333 New Hampshire Avenue, N.W., Washington, D.C. 20036
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Rob Mrowka, Clark County Comprehensive Planning, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89015
Craig Wilkinson, TIMET, PO Box 2128, Henderson, Nevada, 89009-7003
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Susan Crowley, Tronox, PO Box 55, Henderson, Nevada 89009
Keith Bailey, Tronox, Inc, PO Box 268859, Oklahoma City, Oklahoma 73126-8859
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Lee Erickson, Stauffer Management Company, 400 Ridge Rd, Golden, CO 80403
Chris Sylvia, Pioneer Americas LLC, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 3846 Estate Drive, Stockton, California 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Jon Erskine, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Karleen O'Connor, Cox Castle Nicholson, 555 Montgomery Street, Suite 1500, San Francisco, CA 94111
Brian Walsh, Centex Homes, 3606 North Rancho Drive, Suite 102, Las Vegas, NV 89130
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004
Vincent Aiello, Beazer Homes, 4670 South Fort Apache, Suite 200, Las Vegas, NV
David Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544

Attachment A

NDEP Data Verification and Validation Requirements

The intent of this document is to specify the level of data verification and validation that is required for all data collected for the BMI Complex area. Data verification and validation fit into the USEPA overall Quality System as described in *Guidance on Environmental Data Verification and Data Validation, (QA/G-8) (EPA 2002).* Data verification and validation are performed using sample results and the process provides the output necessary to perform data quality assessment. This document only describes the verification and validation requirements and does not address data quality assessment further.

Data verification and validation should be performed in a manner that materially follows the Tiered approach outlined in the draft *Region 9 Superfund Data Evaluation/ Validation Guidance (R9QA/006.1).* More specifically, Tier 2 described in that document should be followed for the organic and inorganic data. In general, radiochemistry can only be reviewed at the Tier 1A level due to the lack of raw data. Following the Tier 2 approach, it is required that **100% of all data collected be reviewed** (per Tier 1A/1B) for the following components (where applicable):

- Completeness Check.
- Chain of Custody (signatures, sample conditions, preservatives, sampling handling/filtering).
- Holding Times.
- Random check (10-20%) of Initial and Continuing Calibration.
- Review of Quality Control Summaries including negative control (blanks) and positive control (LCS) along with Sample Specific Controls (replicates, matrix spikes, surrogates, tracers/ yields).
- Overall assessment.

In addition to this 100% review, **at least 10% of the data must be validated to the level of raw data**. Ideally this level of validation should be focused on a class of compounds that has been identified as significant for the area of interest, based upon previous data; or that represent special cases (e.g. non-standard methods specifically applied to the site). This validation should include the following items (in addition to those listed above):

- 100% validation of Initial and Continuing Calibration, including GC/MS tuning (data reporting forms).
- Random recalculation (10-20%) of reported results versus raw data.
- 100% validation of Interference Check Sample (data reporting forms), ICP Serial Dilution (data reporting forms), GC/MS instrument performance check, Reporting Limits (ensure they include appropriate sample weights, moisture, dilution).
- Internal Standards, Compound Identification, and TICs (where appropriate).
- Random check (5%) of integration and mass spectrum matches (where available and appropriate).
- When project or sampling specific items have been identified in the planning documents for review, these should be added.
- Overall assessment.

To clarify how the percentages should be calculated the following guidelines should be used. When determining the set of data that will meet the 10% requirement for raw data, this should be based on the number of data packages validated compared to the total number of data packages. This is advised since reviewing a complete data package to the raw data level requires a very similar amount of time than if only a part of a data package is validated to this raw data level.

When determining the percentage of a data package that should be randomly (5-20%) checked, this should be on a sample basis. For example, to check 5% of the mass spectrum matches, a single sample out of 20 would meet this criterion.

If full raw data validation activities indicate a systemic problem or repeated non-compliance the level of raw data validation should be increased to adequately determine the level of impact associated with the non-compliance. This increased validation activity should also be used to determine any root cause and necessary corrective actions.

The output of the data verification and validation process described above should include a detailed Data Validation Summary Report (DVSR) to include the following:

- Introduction with Purpose/Objective/Process.
- Applicable Samples, SDG ID, sample ID link to sample location, analyses.
- Level of validation for each sample or SDG and the calculation used to determine the percentage of data reviewed/validated.
- Data validation qualifier definition.
- Definitions for the reason codes that link results in the database to a specific qualifier logic.
- Data validation findings for each parameter based on the level of review. When non-conformances are identified they should be linked to the appropriate sample(s) and SDG.
- Evaluation of PARCCS parameters.
- Conclusions/Recommendations.
- References.
- Electronic database of the dataset that is being addressed by the report including all raw data and laboratory report (on CD in Microsoft Access database).

STATE OF NEVADA
Jim Gibbons, Governor
Department of Conservation & Natural Resources
Allen Biaggi, Director
DIVISION OF ENVIRONMENTAL PROTECTION
Leo M. Drozdoff, P.E., Administrator
ndep NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

February 23, 2007

Mr. Mark Paris
Basic Remediation Company
875 West Warm Springs Road
Henderson, NV 89011

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, NV 89009

Mr. Sam Chamberlain
Pioneer Companies, Inc.
700 Louisiana St, Ste 4300
Houston, TX 77002

Mr. Joe Kelly
Montrose Chemical Corp of CA
600 Ericksen Ave NE, Suite 380
Bainbridge Island, WA 98110

Mr. Brian Spiller
Stauffer Management Co LLC
1800 Concord Pike
Wilmington, DE 19850-6438

Mr. Craig Wilkinson
Titanium Metals Corporation
PO Box 2128
Henderson, NV 89009

Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Additional Guidance on Development of Data Validation Summary Reports (DVSRs)

Dear Sirs and Madam:

Based upon some recent submittals by the BMI Companies, the NDEP has noted some topics regarding DVSRs that require additional clarification. In addition, please note that it may be helpful to review the format and content of the DVSRs submitted by Basic Remediation Company (BRC) and the NDEP's comments on these reports. Generally, the format and content of the more recent BRC DVSRs has been acceptable to the NDEP.

In May 2006 the NDEP provided guidance on the Data Validation process as well as the items that are expected to be included in companies Data Validation Summary Reports.

In that memo, the following items were specified:

The output of the data verification and validation process described above should include a detailed Data Validation Summary Report to include the following:

- Introduction with Purpose/Objective/Process.
- Applicable Samples, SDG ID, that correspond to locations, analyses, level of validation.
- Data validation qualifier definition.
- Reason codes that link results in the database to specific qualifier logic.
- Data validation findings for each parameter based on the level of review. When non-conformances are identified they should be linked to the appropriate sample(s) and SDG.
- Evaluation of PARCCS parameters.
- Conclusions/Recommendations.
- References.

After reviewing a number of DVSRs as well as data usability reports NDEP is providing the following recommendations and additional details on the DVSRs. Each DVSR should include the following, in addition to those items specified above:

- If aqueous samples have been filtered or centrifuged prior to analysis this should be included in the report.
- The DVSRs should include tables that specify when a non-conformance has been identified during the data validation process. These tables should be categorized by issue, for example those samples qualified due to Laboratory Control Sample exceedances should be within the same table. Each table should specify the sample, SDG/lab package (if this is unclear from earlier information in the report), the analyte(s), the data quality indicator and objective (e.g. % Recovery, Limits of 85-115%), the sample result(s) and the data validation qualifier. This information is necessary to both properly evaluate the DVSR and will also facilitate data usability investigations. Each data quality indication, for example percent recovery, percent difference, precision (RPD), area (for internal standards), raw level of blank value that is used to compare with analyte levels in the native samples, cooler temperature, holding time days and exceedance, should be captured in these tables. Since this information is captured during the data validation steps and to minimize duplication of effort, it is recommended that this information be kept in a database (e.g. Excel, Access) to facilitate evaluating the results. However, only tables are required in the DVSR.
- Each DVSR should also be submitted with the original laboratory reports (including Chain-of-Custodies), the database for that set of results, and any data validation reports prepared by a third-party. Make sure the database includes, at a minimum, the sample ID (both field and laboratory), lab package/SDG, type of sample (soil, aqueous, native, QC), start and stop depth (where applicable), sample data, analytical method, chemical name, results, units, all qualifiers and reason codes, detection and reporting limits.

The NDEP would also like to note that if any of the BMI Companies have specific questions a meeting can be arranged between the Companies' data validation team and the NDEP's data validation team. Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov)

Sincerely,

Brian A Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions

BAR:s

CC: Jim Najima, NDEP, BCA, Carson City
Marysia Skorska, NDEP, BCA, Las Vegas
Shannon Harbour, NDEP, BCA, Las Vegas
Barry Conaty, Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1333 New Hampshire Avenue, N.W., Washington, D.C. 20036
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009

Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Rob Mrowka, Clark County Comprehensive Planning, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021
Lee Erickson, Stauffer Management Company LLC, P.O. Box 18890 Golden, CO 80402
Keith Bailey, Tronox, Inc, PO Box 268859, Oklahoma City, Oklahoma 73126-8859
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Chris Sylvia, Pioneer Americas LLC, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 3846 Estate Drive, Stockton, California 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Jon Erskine, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Robert Infelise, Cox Castle Nicholson, 555 Montgomery Street, Suite 1500, San Francisco, CA 94111
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004
Dave Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations
Jim Gibbons, Governor
Allen Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

May 21, 2007

Mr. Mark Paris
Basic Remediation Company
875 West Warm Springs Road
Henderson, NV 89011

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, NV 89009

Mr. Larry Landry
Pioneer Companies, Inc.
700 Louisiana St, Ste 4300
Houston, TX 77002

Mr. Joe Kelly
Montrose Chemical Corp of CA
600 Ericksen Ave NE, Suite 380
Bainbridge Island, WA 98110

Mr. Brian Spiller
Stauffer Management Co LLC
1800 Concord Pike
Wilmington, DE 19850-6438

Mr. Craig Wilkinson
Titanium Metals Corporation
PO Box 2128
Henderson, NV 89009

Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Additional Guidance on Completion of Quality Checks for Cation-Anion Balance

Dear Sirs and Madam:

In response to questions from several of the parties listed above, Attachment A is a document which provides additional guidance on the completion of quality checks for cation-anion balances. This guidance should be shared with your respective analytical laboratory and should be reflected in any data validation that is completed.

Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

Brian A Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions

BAR:s

CC: Jim Najima, NDEP, BCA, Carson City
Marysia Skorska, NDEP, BCA, Las Vegas
Shannon Harbour, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Greg Lovato, NDEP, BCA, Carson City

Barry Conaty, Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1333 New Hampshire Avenue, N.W., Washington, D.C. 20036
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Rob Mrowka, Clark County Comprehensive Planning, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021
Lee Erickson, Stauffer Management Company LLC, P.O. Box 18890 Golden, CO 80402
Keith Bailey, Tronox, Inc, PO Box 268859, Oklahoma City, Oklahoma 73126-8859
Jeff Gibson, AMPAC, 3770 Howard Hughes Parkway, Suite 300, Las Vegas, Nevada 89109
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Chris Sylvia, Pioneer Americas LLC, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 3846 Estate Drive, Stockton, California 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Jon Erskine, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Robert Infelise, Cox Castle Nicholson, 555 Montgomery Street, Suite 1500, San Francisco, CA 94111
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004
Dave Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544
Paul Black, Neptune and Company, Inc., 8550 West 14th Street, Suite 100, Lakewood, CO 80215
Teri Copeland, 5737 Kanan Rd., #182, Agoura Hills, CA 91301
Paul Hackenberry, Hackenberry Associates, 550 West Plumb Lane, B425, Reno, NV, 89509

Attachment A

The analytical parameters that are included for the groundwater samples analyzed at the BMI complex include the major cation and anions along with a measured Total Dissolved Solids (TDS) value. Based on the evaluation of previous data collected at the site, using Standard Methods (Standard Methods for the Examination of Water and Wastewater, 20th Edition, January 1999) Section 1030 E for Correctness of Analyses, it appears numerous samples do not meet the quality checks. The quality checks employed included anion-cation balance, measured TDS to calculated TDS ratio, and measured TDS to EC ratio. These checks were made via the spreadsheet application that had previously been developed by Hackenberry Associates, LLC for the construction of Piper Trilinear diagrams.

Geochemical checks on correctness of analysis were made at three different sites at the BMI Complex. For the example herein, the analytical results were checked for 40 groundwater samples from the 2004 Hydrogeologic Characterization Summary (BRC, 2004, Table 3-24). The check for accuracy of analysis included 17 wells completed in the alluvial aquifer (Aa) and 23 wells completed in the Muddy Creek Formation (MCf).

The anion-cation balance check included major cations and anions as listed below:

1. calcium,
2. magnesium,
3. sodium,
4. potassium,
5. sulfate,
6. chloride,
7. bicarbonate and carbonate, and
8. hydroxide.

Hydroxide alkalinity, although uncommon in natural groundwater (Hem, 1992, p. 64), was added because the pH values were quite high for a number of samples and the hydroxide values were also very high. Fluoride, nitrate, and perchlorate were also included in the anion-cation balance calculation, but were not included in the calculation of percentages for the Piper Trilinear diagrams. The latter three analytes were added more for completeness based on site history than for contribution to the anion-cation balance, because their percentages were less than one percent of total anions. Trace metals were not included in the calculations for the same rationale. Analytes measured in the microgram per liter range would likely not significantly affect the balance outcome. Only four of the 17 samples from the Aa had anion-cation balances within the error limits specified in Standard Methods. Only seven of the 23 samples from the MCf had anion-cation balances within the error limits specified in Standard Methods. The anion-cation balance for three of the samples from the MCf was not verified because their anion sum was beyond the range provided in Standard Methods. Almost all the total dissolved solids values (40 of 49) in Table 3-24 were “J” flagged.

Based on the numerous instances in which the correctness of the analyses did not meet the Standard Method criteria it is recommended that in the future the laboratories performing these analyses also perform the correctness test.

When the correctness test is violated, the laboratory should follow the Standard Method recommendations and evaluate the data for error and, if necessary, re-analyze the samples. If the results of any corrective action are not sufficient, then the data that does not meet these quality checks should be qualified. For example, based on the electronuetrality and TDS checks there are four potential outcomes:

1. Cation-anion balance checks & TDS sum versus TDS measured checks.
2. Cation-anion balance checks & TDS sum versus TDS measured does not check.
3. Cation-anion balance does not check & TDS sum versus TDS measured checks.
4. Cation-anion balance does not check & TDS sum versus TDS measured does not check.

When the quality checks result in outcomes numbered 2 and 3, the data should be qualified using a designation that is specific to the quality issue. When the quality checks result in outcome number 4, the data should be qualified as unreliable. The following qualifier designations are recommended for outcomes 2, 3, and 4:

2. J-TDS
3. J-CAB
4. J-TDS&CAB

December 3, 2008

Mr. Mark Paris
Basic Remediation Company
875 West Warm Springs Road
Henderson, NV 89011

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, NV 89009

Mr. Curt Richards
Olin Corporation
3855 North Ocoee Street, Suite 200,
Cleveland, TN 37312

Mr. Joe Kelly
Montrose Chemical Corp of CA
600 Ericksen Ave NE, Suite 380
Bainbridge Island, WA 98110

Mr. Brian Spiller
Stauffer Management Co LLC
1800 Concord Pike
Wilmington, DE 19850-6438

Mr. Craig Wilkinson
Titanium Metals Corporation
PO Box 2128
Henderson, NV 89009

Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Detection Limits and Data Reporting

Dear Sirs and Madam:

For the purposes of this letter the parties listed above shall be referred to as "the Companies". Guidance on data reporting and detection limits is provided in Attachment A. These issues must be considered and addressed in all future Deliverables. Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

Brian A Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions

BAR:s

CC: Jim Najima, NDEP, BCA, Carson City
Marysia Skorska, NDEP, BCA, Las Vegas
Shannon Harbour, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Greg Lovato, NDEP, BCA, Carson City
Barry Conaty, Holland & Hart LLP, 975 F Street, N.W., Suite 900,Washington, D.C. 20004
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Ebrahim Juma, Clark County DAQEM, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021
Lee Erickson, Stauffer Management Company LLC, P.O. Box 18890 Golden, CO 80402
Keith Bailey, Environmental Answers, 3229 Persimmon Creek Drive, Edmond, OK 73013
Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr., Henderson, NV 89014
Susan Crowley, Tronox LLC, PO Box 55, Henderson, Nevada 89009
Mike Skromyda, Tronox LLC, PO Box 55, Henderson, Nevada 89009
Jeff Gibson, AMPAC, 3770 Howard Hughes Parkway, Suite 300, Las Vegas, Nevada 89109
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Cindi Byrns, Olin Chlor Alkali, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 3846 Estate Drive, Stockton, California 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Robert Infelise, Cox Castle Nicholson, 555 California Street, 10th Floor, San Francisco, CA 94104-1513
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004
Dave Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544
Paul Black, Neptune and Company, Inc., 8550 West 14th Street, Suite 100, Lakewood, CO 80215
Teri Copeland, 5737 Kanan Rd., #182, Agoura Hills, CA 91301
Paul Hackenberry, Hackenberry Associates, 550 West Plumb Lane, B425, Reno, NV, 89509

Attachment A

Chemical concentration data used for human health and ecological risk assessment are often censored because of the difficulty of determining with sufficient confidence a reportable concentration. There are many types of censoring limits for chemical analytical data, however, they can usually be placed in a category of detection limit, reporting limit or quantification limit. A review of the Companies' databases shows that four terms have been used for censoring limits in the databases across the various projects (see Table 1 below):

- Method Detection Limit (MDL)
- Reporting Detection Limit (RDL)
- Quantitation Limit (QL)
- Reporting Limit (RL)

These are not the same terms that are used in the data validation summary reports (DVSRs), in which the following censoring limits are identified:

- Method Detection Limit (MDL)
- Sample Quantitation Limit (SQL)
- Practical Quantitation Limit (PQL)

The purpose of this guidance is to standardize the approach to reporting information for non-detects.

Table 1: Censoring limits in Companies' databases

Dataset	MDL	RDL	QL	RL
Suppl. Background Report	x	x	x	
Deep Background Report	x	x	x	
2005 Background Report	x	x	x	
TRECO	x	x	x	x
Borrow Pit	x	x		x
Parcel 4A	x			x
Parcels A & B (TRONOX)	x			x
Parcel 4B	x			x
Galleria				x
Mohawk (from June 2008 DB)	x			x
Southern RIBS				x
Sunset North	x			x
Western Hook				x

The DVSRs provide the following definitions:

- Method Detection Limit (MDL) – This limit was established by the laboratories according to the requirement in 40 CFR 136, Appendix B, and represents the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. MDLs are established using matrices with little or no interfering species using reagent matrices and are considered the lowest possible reporting limit. Often, the MDL is represented as the instrument detection limit. MDLs are included in data reports as well as the electronic data deliverables (EDDs).

- Sample Quantitation Limit (SQL) – The SQL is defined as the MDL adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes, and takes into account sample characteristics, sample preparation, and analytical adjustments. It represents the sample-specific detection limit and all non-detected results are reported to this level.

- Practical Quantitation Limit (PQL) – This limit is defined as the lowest level at which the entire analytical system gives a recognizable signal and acceptable calibration point for the analyte, and includes the predicted effect of sample matrices with typical interfering species. The PQL is the lowest concentration of an analyte that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions. PQLs are used to estimate or evaluate the minimum concentration at which the laboratory can be expected to reliably

measure a specific chemical contaminant during day-to-day analyses of different sample matrices. Detected results greater than the SQL, but less than the PQL, were qualified by the laboratory as estimated.

SQLs are sample-specific detection limits. They are usually an adjustment from the MDL for sample specific reasons (e.g., dilution, interference). PQLs are greater than the SQLs and are similar to a reporting limit in that, in most cases, they are the lowest calibration level run or some multiple of the SQL.

The censoring limits in the EDDs (as loaded into the database), in most cases, include the MDL, the SQLs for metals and PQLs for all other stable chemistries. All results greater than the SQL and less than the PQL are qualified as estimated (J flag).

In effect, the DVSRs and databases, agree concerning the use of the term MDL; RDL appears to be the same as SQL; and RL appears to be the same as PQL. QL is also the same as PQL.

It is requested that the discrepancy in the nomenclature be resolved. Most sampling and analysis plans, risk assessment reports and other relevant documents describe the censoring limit to be used for statistical data analysis as the SQL. Consequently, NDEP suggests that the MDL, SQL, PQL nomenclature be adopted in the databases as well as in the DVSRs and all other Deliverables.

Of further concern is how the censoring limits have been used in statistical data analysis and risk assessment. Again, there have been inconsistencies. For some projects the SQL (RDL) has been used, and for others the PQL (RL or QL) has been used. There are also inconsistencies between use of censoring limits for inorganic chemicals (metals) and organic chemicals within the same database. NDEP prefers that the SQL is used for all statistical analysis and risk assessment. As noted above this a sample-specific detection limit. This approach allows for inclusion of more information in the statistical analysis, allows background comparisons to be performed more clearly, and removes unnecessary conservatism from the risk assessments.

To clarify, NDEP suggests the following courses of action to make use of censoring limits consistent and as useful as possible:

1. Make the nomenclature consistent between databases, DVSRs and all Deliverables.

2. Report the MDL, SQL and PQL in the databases. NDEP notes that the MDL and SQL are often the same. In those cases, reporting the SQL is sufficient.

3. Use the SQL in statistical analysis and risk assessment.

The situation is somewhat different for radionuclides. In this case, data can be reported regardless of the minimum detectable activity (MDA), which serves as a metric for evaluating sensitivity of the laboratory analysis. The MDA for radionuclides is the lowest level of activity in a given sample that is statistically distinguishable from a sample with no activity, at the 2-sigma confidence interval. The MDAs for radionuclide analysis are determined by a mathematical formula that takes into account sample volume, chemical recovery, instrument detection efficiency and background, and sample counting duration. The

MDA, therefore, is equivalent to the SQL for radiochemical analytes. For radiochemical analysis, no PQL is established as all results are reported to the MDA. In addition, the 2-sigma radiological error is reported for each analyte in each sample. Because a result that is not censored is available for all radionuclide analyses, NDEP prefers that the MDAs are reported in the databases, but are otherwise not used for statistical analysis or risk assessment, and that the raw data are used directly.

Asbestos also provides a unique case. Asbestos data should be reported in terms of the raw counts of asbestos fibers detected in a given sample. Analytical sensitivity and concentration of asbestos in soil can be calculated from the raw data if the other elutriator instrument parameters are also provided (e.g., area of the filter, area of the scanned part of the filter, volume of air passed through the filter). In effect there are no detection limits that can be used to censor the asbestos data.

USER'S GUIDE AND BACKGROUND TECHNICAL DOCUMENT FOR NEVADA DIVISION OF ENVIRONMENTAL PROTECTION (NDEP) BASIC COMPARISON LEVELS (BCLs) FOR HUMAN HEALTH FOR THE BMI COMPLEX AND COMMON AREAS

Nevada Division of Environmental Protection
Bureau of Corrective Actions
Special Projects Branch
2030 East Flamingo Road, Suite 230
Las Vegas, NV 89119

December 2008

Revision 1 – February 2009

TABLE OF CONTENTS

DISCLAIMER

The Nevada Division of Environmental Protection (NDEP) Basic Comparison Levels (BCLs) address common human health exposure pathways. They consider neither all potential human health exposure pathways nor do they address ecological concerns. The comparison of site characterization data against these risk-based media concentrations provides for an initial screening evaluation to assist users in risk assessment components such as the evaluation of data usability, determination of extent of contamination, identification of chemicals of potential concern, and identification of preliminary remediation goals. The values are derived using equations from U.S. Environmental Protection Agency (USEPA) guidance, USEPA toxicity criteria, and USEPA exposure factors. NDEP officials may decide to follow the guidance provided herein or act at variance with the guidance, based on analysis of site-specific circumstances or availability of new or more relevant data or regulatory policies. NDEP also reserves the right to change this guidance at any time without public notice. Every effort has been made to ensure accuracy in these tables; however, if an error is found, please send an e-mail to brakvica@ndep.nv.gov.

These BCLs are designed for use at the BMI Complex and Common Areas in Henderson, Nevada. The applicability of the BCLs should be verified prior to use at any other site.

The guidance set out in this document is not final NDEP action. It is neither intended to nor can it be relied upon, to create any rights enforceable by a party in litigation with the state of Nevada.

1.0 BACKGROUND ON NDEP BASIC COMPARISON LEVELS (BCLs)

The Internet version of the Nevada Division of Environmental Protection (NDEP) Basic Comparison Levels (BCLs) can be found at the worldwide web address http://ndep.nv.gov/bmi/technical.htm.

Users are advised to employ these BCLs only after fully understanding this guidance. The BCL Table was not generated to represent action levels or final cleanup levels but rather as a technical screening tool to assist users in risk assessment components such as the evaluation of data usability, determination of extent of contamination, identifying chemicals of potential concern, and identifying preliminary remediation goals. The BCL Table contains current human health toxicity values that are combined with standard exposure factors to estimate contaminant concentrations in environmental media (air, soil, and water) that are considered by NDEP to be protective of human exposures (including sensitive sub-groups) over a lifetime. Chemical concentrations above the relevant BCLs do not automatically designate the site as needing a response action. However, exceeding a BCL may suggest that further evaluation of the potential risks posed by site contaminants is appropriate. Further evaluation might include additional sampling, consideration of ambient levels in the environment, or a reassessment of assumptions contained in these screening-level estimates (e.g., appropriateness of route-to-route extrapolations, of using chronic toxicity values to evaluate sub-chronic exposures, refining exposure factors, and/or fate and transport modeling).

For each chemical, BCLs are back-calculated from target risk levels. For the inhalation and direct contact pathways, target risk levels for soil exposures are set at a cumulative one-in-a-million (1×10^{-6}) incremental lifetime cancer risk for the cancer endpoint and a hazard quotient (HQ) of one (1) for the non-cancer endpoint. BCLs for the migration-to-groundwater pathway are back-calculated from the following groundwater concentration limits (in order of preference): non-zero maximum contaminant level goals (MCLGs), maximum contaminant levels (MCLs), or health-based limits (based on a cancer risk of 1×10^{-6} or an HQ of 1), with the exception of lead (see Section 3.6.3) and the residential water BCL for perchlorate. The residential water BCL for perchlorate is the provisional Nevada action level of 18 ppb.

BCLs are intended to provide health protection without knowledge of the specific exposure conditions at the site under study. BCLs are applicable when the exposure factors based on site-specific considerations are likely to be more conservative than the default exposure assumptions used in the BCL Table. BCLs are media contaminant concentrations below which no further action or study at a site is generally warranted, provided that specified application conditions associated with the BCLs are met. In general, if adequate site data collection shows that the measured maximum or 95% upper confidence level (UCL) (where appropriate) concentration of a particular contaminant is below the relevant BCL (see Section 3.6.1 for addressing multiple chemicals), then decisions regarding data usability, extent of contamination, chemicals of potential concern, and/or the need for remediation may be supported. If the maximum or the 95% UCL concentration for relevant media is at or above the BCL, further study, though not necessarily a cleanup action, is warranted. When considering BCLs as initial cleanup goals, it is recommended

that the residential BCL be used, unless agreement has been reached with NDEP officials that a non-residential land use assumption can be justified.

The responsibility for using the BCL Table, and for determining its relevance to site-specific circumstances, lies with the person recommending the values to be used and the user of the table. Before using the BCLs at a particular site, the user should consider whether the exposure pathways and exposure scenarios at the site are fully accounted for in the BCL calculations. NDEP BCLs are based on direct contact pathways (i.e., ingestion, dermal contact, and inhalation) for which generally accepted methods, models, and assumptions have been developed for specific land uses and do not consider impact to ecological receptors [see Conceptual Site Model (CSM) section below]. The BCL table contains guidance on soil chemical impacts to groundwater by identifying chemical-specific dilution-attenuation factors (DAF), which can be multiplied by relevant soil concentrations to obtain a leaching-based BCL (LBCL) for comparison to water standards.

The BCLs will be updated over time, as appropriate (once a year at a minimum), to reflect evolving USEPA guidance, changes in toxicological data, and derivation of toxicological surrogates (as applicable) for BMI Complex and Common Areas compounds of interest. There are a number of exotic chemicals associated with the BMI Complex and Common Areas and the need for surrogate derivation will be completed on a case-by-case basis. Interim changes and special considerations identified by NDEP and users will be posted in Appendix A of the User's Guide, and will be integrated into the BCL Table as needed. Therefore, users are urged to check this appendix for any changes relevant to their site-specific/media-specific chemicals.

1.1 Conceptual Site Model

Developing a CSM is a critical step in properly implementing the soil screening process at a site. The CSM is a comprehensive representation of the site that documents current site conditions. It characterizes the distribution of contaminant concentrations across the site in three dimensions and identifies all potential exposure pathways, migration routes, and potential receptors. The CSM is initially developed from existing site data. Where relevant, these site data should include input from community members about their site knowledge, concerns, and interests, and should be revised continually as new site investigations produce updated or more accurate information. The final CSM represents links among contaminant sources, release mechanisms, exposure pathways, and routes and receptors based on historical information. It summarizes the understanding of the contamination problem.

As an initial check, the CSM should answer the following questions:

- Are there potential ecological concerns?
- Is there potential for land use other than those covered by the screening levels (i.e., residential and commercial/industrial)?
- Are there other likely human exposure pathways that were not considered in development of the BCLs (e.g., impacts on areas used for gardens, farming, fishing, or raising beef, dairy, or other livestock)?
- Are there unusual site conditions (e.g., large areas of contamination, high fugitive dust levels, or wetland or floodplain issues)?

- Is there a probable source of vapor emissions from volatile soil or groundwater contaminants that may affect indoor air?
- Is there potential for a short-term construction scenario to result in higher risks than those associated with the long-term scenarios assumed for the BCLs?

If the answer to any of the questions is yes, then the BCLs may not be applicable to a site.

1.2 Application of the Comparison Levels Table

The decision to use the screening levels at a site will be driven by the potential benefits of having generic risk-based concentrations in the absence of site-specific risk assessments. Potential benefits are as follows:

- Supporting quality assurance programs and data usability evaluations;
  Limiting the number of chemicals of potential concern (COPCs) evaluated in risk assessments;
- Screening sites to determine the need for further evaluation;
- Prioritizing multiple "hot spots" within a facility or exposure realm; and
- Focusing future risk assessment efforts.

In general, screening-level concentrations provided in the Table are risk-based. However, for soil there are two important exceptions: (1) for several volatile chemicals, screening levels are based on the soil saturation equation ("sat"), and (2) for relatively less toxic inorganic and semi-volatile contaminants, a non-risk-based "ceiling limit" concentration is given as 10^{+5} mg/kg ("max"). The pathways addressed by the BCLs and those not addressed are summarized below.

Environmental Media	Pathways Addressed by BCLs		Pathways not Addressed by BCLs	
	Residential	Industrial/ Commercial	Residential	Industrial/ Commercial
Soil	• Ingestion • Inhalation of Particulates • Inhalation of VOCs • Dermal Contact	• Ingestion • Inhalation of Particulates • Inhalation of VOCs • Dermal Contact	• Intrusion of VOCs into Indoor Air • Groundwater contact from soil-leached chemicals • Ingestion of Livestock or Produce	• Intrusion of VOCs into Indoor Air • Groundwater contact from soil-leached chemicals • Particulate Emission During Construction/Excavations Activities
Groundwater	• Ingestion from Drinking • Inhalation of VOCs	• None	• Dermal Absorption while Bathing • Intrusion of VOCs into Indoor Air	• Ingestion from Drinking • Inhalation of VOCs • Dermal Absorption • Intrusion of VOCs into Indoor Air

VOC – volatile organic compound

1.3 Potential Issues and Misapplication of BCLs

As discussed previously, the BCLs should be used only when the conditions at the site being screened are similar to those under which the BCLs were derived for use. Special care should be exercised to prevent misuse of the BCLs and to protect human health. Specifically, the following should be avoided:

- Applying screening levels to a site without adequately developing a conceptual site model that identifies relevant exposure pathways and exposure scenarios.
- Not considering background concentrations when choosing screening levels.
- Use of screening levels as cleanup levels without considering other relevant criteria.
- Use of screening levels as cleanup levels without verifying applicability with a qualified risk assessment toxicologist.
- Use of outdated screening-level tables that have been superseded by more recent publications.
- Not considering the effects of the presence of multiple chemicals.

2.0 NDEP BASIC COMPARISON LEVELS (BCLs)

The BCL Table was generated using equations incorporated into a calculation spreadsheet, except for the column "DAF" [the dilution-attenuation factor for use in calculating leaching-based BCLs]. Toxicity values, as well as physical and chemical parameters, are input into the spreadsheet. There are seven primary sections of the spreadsheet: 1) toxicity values, 2) physical/chemical input parameters, 3) BCLs for exposure-specific/scenario-specific risks and hazards for residential land use scenarios, 4) BCLs for industrial/commercial land use scenarios, 5) BCLs for ambient air, 6) BCLs for residential water, and 7) the final integrated BCLs. The "printable" version of the BCL Table contains only the toxicity values, volatile organic compound (VOC) designation, skin absorption value, and final comparison levels. The default values and equations used in developing the table are discussed below.

2.1 Toxicity Values

EPA toxicity values, known as non-carcinogenic reference doses (RfDs), non-carcinogenic reference concentrations (RfCs), and cancer slope factors (SFs) were obtained from USEPA's Integrated Risk Information System (IRIS) on-line database (USEPA, 2008a), EPA's Provisional Peer-Reviewed Toxicity Values Database (PPRTV) (USEPA, 2008b), USEPA's National Center for Environmental Assessment (NCEA), USEPA's Health Effects Assessment Summary Table (HEAST) (USEPA, 1997a), and other sources. The hierarchy for the sources of the toxicity values used to develop the NDEP screening table is as follows: (1) IRIS (indicated by "i" in the table), (2) PPRTV ("p") and (3) NCEA ("n"), HEAST ("h"), and other documents ("o"). The OSWER Directive 9285.7-53 (dated December 5, 2003) (USEPA, 2003a) designates the hierarchy for toxicity criteria above. It should be noted that the USEPA has withdrawn toxicity values for certain chemicals. These are designated with an "x" in the BCL table and should be discussed in the uncertainty section if used in a risk assessment.

The IRIS, PPRTV, and NCEA values are current as of 2008. HEAST has not been updated since the last screening-value table released in 1997 (USEPA, 1997a). HEAST values that have been externally peer reviewed are now in the PPRTV database and are noted by the letter "p" in the key column of the screening table next to the toxicity value. The PPRTV values currently represent the second tier of human health toxicity values for the USEPA Superfund and hazardous waste programs.

Route-to-route extrapolations ("r") were used when toxicity values were not available for a given route of exposure. Oral cancer slope factors ("SFo") and reference doses ("RfDo") were used for both oral and inhalation exposures for organic compounds lacking inhalation values, where applicable. Inhalation cancer slope factors ("SFi") and inhalation reference doses ("RfDi") were used for both inhalation and oral exposures for organic compounds lacking oral values, unless the toxicity data indicated otherwise. An additional route extrapolation that was applied is the use of oral toxicity values to evaluate dermal exposures.

In addition, due to the vast number of specialized compounds and analytical issues associated with the BMI Complex and Common Areas, toxicological surrogates have been derived for several compounds. The derivations for the toxicological surrogates are summarized in Appendix B.

2.2 Physical/Chemical Parameters

The physical/chemical data section of the spreadsheet provides the information needed to calculate the volatilization factors (VFs) and the saturation limits for the contaminants. Volatile chemicals are defined as those that have a Henry's Law constant greater than 10^{-5} (atm-m^3/mol) and a molecular weight less than 200 g/mole (USEPA, 1991). The emission terms used in the VFs are chemical specific and were calculated from physical/chemical information obtained from several sources: the 1996 *Soil Screening Guidance* (USEPA, 1996a, b), the 1996 *Superfund Chemical Data Matrix* (USEPA, 1996c), and the 1988 *Superfund Exposure Assessment Manual* (USEPA, 1988). The VF used to calculate the soil screening levels is derived in the physical/chemical data section of the spreadsheet, using the equation below, which is from the USEPA's Soil Screening Guidance (USEPA, 1996a, b). The volatilization factor for water is not derived but is a constant.

2.3 Soil-to-Air Volatilization Factors (VFs)

Derivation of the Volatilization Factor

$$VF_S \left(\frac{m^3}{kg}\right) = \left(\frac{Q}{C}\right) x \frac{(3.14 \times D_A \times T)^{1/2}}{(2\,\rho_b \times D_A)} \times 10^{-4} \left(\frac{m^2}{cm^2}\right)$$

where:

$$D_A = \frac{(\Theta_a{}^{10/3}\, DiH' + \Theta_w{}^{10/3} Dw)/n^2}{p_b K_d + \Theta_w + \Theta_a \mathrm{H}'}$$

Parameter	Definition (units)	Value
VF	Volatilization factor (m^3/kg)	Chemical specific
D_A	Apparent diffusivity (cm^2/s)	Chemical specific
Q/C	Inverse of the mean concentrate at the center of a 0.5-acre square source (g/m^2-s per kg/m^3)	68.81
T	Exposure interval (s)	9.5×10^8
ρ_b	Dry soil bulk density(g/cm^3)	1.5
Θ_a	Air-filled soil porosity (L_{air}/L_{soil})	0.28 or $n - \Theta_w$
n	Total soil porosity (L_{pore}/L_{soil})	0.43 or $1 - (\rho_b/\rho_s)$
Θ_w	Water-filled soil porosity (L_{water}/L_{soil})	0.15
ρ_s	Soil particle density (g/cm^3)	2.65
Di	Diffusivity in air (cm^2/s)	Chemical specific
H	Henry's Law constant	Chemical specific
H'	Dimensionless Henry's Law constant	Calculated from H by multiplying by 41 (USEPA, 1991)
D_w	Diffusivity in water (cm^2/s)	Chemical specific
K_d	Soil/water partition coefficient (cm^3/g) = $K_{oc}f_{oc}$	Chemical specific
K_{oc}	Soil organic carbon/water partition coefficient (cm^3/g)	Chemical specific
f_{oc}	Fraction organic carbon in soil (g/g)	0.006 (0.6%)

Soil Saturation

The soil saturation concentration "sat" corresponds to the contaminant concentration in soil at which the absorptive limits of the soil particles, the solubility limits of the soil pore water, and saturation of soil-pore air have been reached. Above this concentration, the soil contaminant may be present in free phase (i.e., nonaqueous-phase liquids [NAPLs]) for contaminants that are liquid at ambient soil temperatures and in pure solid phases for compounds that are solid at ambient soil temperatures.

The equation below is used to calculate "sat" for each volatile contaminant. As an update to RAGS HHEM, Part B (USEPA 1991), this equation takes into account the amount of contaminant that is in the vapor phase in soil, in addition to the amount dissolved in the soil's pore water and sorbed to soil particles. The volatilization model is not applicable when free-phase contaminants are present. How these cases are handled depends on whether the contaminant is liquid or solid at ambient temperatures. Liquid contaminants for which screening levels exceed the "sat" concentration are set equal to "sat," whereas for solids (e.g., polycyclic aromatic hydrocarbons [PAHs]), soil screening decisions are based on other appropriate pathways of concern at the site (e.g., ingestion and dermal contact).

2.4 Soil Saturation Concentration (sat)

Derivation of the Soil Saturation Limit

$$Sat = \frac{S}{\rho b}\ (K_d\ \rho b\ +\ \Theta w\ +\ H'\Theta a)$$

Parameter	Definition (units)	Value
Sat	Soil saturation concentration (mg/kg)	Calculated
S	Solubility in water (mg/L-water)	Chemical specific
ρ_b	Dry soil bulk density (kg/L)	1.5
K_d	Soil-water partition coefficient (L/kg)	K_{oc} x f_{oc} (chemical specific)
K_{oc}	Soil organic carbon/water partition coefficient (L/kg)	Chemical specific
f_{oc}	Fraction organic carbon content of soil (g/g)	0.006 or site specific
Θ_w	Water-filled soil porosity (L_{water}/L_{soil})	0.15
Θ_a	Air-filled soil porosity (L_{air}/L_{soil})	0.28 or n – Θ_w
n	Total soil porosity (L_{pore}/L_{soil})	0.43 or 1 – (ρ_b/ ρ_s)
ρ_s	Soil particle density (g/cm^3)	2.65
w	Average soil moisture content (kg_{water}/kg_{soil} or L_{water}/kg_{soil})	0.1
H	Henry's Law constant	Chemical specific
H'	Dimensionless Henry's Law constant	Calculated from H by multiplying by 41 (USEPA, 1991)

The physical/chemical parameters section of the spreadsheet also includes information on molecular weight and skin absorption factors used to calculate the dermal portion of the equations.

2.5 Dermal Absorption Factors

Chemical-specific dermal absorption factors for contaminants in soil and dust based on USEPA (2004; RAGS Part E, *Supplemental Guidance for Dermal Risk Assessment*) are presented in the BCL Table for arsenic, cadmium, chlordane, 2,4-D, DDT, Lindane, PAHs, pentachlorophenol, polychlorinated biphenyls (PCBs), and polychlorinated dibenzo-p-dioxins and dibenzofurans (collectively referred to as "dioxins"). For other chemicals, USEPA (2004) recommends using a default dermal absorption factor of 0.10 for semi-volatile organic chemicals. A default absorption factor for inorganics and volatile organic chemicals is no longer recommended. These USEPA dermal guidelines were applied to the BCLs.

2.6 Default Factors for Volatilization from Residential Water and Particulate Emissions from Soils

The physical/chemical data section of the spreadsheet does not calculate the particulate emission factor or the volatilization factor for residential water. Default values are used for these parameters which can be found in the spreadsheet above the header in the electronic table.

Volatilization Factor for Residential Water

For residential water, an upper-bound volatilization constant (VFw) is used that is based on all uses of household water (e.g., showering, laundering, and dish washing). Certain assumptions were made. For example, it is assumed that the volume of water used in a residence for a family of four is 720 L/day, the volume of the dwelling is 150,000 L, and the air exchange rate is 0.25 air changes/hour (Andelman, cited in USEPA, 1991; USEPA *Exposure Factors Handbook*, USEPA, 1997b). Furthermore, it is assumed that the average transfer efficiency, weighted by water use, is 50% (i.e., half the concentration of each chemical in water will be transferred into air by all water uses). The range of transfer efficiencies extends from 30% for toilets to 90% for dishwashers (Andelman, cited in USEPA, 1991). Volatilization was included in the residential water equations only for compounds with a "1" in the "VOC" column. The value used in calculating the screening level for residential water is 0.5 L/m^3.

Particulate Emission Factor for Soils

To address the soil-to-air pathway for particulate emission, the screening-level calculations incorporate particulate emission factors (PEFs) for nonvolatile contaminants. The PEF relates the contaminant concentration in soil to the concentration of respirable particles in the air due to fugitive dust emissions from contaminated soils. The generic PEF was derived using default values that correspond to a receptor-point concentration of approximately 0.76 $\mu g/m^3$. The relationship is derived by Cowherd (1985) for a rapid assessment procedure applicable to a typical hazardous waste site where the surface contamination provides a relatively continuous and constant potential for emission over an extended period of time (e.g., years). This represents an annual average emission rate based on wind erosion, which should be compared with chronic health criteria; it is not appropriate for evaluating the potential for acute exposures.

The USEPA methodology to derive a PEF for Las Vegas was followed (UESPA, 1996a). Specifically, all standard default parameters were use with the exception of air dispersion modeling constants for the climate zone of Las Vegas (e.g., PEF calculation parameters "A", "B", and "C" as obtained from USEPA, 1996a[1]). The resulting PEF of 1.2×10^9 m^3/kg (USEPA, 1996a) was used. The PEF and associated inhalation dose do not appear to affect most soil screening levels significantly with the exception of specific metals. For more details regarding specific parameters used in the PEF model, the reader is referred to *Soil Screening Guidance: Technical Background Document* (USEPA 1996a).

[1] See Exhibits D-1, D-2 and D-4 of USEPA, 1996a.

Note: The PEF evaluates windborne emissions only and does not consider dust emissions from traffic, or other forms of mechanical disturbance that are typical of short-term construction scenarios.

2.7 Age-Adjustment Factors

Because contact rates may be different for children and adults, carcinogenic risks during the first 30 years of life were calculated using age-adjusted factors ("adj"). Use of age-adjusted factors is especially important for soil ingestion exposures, which are higher during childhood and decrease with age. For purposes of combining exposures across pathways, additional age-adjusted factors are used for inhalation and dermal exposures. These factors approximate the integrated exposure from birth until age 30, combining contact rates, body weights, and exposure durations for two age groups small children and adults. Age-adjusted factors were obtained from USEPA RAGS Part B (USEPA, 1991) or developed by analogy. The equations depicted below are for carcinogens.

(1) ingestion for soil ([mg × yr]/[kg × d]:

$$IFS_{adj} = \frac{ED_c \times IRS_c}{BW_c} + \frac{ED_r - ED_C \times IRS_a}{BW_a}$$

(2) skin contact ([mg × yr]/[kg × d]:

$$SFS_{adj} = \frac{ED_c \times \text{AF} \times SA_c}{BW_c} + \frac{(ED_r - ED_c) \times AF \times SA_a}{BW_a}$$

(3) inhalation ([m^3 × yr]/[kg × d]):

$$InhF_{adj} = \frac{ED_c \times IRA_c}{BW_c} + \frac{(ED_r - ED_c) \times IRA_a}{BW_a}$$

(4) ingestion for water ([l × yr]/[kg × d])

$$IFW_{adj} = \frac{ED_c \times IRW_c}{BW_c} + \frac{(ED_r - ED_c) \times IRW_a}{BW_a}$$

The acronyms and their values are provided in Table 1. These values can also be found in the exposure default section of the BCL Table.

3.0 EXPOSURE-SPECIFIC/SCENARIO-SPECIFIC COMPARISON LEVELS

A BCL for each exposure pathway (ingestion, inhalation, and dermal), where applicable, is calculated separately for carcinogens and non-carcinogens, and is listed under the appropriate heading of residential, industrial-indoor, industrial-outdoor, ambient air, or residential water. Individual pathway values can provide important information with regard to risk drivers by

comparing measurement data to relevant BCLs based on the carcinogenic risk and non-carcinogenic hazard. For the end user who may be using a cancer target risk level greater than 1×10^{-6}, the exposure-specific/scenario-specific section of the spreadsheet can be used to determine whether the carcinogenic endpoint is more stringent than the non-carcinogenic endpoint, which is based on a hazard quotient of 1. The carcinogenic endpoint is not always the most conservative.

Default exposure factors used to develop the BCL values were obtained primarily from the USEPA Exposure Factors Handbook (USEPA, 1997b) and the USEPA Supplemental Soil Screening Guidance (USEPA, 2002). Table 1 lists all exposure factors used, their abbreviations used in the equations in this text, and the source. The equations for calculating the risk or hazard by exposure pathway, as well as the combined risk from all exposures for the scenario, are provided below.

3.1 Equations for Residential Land Use Scenario

Ingestion of Carcinogenic Contaminants in Soil

Eq. 1

$$Comparison\ Level\ \text{mg/kg} = \frac{\text{TR} \times \text{AT} \times 365\ \text{days/year}}{SF_o \times 10^{-6}\ \text{kg/mg} \times EF \times IFS_{adj}}$$

where:

TR	=	Target risk of 10^{-6}
AT	=	Averaging time (70 years)
SF_o	=	Oral cancer slope factor
EF	=	Exposure frequency (350 days)
IFS_{adj}	=	Adjusted soil ingestion (mg-year)/(kg-day) = 114

Ingestion of Non-carcinogenic Contaminants

Eq. 2

$$Comparison\ Level\ \text{mg/kg} = \frac{\text{THQ} \times \text{BW} \times \text{AT} \times 365\ \text{days/year}}{\frac{1}{\text{RfD}_o} \times 10^{-6}\ \text{kg/mg} \times EF \times ED \times IRS}$$

where:

THQ	=	Target hazard quotient of 1
BW	=	Body weight of child (15 kg)
AT	=	Averaging time for child (6 years)
RfD_o	=	Oral reference dose
EF	=	Exposure frequency (350 days/year)
ED	=	Exposure duration of child (6 years)
IRS	=	Soil ingestion rate for child (200 mg/day)

Inhalation of Carcinogenic Contaminants

Eq. 3

$$Comparison\ Level \text{ mg/kg} = \frac{\text{TR} \times \text{AT} \times 365 \text{ days/year}}{SF_{\text{i}} \times \text{EF} \times InhF_{\text{adj}} \times [(\frac{1}{\text{PEF}}) \text{ or } (\frac{1}{\text{VF}})]}$$

where:

TR	=	Target risk of 10^{-6}
AT	=	Averaging time (70 years)
SF_i	=	Inhalation cancer slope factor (chemical-specific)
EF	=	Exposure frequency (350 days/year)
$InhF_{adj}$	=	Adjusted inhalation factor 11(m^3-year)/(kg-day)
PEF	=	Particulate emission factor used for dusts (1.2×10^9 mg^3/kg)
VF	=	Volatilization factor used for volatile organic chemicals (mg^3/kg)

Inhalation of Non-carcinogenic Contaminants

Eq. 4

$$Comparison\ Level \text{ mg/kg} = \frac{\text{THQ} \times \text{BW} \times \text{AT} \times 365 \text{ days/year}}{\text{EF} \times \text{ED} \times \frac{1}{RfD_i} \times \text{IRA} \times [(\frac{1}{\text{PEF}}) \text{ or } (\frac{1}{\text{VF}})]}$$

where:

THQ	=	Target hazard quotient of 1
BW	=	Body weight of child (15 kg)
AT	=	Averaging time for child (6 years)
EF	=	Exposure frequency (350 days/year)
ED	=	Exposure duration for child (6 years)
RfD_i	=	Inhalation reference dose in mg/kg/day (chemical specific)
IRA	=	Inhalation rate for child (10 m^3/day)
PEF	=	Particulate emission factor used for dusts (1.2×10^9 m^3/kg)
VF	=	Volatilization factor used for volatile organic chemicals (m^3/kg)

Skin Contact of Carcinogenic Contaminants

Eq. 5

$$Comparison\ Level \text{ mg/kg} = \frac{\text{TR} \times \text{AT} \times 365 \text{ days/year}}{SF_{\text{o}} \times \text{EF} \times SFS_{\text{adj}} \times \text{ABS} \times 10^{-6} \text{ kg/mg}}$$

where:

TR	=	Target risk of 10^{-6}
AT	=	Averaging time (70 years)

SF_o = Oral cancer slope factor (chemical specific)
EF = Exposure frequency (350 days/year)
SFS_{adj} = Skin contact factor for soils (361 mg-year/kg-day)
ABS = Skin absorption (chemical specific)

Skin Contact of Non-carcinogenic Contaminants

Eq. 6

$$Comparison\ Level \text{ mg/kg} = \frac{\text{THQ} \times \text{BW} \times \text{AT} \times 365 \text{ day/year}}{\text{EF} \times \text{ED} \times \frac{1}{\text{RfD}_o} \times 10^{-6} \text{ kg/mg} \times \text{SA} \times \text{AF} \times \text{ABS}}$$

where:

THQ = Target hazard quotient of 1
BW = Body weight of child (15 kg)
AT = Averaging time of child (6 years)
EF = Exposure frequency (350 days/year)
ED = Exposure duration of child (6 years)
RfD_o = Oral reference dose (chemical-specific)
SA = Surface area of child (2800 cm^2/day)
AF = Adherence factor of child (0.2 mg/cm^2)
ABS = Skin absorption (chemical specific)

Comparison Level for Combined Exposure Pathways for Carcinogenic Contaminants for Residential Receptor

Eq. 7

$$Comparison\ Level \text{ mg/kg} = \frac{1}{\frac{1}{\text{Eq. 1}} + \frac{1}{\text{Eq. 3}} + \frac{1}{\text{Eq. 5}}}$$

Comparison Level for Combined Exposure Pathways for Non-carcinogenic Contaminants for Residential Receptor-

Eq. 8

$$Comparison\ Level \text{ mg/kg} = \frac{1}{\frac{1}{\text{Eq. 2}} + \frac{1}{\text{Eq. 4}} + \frac{1}{\text{Eq. 6}}}$$

Equation 4 for uses the PEF approach for solids and the VF approach for volatile compounds.

3.2 Equations for the Industrial Indoor Worker Scenario

Ingestion of Carcinogenic Contaminants

Eq. 9

$$Comparison\ Level \text{ mg/kg} = \frac{\text{TR} \times \text{BW} \times \text{AT} \times 365 \text{ days/year}}{SF_o \times 10^{-6} \text{ kg/mg} \times \text{EF} \times \text{ED} \times \text{IRS}}$$

where:

TR	=	Target risk of 10^{-6}
AT	=	Averaging time (70 years)
BW	=	Body weight of adult (70 kg)
SF_o	=	Oral cancer slope factor (chemical specific)
EF	=	Exposure frequency (250 days/year)
ED	=	Exposure duration (25 years)
IRS	=	Soil ingestion rate for adult (50 mg/day)

Ingestion of Non-carcinogenic Contaminants

Eq. 10

$$Comparison\ Level \text{ mg/kg} = \frac{\text{THQ} \times \text{BW} \times \text{AT} \times 365 \text{ days/year}}{\frac{1}{\text{RfD}_o} \times 10^{-6} \text{ kg/mg} \times \text{EF} \times \text{ED} \times \text{IRS}}$$

where:

THQ	=	Target hazard quotient of 1
BW	=	Body weight of adult (70 kg)
AT	=	Averaging time (25 years)
RfD_o	=	Oral reference dose (chemical specific)
EF	=	Exposure frequency (250 days/year)
ED	=	Exposure duration (25 years)
IRS	=	Ingestion rate for soil (50 mg/day)

Inhalation of Carcinogenic Contaminants

Eq. 11

$$Comparison\ Level \text{ mg/kg} = \frac{\text{TR} \times \text{BW} \times \text{AT} \times 365 \text{ days/year}}{\text{SFi} \times \text{EF} \times \text{ED} \times \text{IRA} \times [(\frac{1}{\text{PEF}}) \text{ or } (\frac{1}{\text{VF}})]}$$

where:

TR	=	Target risk of 10^{-6}
BW	=	Body weight of adult (70kg)
AT	=	Averaging time (70 years)
SF_i	=	Inhalation cancer slope factor (chemical-specific)

EF = Exposure frequency (250 days/year)
ED = Exposure duration (25 years)
IRA = Inhalation rate (20 m^3/day)
PEF = Particulate emission factor used for dusts (1.2×10^9 m^3/kg)
VF = Volatilization factor used for volatile organic chemicals (m^3/kg)

Inhalation of Non-carcinogenic Contaminants

Eq. 12

$$Comparison\ Level \text{ mg/kg} = \frac{\text{THQ x BW x AT x 365 days/year}}{\text{EF x ED x } (\frac{1}{RfD_i}) \text{ x IRA x } [(\frac{1}{PEF}) \text{ or } (\frac{1}{VF})]}$$

where:

THQ = Target hazard quotient of 1
BW = Body weight of adult (70 kg)
AT = Averaging time (25 years)
EF = Exposure frequency (250 days/year)
ED = Exposure duration (25 years)
RfD_i = Inhalation reference dose in mg/kg/day (chemical specific)
IRA = Inhalation rate of adult (20 m^3/day)
PEF = Particulate emission factor used for dusts (1.2×10^9 m^3/kg)
VF = Volatilization factor used for volatile organic chemicals (mg^3/kg)

Comparison Level for Combined Exposure Pathways for Carcinogenic Contaminants for Indoor Industrial Worker

Eq. 13

$$Comparison\ Level \text{ mg/kg} = \frac{1}{\frac{1}{\text{Eq. 9}} + \frac{1}{\text{Eq. 11}}}$$

Comparison Level for Combined Exposure Pathways for Non-carcinogenic Contaminants for Indoor Industrial Worker-

Eq. 14

$$Comparison\ Level \text{ mg/kg} = \frac{1}{\frac{1}{\text{Eq. 10}} + \frac{1}{\text{Eq. 12}}}$$

3.3 Equations for the Industrial -Outdoor Worker Scenario

Ingestion of Carcinogenic Contaminants

Eq. 15 Screening

$$Comparison\ Level \text{ mg/kg} = \frac{\text{TR} \times \text{BW} \times \text{AT} \times 365 \text{ days/year}}{SF_o \times 10^{-6} \text{ kg/mg} \times \text{EF} \times \text{ED} \times \text{IRS}}$$

where:

TR	=	Target risk of 10^{-6}
AT	=	Averaging time (70 years)
BW	=	Body weight of adult (70kg)
SF_o	=	Oral cancer slope factor (chemical-specific)
EF	=	Exposure frequency (225 days/year)
ED	=	Exposure duration (25 years)
IRS	=	Soil ingestion rate for adult (100 mg/day)

Ingestion of Non-carcinogenic Contaminants

Eq. 16

$$Comparison\ Level \text{ mg/kg} = \frac{\text{THQ} \times \text{BW} \times \text{AT} \times 365 \text{ days/year}}{\frac{1}{\text{RfD}_o} \times 10^{-6} \text{ kg/mg} \times \text{EF} \times \text{ED} \times \text{IRS}}$$

where:

THQ	=	Target hazard quotient of 1
BW	=	Body weight of adult (70 kg)
AT	=	Averaging time (25 years)
RfD_o	=	Oral reference dose (chemical-specific)
EF	=	Exposure frequency (225 days/year)
ED	=	exposure duration (25 years)
IRS	=	Soil ingestion rate for adult (100 mg/day)

Inhalation of Carcinogenic Contaminants

Eq. 17

$$Comparison\ Level \text{ mg/kg} = \frac{\text{TR} \times \text{BW} \times \text{AT} \times 365 \text{ days/year}}{SF_i \times \text{EF} \times \text{ED} \times \text{IRA} \times [(\frac{1}{\text{PEF}}) \text{ or } (\frac{1}{\text{VF}})]}$$

where:

TR	=	Target risk of 10^{-6}
BW	=	Body weight of adult (70 kg)
AT	=	Averaging time (70 years)

SF_i = Inhalation cancer slope factor (chemical specific)
EF = Exposure frequency (225 days/year)
ED = Exposure duration (25 years)
IRA = Inhalation rate for adult (20 m^3/day)
PEF = Particulate emission factor used for dusts (1.2×10^9 m^3/kg)
VF = Volatilization factor used for volatile organic chemicals (m^3/kg)

Inhalation of Non-carcinogenic Contaminants

Eq.18

$$Comparison\ Level \text{ mg/kg} = \frac{\text{THQ} \times \text{BW} \times \text{AT} \times 365 \text{ days/year}}{\text{EF} \times \text{ED} \times \left(\frac{1}{\text{RfD}_i}\right) \times \text{IRA} \times \left[\left(\frac{1}{\text{PEF}}\right) \text{ or } \left(\frac{1}{\text{VF}}\right)\right]}$$

where:
THQ = Target hazard quotient of 1
BW = Body weight of adult (70 kg)
AT = Averaging time (25 years)
EF = Exposure frequency (225 days/year)
ED = Exposure duration (25 years)
RfD_i = Inhalation reference dose in mg/kg/day (chemical specific)
IRA = Inhalation rate of adult (20 m^3/day)
PEF = Particulate emission factor used for dusts ($1.2\times10^9 m^3$/kg)
VF = Volatilization factor used for volatile organic chemicals (m^3/kg)

Skin Contact with Carcinogenic Contaminants

Eq. 19

$$Comparison\ Level \text{ mg/kg} = \frac{\text{TR} \times \text{BW} \times \text{AT} \times 365 \text{ days/year}}{\text{EF} \times \text{ED} \times SF_o \times 10^{-6} \text{ kg/mg} \times \text{SA} \times \text{AF} \times \text{ABS}}$$

where:
TR = Target risk of 10^{-6}
BW = Body weight of adult (70 kg)
AT = Averaging time of worker (25 years)
EF = Exposure frequency (225 days/year)
ED = Exposure duration of worker (25 years)
SF_o = Oral cancer slope factor (chemical specific)
SA = Surface area exposed for adult (3300 cm^2/day)
AF = Adherence factor (0.2 mg/cm^2)
ABS = Skin absorption (chemical specific)

Skin Contact with Non-carcinogenic Contaminants

Eq. 20

$$Comparison\ Level \text{ mg/kg} = \frac{\text{THQ} \times \text{BW} \times \text{AT} \times 365 \text{ days/year}}{\text{EF} \times \text{ED} \times \frac{1}{\text{RfD}_o} \times 10^{-6} \text{ kg/mg} \times \text{SA} \times \text{AF} \times \text{ABS}}$$

where:

THQ	=	Target hazard quotient of 1
BW	=	Body weight of adult (70 kg)
AT	=	Averaging time of outdoor worker (25 years)
EF	=	Exposure frequency (225 days/year)
ED	=	Exposure duration of worker (25 years)
RfD_o	=	Oral reference dose (chemical specific)
SA	=	Surface area exposed for adult (3300 cm^2/day)
AF	=	Adherence factor (0.2 mg/cm^2)
ABS	=	Skin absorption (chemical-specific)

Comparison Level for Combined Exposure Pathways for Carcinogenic Contaminants for Outdoor Industrial Worker

Eq. 21

$$Comparison\ Level \text{ mg/kg} = \frac{1}{\frac{1}{Eq.15} + \frac{1}{Eq.17} + \frac{1}{Eq.19}}$$

Comparison Level for Combined Exposure Pathways for Non-carcinogenic Contaminants for Outdoor Industrial Worker

Eq.22

$$Comparison\ Level \text{ mg/kg} = \frac{1}{\frac{1}{Eq.16} + \frac{1}{Eq.18} + \frac{1}{Eq.20}}$$

3.4 Ambient Air Equations

Inhalation of Carcinogenic Contaminants

Eq. 23

$$Comparison\ Level\ (\mu g/m^3) = \frac{TR \times AT \times 365\ days/year \times 1{,}000\ \mu g/mg}{EF \times InhF_{adj} \times SF_o}$$

where:

TR	=	Target risk of 10^{-6}
AT	=	Averaging time (70 years)
EF	=	Exposure frequency (350 days/year)
$InhF_{adj}$	=	Adjusted inhalation factor (11 m^3-year/kg-day)
SF_o	=	Oral cancer slope factor (chemical specific)

Inhalation of Non-carcinogenic Contaminants

Eq.24

$$Comparison\ Level\ (\mu g/m^3) = \frac{THQ \times BW \times AT \times 365\ days/year \times 1{,}000\ \mu g/mg}{EF \times ED \times IRA \times \frac{1}{RfD_i}}$$

where:

THQ	=	Target hazard quotient of 1
BW	=	Body weight of adult (70 kg)
AT	=	Averaging time of resident (30 years)
EF	=	Exposure frequency (350 days/year)
ED	=	Exposure duration (30 years)
IRA	=	Inhalation rate (20 m^3/day)
RfD_i	=	Inhalation reference dose (chemical-specific)

3.5 Residential Water Equations

Ingestion and Inhalation of Carcinogenic Contaminants

Eq. 25

$$Comparison\ Level\ (\mu g/l) = \frac{TR \times AT \times 365\ days/year \times 1{,}000\ \mu g/mg}{EF \times [(IFW_{adj} \times SF_o) + (VF \times InhF_{adj} \times SF_i)^*]}$$

where:

TR	=	Target risk of 10^{-6}
AT	=	Averaging time (70 years)

EF = Exposure frequency (350 days/year)
IFW_{adj} = Ingestion factor for water (1.1 L-year/kg-day)
SF_o = Oral cancer slope factor (chemical specific)
VF = Volatilization factor for water (0.5 L/m^3)
$InhF_{adj}$ = Adjusted inhalation factor (11 m^3-yr/kg-day)
SF_i = Inhalation cancer slope factor (chemical specific)
* Inhalation component of the equation is calculated only for volatile organic chemicals.

Ingestion and Inhalation of Non-carcinogenic Contaminants

Eq. 26

$$Comparison\ Level\ \mu g/L = \frac{THQ \times BW \times AT \times 365\ days/year \times 1{,}000\ \mu g/mg}{EF \times ED\ [(\frac{IRW}{RfD_o}) + (VF \times IRA \times \frac{1}{RfD_i})^*]}$$

where:
THQ = Target hazard quotient of 1
BW = Body weight of adult (70 kg)
AT = Averaging time of resident (30 years)
EF = Exposure frequency (350 days/year)
ED = Exposure duration (30 years)
IRW = Drinking water ingestion (2 L/day)
RfD_o = Oral reference dose (chemical specific)
VF = Volatilization factor for water (0.5 L/m^3)
IRA = Inhalation rate (20 m^3/day)
RfD_i = Inhalation reference dose (chemical specific)
* Inhalation part of equation only calculated for volatile organic chemicals

Table 1 provides the Standard Default Exposure Factors used in the preceding equations.

Development of Final Residential Soil BCLs in the Absence of an RfC

Several values are compared in order to develop the final comparison level. These include the comparison to a maximum of 100,000 for the less toxic chemicals, and to the soil saturation limit. These equations are listed below.

If the contaminant is a solid, the following applies:

Eq. 27a: Comparison Level (mg/kg) = Minimum value from Eq. 7, Eq. 8*, or 100,000
*Equation 8 uses the Eq. 4 option.

If the contaminant is not a solid, the following applies:

Eq. 27b Comparison Level (mg/kg) = Minimum value from saturation, Eq. 7, Eq. 8*, or 100,000
*Equation 8 uses the Eq. 4 option.

Residential Soil Value when RfC is Available

If the contaminant is a solid, the following applies:

Eq. 27a Comparison Level (mg/kg) = Minimum value from Eq. 7, Eq. 8*, or 100,000
*Equation 8 uses the Eq. 4 option.

If the contaminant is not a solid, then the following applies:

Eq. 27b Comparison Level (mg/kg) = Minimum value from saturation, Eq. 7, Eq. 8*, or 100,000
*Equation 8 uses the Eq. 4 option.

Industrial Soil Indoor Worker

If the contaminant is a solid, the following applies:

Eq. 28a Comparison Level (mg/kg) = Minimum value from Eq. 13, Eq. 14, or 100,000

If the contaminant is not a solid, the following applies:

Eq. 28b Comparison Level (mg/kg) =
Minimum value from saturation, Eq. 13, Eq. 14, or 100,000

Industrial Soil Outdoor Worker

If the contaminant is a solid, the following applies:

Eq. 29a Comparison Level (mg/kg) = Minimum value from Eq. 21, Eq. 22, or 100,000

If the contaminant is not a solid, the following applies:

Eq. 29b Comparison Level (mg/kg) = Minimum value from saturation, Eq. 21, Eq. 22, or 100,000

Ambient Air

Eq. 30 Comparison Level ($\mu g/m^3$) = Minimum value from Eq. 23 or Eq. 24

Residential Water

Eq. 31 Comparison Level ($\mu g/L$) = Minimum value from Eq. 25 or Eq. 26

3.6 Special Considerations

3.6.1 Screening with Multiple Contaminants

A suggested stepwise approach for BCL-screening of sites with multiple pollutants is as follows:

- Perform an extensive records search and compile existing data.
- Use the CSM to identify all known and potential site contaminants in the BCL Table. Record the BCL concentrations for various media and note whether the chemical has been assigned cancer (indicated by "ca") and/or non-cancer (indicated by "nc") toxicological criteria. Segregate cancer BCLs from non-cancer BCLs and exclude (but do not eliminate) non-risk based BCLs ("sat" or "max").
- For cancer risk estimates, take the site-specific concentration (maximum or 95 UCL) and divide by the BCL concentration designated for cancer evaluation ("ca"). Multiply this ratio by 10^{-6} to estimate chemical-specific risk for a reasonable maximum exposure (RME). For multiple pollutants, simply add this risk estimate for each chemical as follows:

$$Risk = \left[\left(\frac{Conc_x}{BCL_x}\right) + \left(\frac{Conc_y}{BCL_y}\right) + \ldots + \left(\frac{Conc_z}{BCL_z}\right)\right] \times 10^{-6}$$

- For non-cancer hazard estimates, divide the site exposure point concentration term by the respective non-cancer BCL (designated as "nc") and sum the ratios for multiple contaminants. The cumulative ratio represents a screening non-cancer hazard index (HI). A screening hazard index of 1 or less is considered "safe". A ratio greater than 1 suggests further evaluation (see USEPA, 1989, page 8-14 for segregation of hazard indices by effect and mechanism of action). [Note that carcinogens may also have an associated non-cancer BCL that is not listed in the BCL Table. To obtain these values, the user should view or download the BCL Detail Tables at the BCL website and display the appropriate sections.]

$$Hazard\ Index = \left[\left(\frac{Conc_x}{BCL_x}\right) + \left(\frac{Conc_y}{BCL_y}\right) + \ldots + \left(\frac{Conc_z}{BCL_z}\right)\right]$$

For initial screening of data when multiple chemicals have been released, a simplified conservative approach of employing one-tenth of the BCL can be applied.

3.6.2 Evaluating Migration of Soil Chemicals to Groundwater: Leaching-Based BCLs (LBCLs)

The method for calculating leaching-based soil screening levels (LBCLs) for migration to groundwater was developed to identify chemical concentrations in soil that have the potential to contaminate groundwater. Migration of contaminants from soil to groundwater is evaluated as a two-stage process: (1) release of contaminant in soil leachate, and (2) transport of the contaminant

through the underlying soil and aquifer to a receptor well. The LBCL methodology considers both of these transport mechanisms.

LBCLs are back-calculated from acceptable groundwater concentrations (i.e., non-zero MCLGs, MCLs, or risk-based screening levels). Residential exposure scenarios are assumed based on a fixed upper-bound risk of 10^{-6} or a fixed hazard quotient of 1. First, the acceptable groundwater concentration is multiplied by a dilution factor to obtain a target leachate concentration. For example, if the dilution factor is 10 and the acceptable groundwater concentration is 0.05 mg/L, the target soil leachate concentration would be 0.5 mg/L. The partition equation (presented in USEPA, 1996a) is then used to calculate the total soil concentration that corresponds to this soil leachate concentration. The BCL Table presents the dilution-attenuation factors (DAF) for relevant chemicals, which can be used to calculate the LBCL. Due to rounding, there may be some slight difference in the Table values and the values found in the *Soil Screening Guidance* (USEPA, 1996a).

3.6.3 BCLs for Chemicals with Special Considerations

Polycyclic aromatic hydrocarbons, and polychlorinated dibenzo-p-dioxins, dibenzofurans, and dioxin-like (coplanar) polychlorinated biphenyls, are chemical mixtures for which alternative approaches have been developed by USEPA to simplify risk calculations using a toxicity-equivalence factor approach. In addition, special conditions for certain metals, inorganics, total petroleum hydrocarbons, and vinyl chloride have been adopted by USEPA Region 9 (USEPA, 2004b, 2008c) and are also considered appropriate with respect to BCLs, as explained below.

Cadmium
Because IRIS provides different oral RfDs for cadmium in water and in foods, the BCL for cadmium in water is based on the oral RfD for water, and the BCL for soil ingestion is based on the RfD for foods.

Lead
The residential soil value for lead is based on the Integrated Exposure Uptake Biokinetic (IEUBK) Model for lead in children developed using default parameters (USEPA, 1994). More information on this model and other lead risk assessment guidance can be found at http://www.epa.gov/superfund/health/contaminants/lead/index.htm. The industrial BCL is based on equations developed by the technical review group (adult lead model), as described below.

The Adult Lead Model (ALM) is a tool for assessing risks associated with **non-residential** adult exposures to lead in soil. The ALM focuses on estimating fetal blood lead concentrations in pregnant women exposed to lead-containing soils in a commercial/industrial setting. It is the product of extensive evaluations by the Technical Review Workgroup for Lead (TRW). In December 1996, the TRW released the document *Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil* (*TRWR*; USEPA, 1996d), which describes the equations and default parameters that can be used with the ALM.

Manganese
The IRIS RfD (0.14 mg/kg-day) includes manganese from all sources, including the diet. The IRIS assessment on manganese recommends that the dietary contribution from the normal U.S. diet (an upper limit of 5 mg/day) be subtracted when evaluating non-food (e.g., drinking water or soil) exposures to manganese, leading to an RfD of 0.071 mg/kg-day for non-food items. The explanatory text in IRIS further recommends using a modifying factor of 3 when calculating risks associated with non-food sources, due to a number of uncertainties that are discussed in the IRIS file for manganese, leading to an RfD of 0.024 mg/kg-day. This modified RfD is applied in the derivation of manganese BCLs for soil and water.

Nitrates/Nitrites
Tap-water BCLs for nitrates/nitrites are based on the MCL, because there is no available RfD for these compounds. For more information, please see IRIS (USEPA, 2008a) at: http://www.epa.gov/iris.

Perchlorate
The residential drinking water BCL for perchlorate is based upon the provisional Nevada Action Level of 18 ppb.

Polychlorinated Dibenzo-p-dioxins, Dibenzofurans, and Some Polychlorinated Biphenyls
USEPA has developed a toxicity equivalence factor (TEF) approach for calculating the potential health risks from "dioxin-like" chemicals that are assumed to elicit the same range of toxic effects as those observed for the most potent member of these chemical families—2,3,7,8-tetra chlorodibenzo-p-dioxin(TCDD). These dioxin-like compounds must be multiplied by their appropriate TEFs, and the resulting toxicity equivalents (TEQs) must be summed before comparing to the BCLs. NDEP has adopted the 1997 World Health Organization (WHO) TEFs. For more information on the TEFs, please see the working group summary article (Van den Berg et al., 1998) at the following Internet address:
http://www.ehponline.org/members/1998/106p775-792vandenberg/vandenberg-full.html

Polycyclic Aromatic Hydrocarbons (PAHs)
USEPA has developed potency factors approach for calculating the potential health risks from PAHs with the characteristic "Bay-K region," a structural distinction that defers carcinogenic properties to benzo-a-pyrene (BaP) and the other carcinogenic PAHs (USEPA, 1993). BaP is the best characterized and most potent of the carcinogenic PAH compounds, and hence, the slope factors for BaP are used in conjunction with the potency factor approach to calculate benozo-a-pyrene equivalents (BaPEq). Accordingly, each of the carcinogenic PAHs must be multiplied by its associated potency factor to calculate the BaPEq, and the summed BaPEq across all carcinogenic PAHs at the site is compared to the BCL for BaP. The TEFs are as follows: benzo-a-pyrene (1.0), benzo-a-anthracene (0.1), benzo-b-fluoranthene (0.1), benzo-k-fluoranthene (0.01), chrysene (0.001), dibenzo-a,h-anthracene (1.0), and indeno-1,2,3,-cd-pyrene (0.1) (USEPA, 1993).

Thallium
IRIS has many values for the different salts of thallium. However, analytical data packages typically report only total thallium. Therefore, a BCL based on total thallium was derived for

practical purposes by adjusting the thallium sulfate RfD by the molecular weight of thallium to derive a thallium-only RfD of 6.6×10^{-5} mg/kg-day.

Total Petroleum Hydrocarbons

Petroleum hydrocarbon mixtures in soils, such as gasoline, kerosene, diesel, or waste oils, are relatively common, and some groups have attempted to develop non-cancer toxicity criteria based on selected petroleum fractions such as gasoline- or diesel-range hydrocarbons. At present, NDEP does not recommend using these petroleum fraction toxicity criteria. Instead, the indicator chemicals for common petroleum hydrocarbon mixtures should be evaluated, including benzene, toluene, ethylbenzene, and total xylenes (BTEX); MTBE (and other oxygenates and/or additives, where relevant); and PAHs. Demonstrating compliance with respect to these indicator compounds will be assumed to also minimize any risks attributable to other petroleum-fraction components in soils.

Vinyl Chloride

IRIS (USEPA, 2008a) presents two cancer slope factors for vinyl chloride—one for adult exposures and a second, more protective, slope factor to account for the unique susceptibility identified in young animals that suggests a greater susceptibility to vinyl chloride carcinogenicity in young children. The more conservative factor for children is applied for the BCL corresponding to residential vinyl chloride exposure scenarios, and includes an assumption of lifetime (70 years) exposure for residential receptors as an added conservative measure based on USEPA Region 9 recommendations. The adult exposure cancer slope factor is used as the basis for the commercial/industrial BCL.

Chemicals for Which the BCL is Based on a Toxicological Surrogate

BCLs for the following chemicals are based on a toxicological surrogate approach:

- Acenaphthalene
- Benzo[g,h,i]perylene
- Phenanthrene
- Diethyl phosphorodithioate(DEPT)
- Dimethyl phosphorodithioate (DMPT)
- m-Phthalic acid
- o-Phthalic acid
- p-Chlorobenzene sulfonic acid (pCBSA)
- Benzene sulfonic acid (BSA)

Documentation of the basis of the surrogate selection for each of these chemicals is provided in Appendix B.

Six chemicals in the table did not have toxicity criteria from any of the USEPA hierarchy of sources used in this guidance (USEPA, 2003). Therefore, other sources were used. Table C-1 provides a listing of these chemicals and the source of the toxicity values used to calculate the BCLs.

4.0 REFERENCES

Cowherd, C., G. Muleski, P. Engelhart, and D. Gillette. 1985. *Rapid Assessment of Exposure to Particulate Emission from Surface Contamination*. EPA/600/8-85/002. Prepared for Office of Health and Environmental Assessment, U.S. Environmental Protection Agency, Washington, DC. NTIS PB85-192219 7AS.

USEPA, 1988. *Superfund Exposure Assessment Manual* (SEAM). Office of Emergency and Remedial Response (OSWER Directive 9285.5-1).

USEPA. 1989. *Risk Assessment Guidance for Superfund, Vol. I, Human Health Evaluation Manual (Part A)*. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, December. http://www.epa.gov/oswer/riskassessment/ragsa/index.htm

USEPA. 1991. Risk *Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)*. Publication 9285.7-01B. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC. NTIS PB92-963333.

USEPA. 1993. *Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons*. U.S. Environmental Protection Agency, Office of Research and Development, July. http://www.epa.gov/oswer/riskassessment/pdf/1993_epa_600_r-93_c89.pdf

USEPA. 1994. *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK)*. U.S. Environmental Protection Agency, Office of Research and Development. http://www.epa.gov/superfund/lead/products.htm

USEPA. 1996a. *Soil Screening Guidance: Technical Background Document*. EPA/540/R95/128. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC. PB96-963502. http:www.epa.gov/superfund/resources/soil/index.htm

USEPA. 1996b. *Soil Screening Guidance: User's Guide*. EPA/540/R-96/018. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC. PB96-963505. http:www.epa.gov/superfund/resources/soil/index.htm

USEPA 1996c. *Superfund Chemical Data Matrix*. EPA/540/R-96/028. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. PB94-963506.

USEPA. 1996d. *Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil*. U.S. Environmental Protection Agency Technical Workgroup for Lead. December.
http://www.epa.gov/superfund/lead/products/adultpb.pdf

USEPA. 1997a. *Health Effects Assessment Summary Tables* (HEAST): Annual Update, FY 1997. National Center for Environmental Assessment (NCEA), Office of Research and Development and Office of Emergency and Remedial Response, Washington, DC.

USEPA. 1997b. *Exposure Factors Handbook, Vol. I-III*. Office of Research and Development. August.
http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=12464&CFID=1397947&CFTOKEN=85996170

USEPA, 2001. Risk Assessment Issue Paper for: Derivation of the Provisional RfD for Iron (CASRN 7439-89-6) and Compounds. NCEA, November 14. (SRC SF 01-021a/11-14-01).

USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* OSWER 9355.4-24, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.
http://www.epa.gov/superfund/resources/soil/ssg_main.pdf

USEPA. 2003. *Human Health Toxicity Values in Superfund Risk Assessments*. OSWER Directive 9285.7-53, December 5. http://www.epa.gov/oswer/riskassessment/pdf/hhmemo.pdf

USEPA, 2004a. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)*. EPA/540/R/99/005. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. PB99-963312.
http://www.epa.gov/superfund/programs/risk/ragse/index.htm

USEPA, 2004. *Preliminary Remediation Goals (PRGs), Region 9, User's Guide*.
http://www.epa.gov/region09/waste/sfund/prg/files/04usersguide.pdf

USEPA, 2008a. *Integrated Risk Information System (IRIS).* Online database of USEPA toxicity criteria. www.epa.gov/iris/

USEPA, 2008b. *Quarterly Distribution of the PPRTV Status Table of Provisional Peer Reviewed Toxicity Values Developed by the Superfund Health Risk Technical Support Center (STSC).* Office of Research and Development, July 23.

USEPA, 2008c. *Preliminary Remediation Goals (PRGs), Region 9*.
http://www.epa.gov/region09/waste/sfund/prg/

USEPA, 2008d. Risk-Based Concentration Table, Mid-Atlantic Risk Assessment, User's Guide, September 18.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm

Van den Berg et al. 1998. Van den Berg, M., Birnbaum, L. Bosveld, B.T.C., Brunstrom, B., Cook, P., Feeley, M., Giesy, J.P., Hanberg, A., Hasagawa, R., Kennedy, S.W., Kubiak, T., Larsen, J.C., van Leeuwen, F.X.R., Liem, A.K.D., Nolt, C., Peterson, R.E., Poellinger, L., Safe, S., Schrenk, D., Tillitt, D., Tysklind, M., Younes, M., Waern, F., Zacharewski, T., 1998. Toxic Equivalency

Factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environmental Health Perspectives, 106(12):775-792. (cited on World Health Organization [WHO] http://www.ehponline.org/members/1998/106p775-792vandenberg/vandenberg-full.html

ADDITIONAL RECOMMENDED REFERENCES

Howard, P.H. 1990. *Handbook of Environmental Fate and Exposure Data for Organic Chemicals*. Lewis Publishers, Chelsea, Michigan.

USEPA. 1986. *Proposed Guidelines for Carcinogen Risk Assessment*. Federal Register, Vol. 51, No. 185, September 24. U.S. Environmental Protection Agency. http://www.epa.gov/ncea/raf/car2sab/guidelines_1986.pdf#search=%221986.%20%20Proposed%20Guidelines%20for%20Carcinogen%20Risk%20Assessment%22

USEPA. 1986. *Guidelines for the Health Risk Assessment of Chemical Mixtures*. Federal Register 51(185):34014-34025, September 24. U.S. Environmental Protection Agency. www.epa.gov/ncea/raf/pdfs/chem_mix/chemmix_1986.pdf

USEPA. 1992. *Guidance for Data Usability in Risk Assessment (Part A), Final*. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, April. http://www.epa.gov/oswer/riskassessment/datause/parta.htm

USEPA. 1992. *Guidance for Data Usability in Risk Assessment (Part B), Final*. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, May. http://www.epa.gov/oswer/riskassessment/datause/partb.htm

USEPA. 1992. *Guidelines for Exposure Assessment*. Federal Register 57 (104):22888-22938. U.S. Environmental Protection Agency. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=15263

USEPA. 1994. *Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry,* U.S. Environmental Protection Agency.

USEPA. 1994. *Superfund Chemical Data Matrix*. EPA/540/R-94/009. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. PB94-963506.

USEPA. 1995. *Land Use in the CERCLA Remedy Selection Process*. OSWER Directive from Elliott Laws, Assistant Administrator, May 25. OSWER 9355.7-04. U.S. Environmental Protection Agency.

USEPA. 2000. *Soil Screening Guidance for Radionuclides: User's Guide*. U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Office of Solid Waste and Emergency Response, October. http://www.epa.gov/superfund/resources/radiation/radssg.htm#user

USEPA. 2000. *Soil Screening Guidance for Radionuclides: Technical Background Document*. U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Office of Solid Waste and Emergency Response, October. http://www.epa.gov/superfund/resources/radiation/radssg.htm#user

USEPA. 2000. *Supplementary Guidance for Conducting Health Risk Assessment of Chemical Mixtures*. U.S. Environmental Protection Agency, Risk Assessment Forum, August. www.epa.gov/ncea/raf/pdfs/chem_mix/chem_mix_08_2001.pdf

USEPA. 2000. *Draft Final Guidelines for Carcinogen Risk Assessment*. U.S. Environmental Protection Agency, Risk Assessment Forum, February. EPA/630/P-03/001A. http://cfpub.epa.gov/ncea/raf/recordisplay.cfm?deid=54932&CFID=1320953&CFTOKEN=65054591&jsessionid=4c30bc86523e776fdf602b78363d3a17162cTR

USEPA. 2005. *Guidelines for Carcinogen Risk Assessment, Risk Assessment Forum, March*. EPA/630/P-03/001F. U.S. Environmental Protection Agency. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=116283

USEPA, 2006. *Science Policy Council Cancer Guidelines Implementation Workgroup. FACT SHEET: Implementation of the Supplemental Guidance in Cancer Risk Assessment*, June. http://www.epa.gov/osa/spc/pdfs/CGIWG_factsheet.pdf

USEPA. 2008. *Drinking Water Contaminants*. Updated June 5. U.S. Environmental Protection Agency. http://www.epa.gov/safewater/contaminants/index.html

USEPA. 2008. *Preliminary Remediation Goals (PRGs)*. U.S. Environmental Protection Agency Region 9. http://www.epa.gov/region09/waste/sfund/prg/

Table 1. Standard Default Exposure Parameters
NDEP Basic Comparison Levels

Abbreviation	Definition	Parameter Value	Reference
Sfo	Cancer slope factor, oral; $(mg/kg\text{-}d)^{-1}$	Chemical Specific	IRIS, PPRTV, NCEA, HEAST or Other Document
SFi	Cancer slope factor inhalation $(mg/kg\text{-}d)^{-1}$	Chemical Specific	IRIS, PPRTV, NCEA, HEAST or Other Document
RfDo	Reference dose oral (mg/kg-d)	Chemical Specific	IRIS, PPRTV, NCEA, HEAST or Other Document
RfDi	Reference dose inhalation (mg/kg-d)	Chemical Specific	IRIS, PPRTV, NCEA, HEAST or Other Document
RfC	Reference concentration (mg/m^3)	Chemical Specific	IRIS, PPRTV, NCEA, HEAST or Other Document
TR	Target cancer risk	10^{-6}	--
THQ	Target hazard quotient	1	--
BWa	Body weight, adult (kg)	70	RAGS Part A, USEPA 1989
BWc	Body weight, child (kg)	15	Exposure Factors Handbook USEPA, 1997b
ATc	Averaging time - carcinogens (days)	25550	RAGS Part A, USEPA 1989
ATn	Averaging time - noncarcinogens (days)	ED*365	
SAa	Exposed surface area, adult (cm2/day)	5700	RAGS Part E, USEPA 2004
SAc	Exposed surface area, child (cm2/day)	2800	RAGS Part E, USEPA 2004
SAao	Exposed surface area, outdoor worker (cm2/day)	3300	RAGS Part E, USEPA 2004
AFa	Adherence factor, adult (mg/cm^2)	0.07	RAGS Part E, USEPA 2004
AFw	Adherence factor, adult-work (mg/cm^2)	0.2	RAGS Part E, USEPA 2004
AFc	Adherence factor, child (mg/cm^2)	0.2	RAGS Part E, USEPA 2004
ABS	Skin absorption (unit less):		
	– volatile organics/inorganics	none	RAGS Part E, USEPA 2004
	-- semi-volatile organics	0.1	RAGS Part E, USEPA 2004
IRAa	Inhalation rate - adult (m^3/day)	20	Exposure Factors Handbook USEPA, 1997b
IRAc	Inhalation rate - child (m^3/day)	10	Exposure Factors Handbook USEPA, 1997b
IRWa	Drinking water ingestion - adult (L/day)	2	RAGS Part A, USEPA 1989
IRWc	Drinking water ingestion - child (L/day)	1	Exposure Factors Handbook USEPA, 1997b
IRSa	Soil ingestion - adult		
	(resident and outdoor worker-mg/day)	100	Exposure Factors Handbook USEPA, 1997b
IRSc	Soil ingestion - child (mg/day),	200	Exposure Factors Handbook USEPA, 1997b
IRSo	Soil ingestion - indoor worker (mg/day)	50	Exposure Factors Handbook USEPA, 1997b
EFr	Exposure frequency - residential (d/y)	350	Exposure Factors Handbook USEPA, 1997b
EFo	Exposure frequency - outdoor worker (d/y)	250	Exposure Factors Handbook USEPA, 1997b
EFout	Exposure frequency- outdoor worker (d/y)	225	Supplemental Soil Screening Guidance, USEPA 2002
EDr	Exposure duration - residential (years)	30[a]	Exposure Factors Handbook USEPA, 1997b
EDc	Exposure duration - child (years)	6	Exposure Factors Handbook USEPA, 1997b
EDo	Exposure duration - occupational (years)	25	Exposure Factors Handbook USEPA, 1997b
VFw	Volatilization factor for water (L/m^3)	0.5	RAGS Part B, USEPA 1991
PEF	Particulate emission factor (m^3/kg)	1.32E+09	Soil Screening Guidance USEPA 1996a
VFs	Volatilization factor for soil (m^3/kg)	Chemical Specific	Soil Screening Guidance USEPA 1996a
sat	Soil saturation concentration (mg/kg)	Chemical Specific	Soil Screening Guidance USEPA 1996a
	Age-adjusted factors for carcinogens:		
IFSadj	Ingestion factor, soils ([mg × yr]/ [kg × d])	114	RAGS Part B, USEPA 1991
SFSadj	Skin contact factor, soils ([mg × yr]/ [kg × d])	361	By analogy to RAGS Part B, USEPA, 1991
InhFadj	Inhalation factor ([m^3 × yr]/ [kg × d])	11	By analogy to RAGS Part B, USEPA, 1991
IFWadj	Ingestion factor, water ([l × yr]/ [kg × d])	1.1	By analogy to RAGS Part B, USEPA, 1991

Footnote:

[a]Exposure duration for lifetime residents is assumed to be 30 years total (USEPA, 1989). For carcinogens, exposures are combined for children (6 years) and adults (24 years).

Appendix A

Annotation of Updates to the BCL Table

February 2009

1. Corrections to Equations 1 and 4 under Section 2.7.
2. Addition of an Indoor Worker screening values to the BCL table.
3. Addition of BCLs for lithium, titanium, tungsten, and uranium.
4. Correlation of the "a" footnote in the BCL table to lead.
5. Update to the PEF to reflect the Las Vegas meteorological zone per USEPA (1996a) guidance.
6. Update to the iron oral reference dose from 0.003 to 0.7 mg/kg-day.
7. Removal of the cancer classification for 1,2-dibromoethane from the BCL table.
8. Oral SF for dicofol added to BCL table.
9. Inhalation RfD updated for ethylene glycol.
10. Inhalation RfD for tetrachloroethylene removed from BCL table.
11. Appendix C and Table C-1 added to present source of "other" toxicity criteria.

Appendix B

Documentation for Toxicological Surrogates

TABLE B-1 TOXICOLOGICAL SURROGATES APPLIED FOR BCLS

Chemical	CAS #	Surrogate	Surrogate CAS Number	Oral RfD (mg/kg-day)	Inhalation RfD (mg/kg-day)
Acenaphthalene	208-96-8	pyrene	129-00-0	3.0×10^{-2} (IRIS)	3.0×10^{-2} (route extrapolation)
Benzo[g,h,i]perylene	191-24-2	pyrene	129-00-0	3.0×10^{-2} (IRIS)	3.0×10^{-2} (route extrapolation)
Phenanthrene	85-01-8	pyrene	129-00-0	3.0×10^{-2} (IRIS)	3.0×10^{-2} (route extrapolation)
Diethyl phosphorodithioate (DEPT)	298-06-6	diisopropyl methylphosphonate (DIMP)	1445-75-6	8.0×10^{-2} (Integral, 2006; NDEP, 2007)	8.0×10^{-2} (route extrapolation)
Dimethyl phosphorodithioate (DMPT)	756-80-9	isopropyl methylphosphonate (IMPA)	1832-54-8	1.0×10^{-1} (Integral, 2006; NDEP, 2007)	1.0×10^{-1} (route extrapolation)
m-Phthalic acid	121-91-5	phthalic anhydride	85-44-9	2.0×10^{0} (IRIS)	3.4×10^{-2} (HEAST)
o-Phthalic acid	88-99-3	phthalic anhydride	85-44-9	2.0×10^{0} (IRIS)	3.4×10^{-2} (HEAST)
p-Chlorobenzene sulfonic acid (pCBSA)	98-66-8	NA (RfD based on pCBSA study)	NA	1.0×10^{0} (derived by Integral, 2007)	1.0×10^{0} (route extrapolation)
Benzene sulfonic acid (BSA)	98-11-3	p-toluenesulfonic acid (pTSA)	104-15-4	5.0×10^{-1} (derived by Integral, 2007)	5.0×10^{-1} (route extrapolation)

Integral Consulting, Inc., 2006. Development of Human Health Toxicological Criteria for DMPT and DEPT, October 31. http://ndep.nv.gov/bmi/docs/061031%20surrogate_toxicity_report_20061031_final_integral.pdf

Integral Consulting, Inc., 2007. Toxicological Profiles for Three Organic Acids, November 16, 2007 (p. 3-3). http://ndep.nv.gov/bmi/docs/071116-organicacidprofiles.pdf

TABLE B-1 TOXICOLOGICAL SURROGATES APPLIED FOR BCLS

NDEP, 2007. NDEP concurrence regarding the derivation of toxicological surrogates for DEPT and DMPT, February 12. http://ndep.nv.gov/bmi/docs/070212_dmpt_dept.pdf

Note: all surrogate derivations can be found at http://ndep.nv.gov/bmi/technical.htm under “Toxicology”.

Appendix C

Documentation of “Other” Toxicological Value

Table C-1 Source of "Other" Toxicological Values

Chemical	CAS #	Toxicological Value	Source
p-Chlorobenzene sulfonic acid	98-66-8	Oral RfD	Integral, 2007
4-Chlorobenzotrifluoride	98-56-6	Missing RfDi ref	
Methyl terbutyl ether (MTBE)	1634-04-4	Oral and Inhalation SF	CalEPA, 2009
Tetrachloroethylene (PCE)	127-18-4	Oral and Inhalation SF	CalEPA, 2009
Titanium	N/A	Oral and Inhalation RfD	USEPA (Region 9), 2008 Kerger, 2008
Tungsten	N/A	RfD	Kerger, 2008

CalEPA, 2009. Toxicity Criteria Database, Office of Environmental Health Hazard Assessment. http://oehha.ca.gov/risk/ChemicalDB/index.asp

Integral Consulting, Inc., 2007. Toxicological Profiles for Three Organic Acids, November 16, 2007 (p.3-3). http://ndep.nv.gov/bmi/docs/071116-organicacidprofiles.pdf

Kerger, B.D., 2008. Toxicity Criteria for Titanium and Compounds, and for Tungsten and Compounds. December 19. (http://ndep.nv.gov/bmi/docs/ndeptechmemotitaniumtungsten.pdf)

USEPA Region 9, 2008. Risk Assessment Issue Paper for: derivation of interim oral and inhalation toxicity values for titanium (CAS No. 7440-32-6) and compounds, especially titanium dioxide (CAS No. 13463-67-7), but excluding titanium tetrachloride (CAS No. 7550-45-0_, titanium dichloride and organic complexes of titanium such as titanocenes. DRAFT document; 95-019/05-26-95).

February 6, 2009

Mr. Mark Paris
Basic Remediation Company
875 West Warm Springs Road
Henderson, NV 89011

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, NV 89009

Mr. Curt Richards
Olin Corporation
3855 North Ocoee St., Suite 200,
Cleveland, TN 37312

Mr. Joe Kelly
Montrose Chemical Corp of CA
600 Ericksen Ave NE, Suite 380
Bainbridge Island, WA 98110

Mr. Brian Spiller
Stauffer Management Co LLC
1800 Concord Pike
Wilmington, DE 19850-6438

Mr. Craig Wilkinson
Titanium Metals Corporation
PO Box 2128
Henderson, NV 89009

Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Guidance for Evaluating Radionuclide Data for the BMI Plant Sites and Common Areas Projects

Dear Sirs and Madam:

All of the parties listed above shall be referred to as "the Companies" for the purposes of this letter. Guidance for evaluating radionuclide data is provided in Attachment A. This guidance is a supplement to the secular equilibrium tool issued via electronic mail on January 22, 2009 and the secular equilibrium guidance document issued on February 6, 2009.

Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

Brian A Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions

BAR:s

CC: Jim Najima, NDEP, BCA, Carson City
Marysia Skorska, NDEP, BCA, Las Vegas
Shannon Harbour, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Greg Lovato, NDEP, BCA, Carson City
Barry Conaty, Holland & Hart LLP, 975 F Street, N.W., Suite 900,Washington, D.C. 20004
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Ebrahim Juma, Clark County DAQEM, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021
Lee Erickson, Stauffer Management Company LLC, P.O. Box 18890 Golden, CO 80402
Keith Bailey, Environmental Answers, 3229 Persimmon Creek Drive, Edmond, OK 73013
Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr., Henderson, NV 89014
Mike Skromyda, Tronox LLC, PO Box 55, Henderson, Nevada 89009
Jeff Gibson, AMPAC, 3770 Howard Hughes Parkway, Suite 300, Las Vegas, Nevada 89109
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Cindi Byrns, Olin Chlor Alkali, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 10733 Wave Crest Court Stockton, CA 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Robert Infelise, Cox Castle Nicholson, 555 California Street, 10th Floor, San Francisco, CA 94104-1513
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004
Dave Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544
Paul Black, Neptune and Company, Inc., 8550 West 14th Street, Suite 100, Lakewood, CO 80215
Teri Copeland, 5737 Kanan Rd., #182, Agoura Hills, CA 91301
Paul Hackenberry, Hackenberry Associates, 550 West Plumb Lane, B425, Reno, NV, 89509

ATTACHMENT A

Introduction

Issues were raised in the latter part of 2007 when datasets of radioactivity in soil samples from several of the BMI Companies (hereinafter "the Companies") continued to both pass and fail soil-based background comparisons for radionuclides in the same chain. This brought into question the appropriateness of some of the radionuclide data, since radionuclides in the same chain should obtain similar background comparison results under the assumption of secular equilibrium. The Nevada Division of Environmental Protection (NDEP) issued a letter to the Companies dated December 7, 2007 (BMI Plant Sites and Common Areas Projects, Henderson, Nevada: *Advisement Regarding Radionuclide Analysis for Uranium*) asking specific questions about radiochemical analysis methods for potentially affected projects and datasets. The Companies have provided responses, and all relevant issues within each correspondence are addressed as part of this report.

The goals of this guidance are to describe some of the chronology of how the issue arose and interactions and information shared with the Companies, evaluate analytical methods and data, and provide recommendations for recovering from historical issues that have caused apparent bias in the radionuclide data. There are three Companies involved that have submitted data to the NDEP thus far: Basic Remediation Company (BRC), Titanium Metals Corporation (TIMET) and TRONOX LLC (TRONOX) (collectively, also referred to as "the Companies" for the purposes of this letter). Several radionuclides from two radionuclide chains are of primary concern: The uranium (U)-238 chain (uranium chain) focusing on the long-lived radionuclides U-238, U-234, Thorium (Th)-230 and Ra-226; and, the thorium-232 chain (thorium chain) focusing on the long-lived radiounclides Th-232, Th-228 and Ra-228. These radionuclides are of interest because the projects require their data collection to support human health risk assessment. Other radionuclides, with the exception of U-235 are not included directly in these risk assessment. No evaluation of the U-235 decay chain data was performed since most radionuclides appear to be barely discernable from the minimum detectable concentration. Nevertheless, issues raised by the Companies pertaining to Polonium (Po)-210 and Lead (Pb)-210 are also discussed in this report.

Secular equilibrium (SE) exists when the quantity of a radioactive isotope remains constant because its production rate (due to the decay of a parent isotope) is equal to its decay rate. In theory, if secular equilibrium exists, the parent isotope activity should be equivalent to the activity of all daughter radionuclides. Pure secular equilibrium is not expected in environmental samples because of the effect of natural chemical and physical processes. For example, characteristics such as partitioning and solubility differ by element, and, for the entire uranium and thorium chains, radon is a gas that can escape the environmental system. In addition, differences in analytical methods could also cause minor effects or relative bias in the radionuclide data. However, approximate secular equilibrium is expected under background conditions. Natural abundance ratios of the uranium isotopes also offer a metric by which background radionuclide conditions can be evaluated. It should be noted that failure of secular equilibrium or natural abundance ratios implies contamination, whereas lack of failure does not

imply lack of contamination; rather, it implies lack of contamination or contamination that maintains the relevant proportions. Although natural abundance ratios could be used to evaluate the presence of radionuclides, it is easier to perform the evaluation using secular equilibrium because the activities of isotopes within a chain should be approximately equivalent.

This memorandum is divided into three main sections[1]. The first section addresses some of the underlying historical radionuclide data assembled by BRC, TIMET and TRONOX. Of specific interest are the radiochemical analytical methods used in the different investigations. Background data sets are available from three investigations: the original 2005 BRC/TIMET background study; the 2008 supplemental BRC background study; and, the 2008 BRC deep background study. Site data sets are available from seven investigations: TRECO; TRONOX Parcels A/B and Parcels C/D/F/G; the BRC Utility Corridor; the BRC upgradient groundwater wells soil sampling; BRC's Parcel 4B; and the BRC northeast area wells soils investigation. The focus is the soil sampling and analysis that was performed for these 10 investigations. Exploratory data analyses are presented and secular equilibrium is evaluated using an equivalence testing procedure, which is described in NDEP's guidance *Statistical Methods for Secular Equilibrium: For Radionuclide Data from Soil Samples Collected at the BMI Complex and Common Areas in Henderson, Nevada* (Statistical Methods for Secular Equilibrium Guidance), document dated January, 2009. The second section addresses a TIMET technical memorandum concerning a methods comparison for estimating radium (Ra)-228. The third section addresses the concerns regarding polonium-210 and lead-210. The report concludes with recommendations on how questionable radionuclide activity data from these studies can be used to support background comparisons and risk assessment, and describes the radiochemical analytical methods that should be used for future investigations.

Evaluation of the Uranium and Thorium Radionuclide Chains

The December 2007 NDEP memorandum highlighted issues relating to radiochemical analytical methods used for isotopic uranium analysis. The primary issue at hand was whether laboratory preparation methods were performed using hydrofluoric acid (HF). The NDEP requested that the Companies identify datasets that were prepared using a non-HF procedure. The NDEP also requested the Companies propose a plan to rectify all affected datasets under the assumption that non-HF methods would yield low-bias radioactivities. In response to the NDEP request, BRC listed all affected datasets and proposed a plan to salvage those data that were compromised. These datasets included datasets associated with BRC investigations and TRONOX investigations. TIMET stated from a response to NDEP comments as recent as January 29, 2008 that isotopic uranium and thorium preparation used the same method employed for the 2005 BRC/TIMET Shallow Soils Background data. TIMET did however identify issues with the preparation and analytical methods for Ra-228 and Pb-210, which are discussed later in this report. The results of exploratory and statistical analyses are presented below that shed light on the identified datasets and evaluate the proposed correction measure proposed by BRC and TRONOX. Datasets for TIMET were not specifically evaluated as it was believed that this would not add value to the development of this guidance document.

[1] All references to the Henderson site datasets included in this analysis are provided at the end of this report in a section titled "References for the Henderson Site datasets".

Exploratory data analysis (EDA) performed on the BRC and TRONOX data includes box plots, correlation matrices, and summary statistics tables for the uranium and thorium radionuclide chains. These analyses were performed to qualitatively assess if the radionuclide data exhibit secular equilibrium. The EDA is followed by statistical analysis that involves equivalence testing for secular equilibrium, as described in NDEP's Statistical Methods for Secular Equilibrium Guidance (January 2009), and recommendations are made regarding recovery of historical data and radiochemical analysis for future studies.

Exploratory Data Analysis

Several of the soil datasets identified by BRC that were affected by the preparatory methods exhibited noticeable differences in the box plots and summary statistics between radionuclides within each chain (see Appendices A and B below). Some of the most noticeable differences between radionuclides (both thorium and uranium chains) were identified for datasets flagged by BRC as "requiring correction". These datasets include: BRC Parcel 4B, TRONOX Parcels C/D/F/G, BRC northeast area wells, and BRC upgradient groundwater wells. Comparison between radionuclides and comparison with the background data sets are helpful when interpreting the EDA.

Although there are some small differences in the box plots and summary statistics for the three background datasets, they appear to exhibit approximate secular equilibrium. They also show radioactivities that are a little greater than 1 pCi/g on average for radionuclides in the uranium chain, with high values around 3 pCi/g. Radioactivities in the thorium chain are a little greater than 1.5 pCi/g on average, with high values around 3 pCi/g again. Of further interest is that the correlations appear to be high within the uranium chain, but correlations with Ra-228 appear very low in the thorium chain (see Appendix C below). These are useful references for evaluation of the seven site datasets.

The BRC Parcel 4B data show clear differences in the uranium chain, with Ra-226 showing much higher activities than Th-230, which in turn are much higher than those for the uranium isotopes. Differences between Ra-228 and the thorium isotopes are also clear in the thorium chain (see Appendices A and B below). For both chains, the Ra results appear to be roughly in line with background. Hence, the uranium and thorium data appear to be too low.

The TRONOX Parcels A/B data exhibit noticeable differences in both radionuclide chains, however these data were identified in the BRC memorandum as not requiring further corrections because they were corrected for the No Further Action Determination (NFAD) for these parcels (see Appendices A and B below). The uranium chain box plot shows that the Ra-226 data are similar to background, and the Th-230 data are slightly higher than the Ra-226 data. However, the radioactivities for the uranium isotopes appear to be too low. Results for the thorium chain appear to be reasonable. Of interest again is that the correlations are low with Ra-228. The lack of correlation with Ra-228 is a recurring theme.

The BRC upgradient groundwater wells and the BRC northeast area wells data exhibit the same general pattern as the TRONOX Parcels A/B data. However, the correlations with Ra-228 are high for these two datasets, and are the exceptions in this regard across the 10 datasets evaluated.

The TRONOX Parcels C/D/F/G and the Utility Corridor data show similar patterns with respect to the uranium and thorium chains, although there is some greater variability in the TRONOX Parcels C/D/F/G data. The correlations with Ra-228 are again quite low.

The TRECO study was performed a few years earlier than the other site studies reported here. The uranium chain data appear to be in line with background with the exception of the Ra-226 data, which appear to be greater than the data for the other isotopes. The Ra-226 data also appear to be greater than background. The data imply either an analytical issue, or low levels of Ra-226 contamination at TRECO. For the thorium chain, the data appear to be similar to background and they are in approximate secular equilibrium. However, the mean for Ra-228 is lower than for the thorium isotopes. The correlations with Ra-228 again appear to be low.

The EDA and correlations suggest some potential issues with the radionuclide data. When the radioactivities are too low, the implication is an analytical issue, which has been traced back to the preparation method for uranium, and possibly for thorium, for some of the investigations. If the radionuclides are in secular equilibrium, then their correlations should be expected to be high. Consequently, the lack of correlation with Ra-228 is also of concern. Correlations in the uranium chain are generally high, but there are exceptions. For example, the correlations with Ra-226 at BRC Parcel 4B are negative, which further brings into question the analytical methods for that investigation. The correlations with Ra-226 at TRECO are also low.

Equivalence Test for Secular Equilibrium

The EDA involves comparison of data in the box plots and summary statistics that does not address the inherent correlation if secular equilibrium holds. That is, distributions might appear to be similar, but lack of correlation is also a concern. Conversely, a strong correlation does not imply similar results for the radionuclides. For example, the correlations in the uranium chain for the BRC upgradient groundwater wells soil data are strong, but there are clear differences between the uranium isotopic activities and those of radium-226 and thorium-230. In other cases where differences occur, the correlations are also low. The comparison issues are, apparently, complex. To further the evaluation, equivalence tests are presented to evaluate secular equilibrium. Equivalence testing, unlike standard classical significance testing, evaluates whether means are approximately equal, as opposed to exactly equal. The equivalence testing approach compares mean radioactivities while accounting for the correlation in the data. The approach is described in NDEP's Statistical Methods for Secular Equilibrium Guidance (January 2009).

Statistical equivalence testing essentially involves reversing the standard null and alternative hypotheses used in analysis of variance (ANOVA), and, in the process, allowing for non-point valued null hypothesis statements. Equivalence testing allows some flexibility in how approximate secular equilibrium is defined. The hypotheses allow a family of possible options, instead of the point null hypothesis that is common in classical statistics, by specifying that the

mean radioactivities can be close to the same as opposed to exactly equal. The result of equivalence testing for secular equilibrium will either indicate that the radionuclides are in approximate secular equilibrium (the alternative hypothesis), or that they are not (the null hypothesis). If the radionuclide data do not exhibit secular equilibrium, then there is some indication of radionuclide specific contamination. If the radionuclide data exhibit secular equilibrium, then either the data are similar to background, or there is more general contamination for all radionuclides in the decay chain.

The equivalence testing approach involves establishing an allowable difference between the mean activities for the radionuclides in the same decay chain. Specification of this difference is not necessarily straightforward. In this case, however, it seems reasonable to assume approximate secular equilibrium for the background data. Equivalence tests were performed on the background data for several possible allowable differences. The equivalence tests start to fail when the allowable difference is much less than 10%, in which case a difference of 10% was used to test the site data.

The results of the equivalence testing are presented in Table 1 (uranium chain) and Table 2 (thorium chain). Several sites did not meet the conditions of secular equilibrium (SE) for the uranium chain. These are TRECO, TRONOX Parcels A/B, the BRC upgradient groundwater wells, and the BRC northeast area wells. In BRC's response to a NDEP memorandum dated January 10, 2008, many of these datasets were flagged as requiring correction (with the exception of TRECO). The only site for which the conditions of secular equilibrium were not met was BRC Parcel 4B. Although the correlations with Ra-228 are often very low, the means are sufficiently close that the hypothesis of secular equilibrium is supported using the equivalence testing approach.

Table 1. Equivalence testing results for the uranium chain.

				Mean Proportion			
Site	Delta	p-value	Secular Equilibrium	Ra-226	Th-230	U-233/234	U-238
2005 BRC/TIMET Background	0.1	0.00	Yes	0.2401	0.2720	0.2448	0.2431
2008 Supplemental Background	0.1	0.03	Yes	0.2114	0.2934	0.2716	0.2236
2008 Deep Background	0.1	0.00	Yes	0.2430	0.2562	0.2569	0.2438
TRECO	0.1	0.50	No	0.3168	0.1925	0.1956	0.2951
Tronox Parcels A/B	0.1	0.50	No	0.3367	0.3799	0.1705	0.1128
Tronox Parcels C/D/F/G	0.1	0.00	Yes	0.2530	0.2159	0.2360	0.2951
Utility Corridor	0.1	0.00	Yes	0.2494	0.2585	0.2709	0.2211
Upgradient Groundwater Wells	0.1	0.50	No	0.2906	0.4122	0.1634	0.1338
BRC Parcel 4B	0.1	0.50	No	0.5249	0.2586	0.1145	0.1021
Northeast Area Wells	0.1	0.50	No	0.3447	0.3058	0.1863	0.1632

Results highlighted in yellow indicate that the uranium chain is not in secular equilibrium.
Note that p-values reported as 0.50 are greater than or equal to 0.50.

Table 2. Equivalence testing results for the thorium chain

				Mean Proportion		
Site	Delta	p-value	Secular Equilibrium	Ra-228	Th-228	Th-232
2005 BRC/TIMET Background	0.1	0.00	Yes	0.3599	0.3270	0.3130
2008 Supplemental Background	0.1	0.00	Yes	0.3143	0.3647	0.3210
2008 Deep Background	0.1	0.00	Yes	0.3117	0.3586	0.3297
TRECO	0.1	0.00	Yes	0.3571	0.3406	0.3023
Tronox Parcels A/B	0.1	0.00	Yes	0.3786	0.3191	0.3022
Tronox Parcels C/D/F/G	0.1	0.00	Yes	0.3564	0.3324	0.3113
Utility Corridor	0.1	0.00	Yes	0.3507	0.3615	0.2878
Upgradient Groundwater Wells	0.1	0.00	Yes	0.3440	0.3375	0.3185
BRC Parcel 4B	0.1	0.50	No	0.4616	0.2671	0.2713
Northeast Area Wells	0.1	0.00	Yes	0.3291	0.3615	0.3095

Results highlighted in yellow indicate that the Th-232 chain is not in secular equilibrium.
Note that p-values reported as 0.50 are greater than or equal to 0.50.

Preparation and Analysis Methods

The results of the secular equilibrium tests confirm some of the findings in the EDA and correlation analyses. Differences occur in the data for each radionuclide in the uranium chain for some sites, but the issue appears to be low radioactivities, implying an issue with the radiochemical analysis. However, secular equilibrium is observed in the thorium chain (with the exception of BRC Parcel 4B), despite the lack of correlation with Ra-228 in many of the datasets. After some investigation, the main issue appears to be associated with the preparation method used for the uranium and thorium analyses.

The methods and analyses used for isotopic uranium and thorium analysis for the sites that are addressed as part of this memorandum are presented in Table 3. There is some clear relationship between methods used and the statistical analysis results presented above. For example, the comparatively low uranium radioactivities correspond to investigations that did not use HF acid in the sample preparation (prep) step for dissolution of the sample. Results of the thorium analysis for BRC Parcel 4B might be a consequence of a similar issue. The data are compelling, but there is no other evidence to support the apparently low thorium activities at this site.

There are two reasons why it is recommended that all future isotopic uranium and thorium analysis for soils/sediments/solid samples should be digested using HF for total dissolution with subsequent analysis by alpha spectroscopy (spec). The first is that this is how the background data have been analyzed, and comparison of site and background data require comparability between datasets. The second is that based on the statistical analysis presented, it appears that this approach will provide the most reliable data for these radionuclides. This recommendation is consistent with how GEL and STL-Saint Louis have performed analysis for the thorium and uranium isotopes for the sampling events listed in Table 3, and is also consistent with how STL-Richland performed these analyses for the 2008 BRC deep soils background analysis.

Table 3. Radionuclide Methods.

Event	Pass U SE?	Pass Th SE?	Laboratory and Date	U preparation and analysis methods	Th preparation and analysis methods	Ra-226 preparation and analysis methods	Ra-228 preparation and analysis methods
2005 BRC/TIMET Background*	Y	Y	STL-SL, 2005	HF, alpha spec.	HF, alpha spec.	Prep acids unknown, Alpha spec. GFPC 9315.	Prep acids unknown, Beta spec, 9320.
2008 Supplemental Background	Y	Y	GEL, April 2008	HF, alpha spec.	HF, alpha spec.	Prep acids unknown, 903.1 Lucas cell alpha.	Prep acids unknown, 904.0 beta.
2008 Deep Background	Y	Y	STL-RICH, 2008	HF, alpha spec.	HF, alpha spec.	non-HF acids, 903.1, alpha scintillation counting.	non-HF acids, 904.0, GPC beta
TRECO	N	Y	STL-SL, 2005	Likely HF, alpha spec.	Likely HF, alpha spec.	Prep acids unknown, Alpha spec. GFPC 9315.	Prep acids unknown, Beta spec, 9320.
Tronox Parcels A/B (also #47)	N	Y	STL-RICH, 2007	Non HF, alpha spec.	HF**, alpha spec	gamma (soils)	gamma
Tronox Parcels C/D/F/G	Y	Y	STL-RICH, 2007	Non HF, alpha spec.	HF**, alpha spec	gamma	gamma
Utility Corridor (DVSR #50)	Y	Y	GEL, April 2008	HF, alpha spec.	HF, alpha spec.	Prep acids unknown, 903.1 Lucas cell alpha.	Prep acids unknown, 904.0 beta.
Upgradient Groundwater Wells (#47)	N	Y	STL-RICH, 2007	Non HF, alpha spec.	HF**, alpha spec	gamma	gamma
BRC Parcel 4B (#43)	N	N	STL-RICH, 2007	Non HF, alp ha spec.	HF**, alpha spec	gamma	gamma
Northeast Area Wells (#46)	N	N	STL-RICH, 2007	Non HF, alpha spec.	HF**, alpha spec	gamma	gamma

* Ra-226 and Ra-228 were re-analyzed at STL-Richland due to anomalies using isotopic barium carrier using the digestions prepared at STL-SL.
** Per email from Erika Jordan (Richland) all thorium used HF, uranium non-HF prior to 2008 Deep Background investigation. STL-ST: Severn Trent Laboratories, St. Louis. STL-RICH: Severn Trent Laboratories, Richland.

The issues regarding radium are less clear. Radium results often seem reasonable. However, a lack of correlation in some cases is of concern. For radium-226, correlations are highest at the BRC upgradient groundwater wells and the BRC northeast area wells sites, but neither of these sites demonstrates approximate secular equilibrium because of issues with the uranium analysis. Correlations are also quite high in the three background datasets and the BRC utility corridor data, all of which involves alpha spectroscopsy (spec) analysis following HF acid preparation. Although there is not much evidence of analytical issues with the gamma spectroscopy method for radium-226, the main reason for using alpha spectroscopy is that this is the method used for the background data, and comparability of data is important for background comparisons.

The same applies to the radium-228 analysis; that is, beta spectroscopy should be used for site investigations because this is the method that was used for the background data. However, there is some evidence in the radium-228 data, based on the correlation analysis, for the BRC upgradient groundwater wells and the BRC northeast area wells sites that the gamma spec method outperforms the beta emissions methods. The lack of correlation could also be related to lack of sensitivity of the methods at the radioactivity levels being reported.

For the BRC 2008 deep background data the preparation method for both radium isotopes involved non-HF acids, in which case underestimation of the radium data might be expected. The results seem reasonable, however. A possible explanation is that radium is more soluble than thorium and radium, and HF acid is not necessary to obtain reliable data. Further discussion of radium-228 analysis is presented in the next section in response to TIMET's side-by-side study of gamma and beta spectroscopy analysis for this isotope.

Based on the observations made, and the analytical methods that were used for the background data, it is recommended that soils/sediments/solid being analyzed for Ra-226 should use alpha spectroscopy consistent with EPA methods 903.0/903.1 and 9315. It is recommended that isotopically labeled barium be used as the tracer. For Ra-228, soils/sediments/solid samples should be analyzed using beta spectroscopy consistent with EPA methods 904.0 and 9320. It is also recommended that isotopically labeled barium be used as the tracer.

Evaluating BRC's proposed correction approach and recommended decision logic

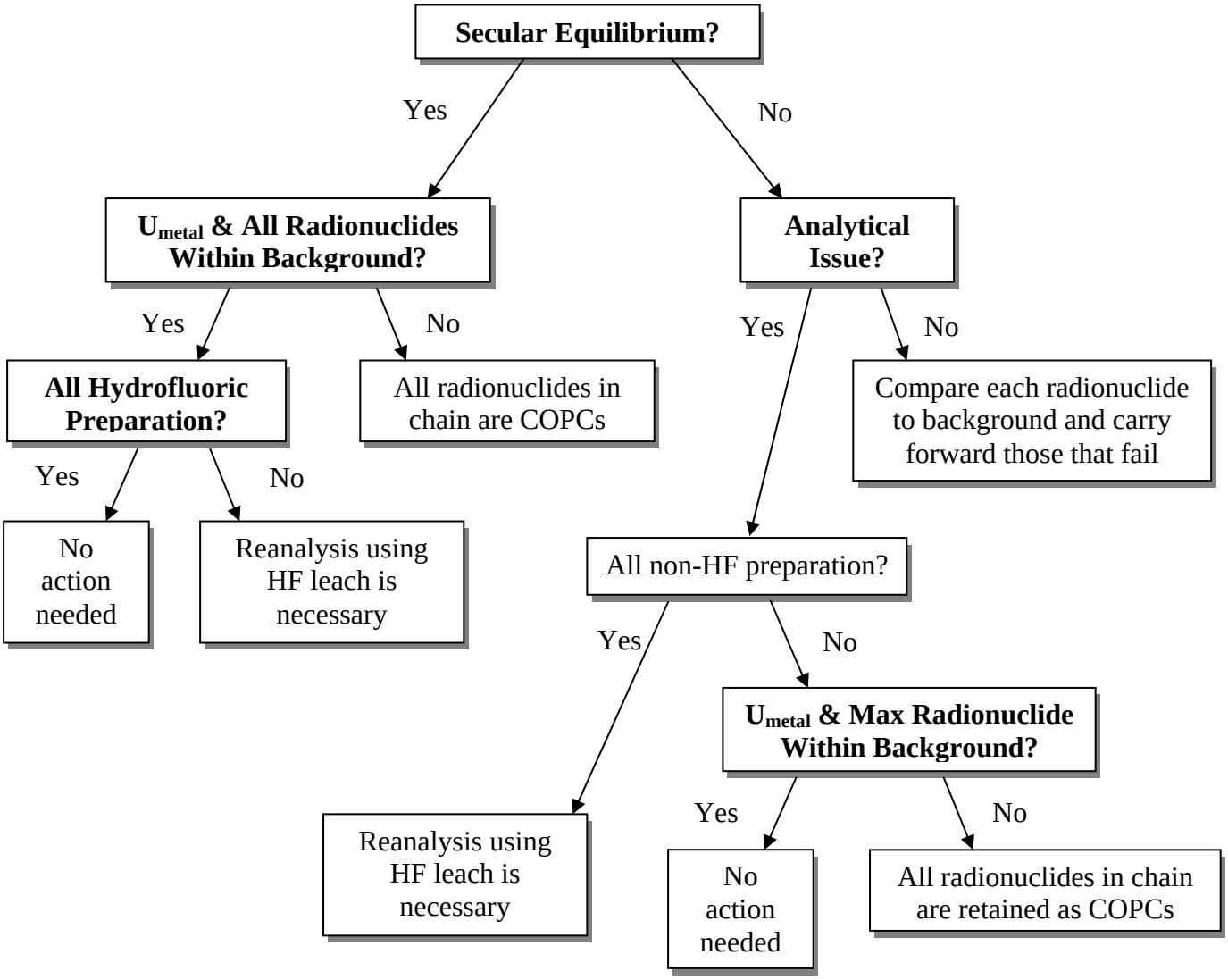
In BRC's response to the NDEP memorandum dated January 10, 2008, BRC proposed a correction factor approach in an attempt to salvage existing data sets that were affected by differences in preparatory methods. BRC constructed a dataset of 14 randomly chosen samples from the BRC 2008 deep soil background dataset and five randomly chosen samples from the TRONOX Parcels A/B dataset that were digested using the HF procedure and then reanalyzed. A ratio was then calculated for each sample by taking the HF acid reanalysis result and dividing it by the initial non-HF result for U-238, U-235/236, and U-233/234. An average correction ratio was then calculated for each nuclide. The correction procedure is then accomplished by multiplying the existing U-238 and U-233/234 activities analyzed using non-HF acid dissolution methods by the nuclide-specific average ratio.

Based on the statistical analyses presented above, the correction factor approach is likely to provide unreliable and unsupportable results. The correction factor approach can only be applied if the data to which it is applied exhibits the same problem as the data on which the correction factor is based. The

difference in data for the site datasets implies this is unlikely to be the case. For example, the mean uranium activity at the BRC Parcel 4B site is about 0.2 pCi/g, whereas at the BRC upgradient groundwater wells site, the mean is about 0.6 pCi/g. Although there are problems with the data, a single correction factor approach seems unreasonable. NDEP's recommended approach is presented in Figure 1. This flowchart describes a decision framework that is applicable to all metallic uranium and radionuclide datasets that have been collected to date.

If secular equilibrium is exhibited in the isotope chains, then background comparisons should be performed to confirm if all the radionuclides in a decay chain are similar to background. If they are greater than background, then all the radionuclides would be carried forward in a risk assessment. If they are not greater than background and HF acid dissolution was used, then no further action is needed. If HF acid dissolution was not used, however, then reanalysis is necessary because all the radionuclide activities are probably underestimated.

If secular equilibrium is not exhibited, but there are no analytical issues (e.g., use of non-NDEP-approved analytical methods, or non-HF acid dissolution for uranium and thorium), then background comparisons can be performed for each radionuclide separately and for uranium as a metal. If there are analytical issues for all the radionuclides then reanalysis is necessary. If the analytical issues apply only to some of the radionuclides (such as uranium in the case of several of the datasets studied in this report, and thorium in BRC Parcel 4B), then the approach that NDEP will support for the historical data is to perform background comparisons with metallic uranium concentrations (if such data were collected at the site), and with the radionuclide for which the analytical methods are reasonable (usually radium-226 and radium-228).



COPCs indicates "chemicals of potential concern".
U_{metal} denotes metallic uranium.

Figure 1. Flowchart describing the decision framework for radionuclide historical dataset usability for Sites within the BMI Complex and Common Areas, Henderson, NV.

Method comparison of radium-228 in soils (TIMET)

TIMET responded to an NDEP comment dated January 11, 2008 to identify all datasets that are not comparable. Specific to this section of the memorandum, TIMET identified differences in preparation and analytical methods for soil samples for Ra-228. To address this issue, a TIMET memorandum dated May 9, 2008 outlined method comparisons of gamma spectroscopy (Gamma Spec) to gas flow proportional counting (GFPC) for estimating Ra-228. The purpose of the TIMET memorandum was to provide a basis for using gamma spec Ra-228 data to support background comparisons, although it was clearly indicated that this approach had not previously been approved by the NDEP.

There are several issues brought to light by this TIMET memorandum. TIMET states that back quantitation of Ra-228 from parent radionuclide (Th-232) should not be performed because of issues of comparability between the TIMET Hydrogeologic Investigation and the TIMET Vertical Delineation Investigation data, and the BRC/TIMET shallow soil background data. Data was not presented to support these statements.

Instead, in order to use Ra-228 data from non-NDEP-approved gamma spectroscopy techniques, TIMET proposed using samples from four boring locations that were analyzed by both gamma spec and GFPC (the NDEP approved method) to predict Ra-228 activity based on the gamma spec results. This would potentially allow those data analyzed by gamma spec to be used in future background comparisons at the site.

Several concerns regarding this approach are as follows:

Regression equation

The regression equation (see Figure 2) is surprising perhaps in that the intercept is significant, implying that a value of zero from gamma spec would not predict a value near zero for GFPC. This is not necessarily a problem, provided the regression model is used only within the range of the experimental data. However, the positive intercept and the slope of about ½ demonstrate that the model under-predicts GFPC results at high gamma spec values, and over-predicts at low gamma spec values. There is some cause for concern because this implies that the predicted distribution will be tighter than the input gamma spec distribution (see below).

Range of the data

Regression analyses should only be used within the range of the available data. Extrapolation is rarely supported. The range of the gamma spec data is from a minimum of 0.4 pCi/g to a maximum of 1.9 pCi/g. The range of the GFPC data is from a minimum of 1.0 pCi/g to a maximum of 2.2 pCi/g. In both cases, this is a much tighter range than has been observed in the background data and in data from other BMI sites. The range of data for this study needs to be increased for potential use of the regression equation to predict GFPC results.

The removal of 'outlying' data

TIMET used three statistical criteria to evaluate whether or not "outliers" or "influential points" existed in the data in order to improve the fit of their ordinary least squares model. These criteria are studentized residuals, hat matrix diagonals, and Cook's D influence. From these three criteria, TIMET identified one residual as an outlier and two data points as influential. The outlier was the only point removed before TIMET revised the model. It is not clear that it is appropriate to remove an outlier without further justification simply to support an improved statistical model that is based on statistical assumptions that might not hold. Also, the difference between the two models is not sufficient to justify preference of the model without the outlier, and the regression lines are not very different. The small difference is probably because the outlier is not far outside the criteria used for its identification. Also, with 33 data points, identification of one outlier is not surprising. The unadjusted model should be used.

It is also not clear why a discussion of methods for identifying influential values is presented, when the TIMET memorandum does not include any regression analysis without these values.

Artificial tightening of post-hoc GFPC values, how will standard deviation / variance in prediction be addressed?

The issue here involves the fact that the original GFPC values in this data set had a standard deviation of 0.32 pCi/g where the gamma corrected GPFC predicted values have a standard deviation of about 0.16 pCi/g, or half that of the original data. This means that the confidence intervals constructed around these data will be much tighter and could have an effect on distributional background comparison tests, given the dependence of the distributional tests on the variance of the underlying data sets.

Heteroscedacity in variance around prediction line

This is likely a minor issue relative to the aforementioned, but there does appear to be heteroscedacity in the variance (i.e., different variances) around the prediction line as shown in Figure 2. Normally, this issue can be addressed by utilizing some form of a generalized linear model that accounts for the lack homogeneity in the residuals.

Variability between boring sites

There is some concern about the boring site variability. Figure 2 plots Ra-228 values from GFPC against those from gamma spec and clearly shows that grouping is occurring with respect to the boring site variable. Borings TMSB-131 and TMSB-135 are nearly always under-predicted while borings TMSB-132 and TMSB-133 are nearly always over-predicted. If all four borings can be assumed to be representative of the site then this is not a concern. The model accurately captures the "mean" behavior of the borings, however it cannot be applied to any particular boring and thus inferences should not be made about particular locations with this prediction model.

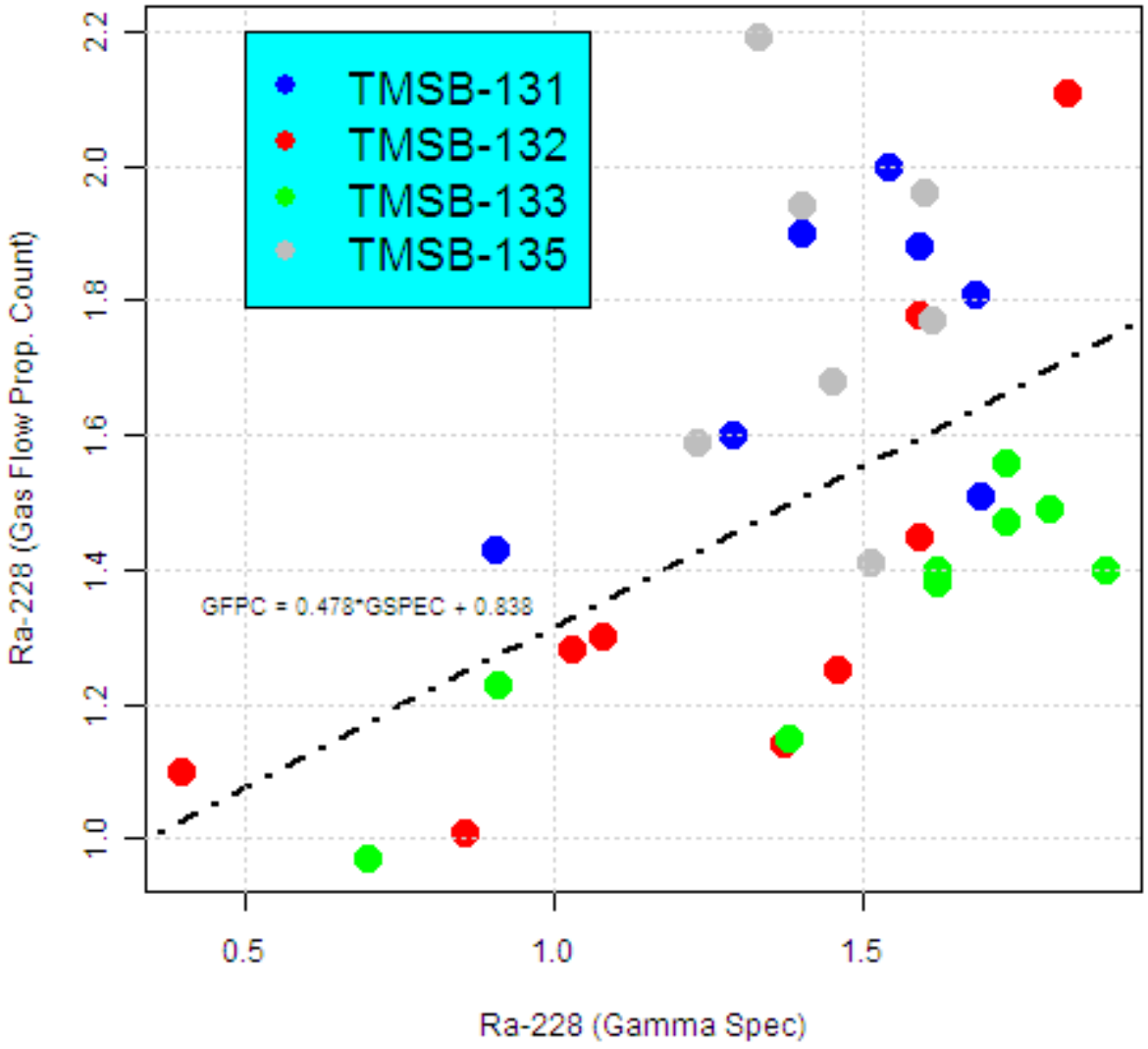
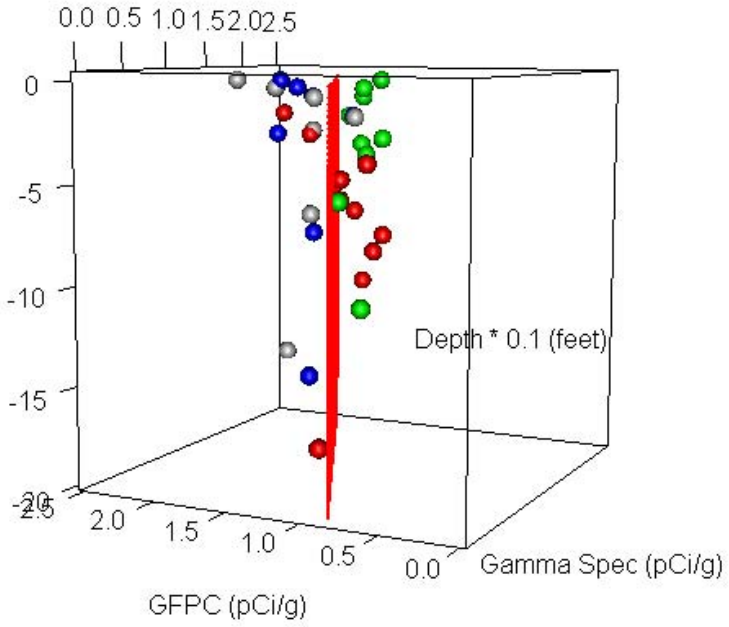


Figure 2: Radium-228 data from GFPC and Gamma Spec analysis (including prediction line)

Seemingly no relationship to depth

Diagnostically, from Figure 3, it appears that there is little relationship of prediction ability with depth of sample. A "side" shot, viewing down the prediction line (projected onto depth) shows that there is little deviation away from the prediction line as a function of depth. Therefore, these data do not support the inclusion of depth as part of the prediction model.



Color points share the same legend as presented in Figure 2.

Figure 3. Radium-228 data from GFPC and Gamma Spec analysis (with the regression line projected onto depth).

TIMET Lead-210 & Polonium-210 issues

TIMET proposed to conduct statistical correlations of results within the uranium decay chain to evaluate secular equilibrium for the analytical methods for Pb-210 and Po-210 (see TIMET's response to NDEP comments dated January 29, 2008). No further information has been provided. The most recent correspondence between TIMET and the NDEP dated April 11, 2008, indicates that TIMET has not yet completely resolved the Pb-210 and Po-210 analytical methods comparability issue, therefore we cannot comment further. If TIMET has conducted this analysis or have collected relevant data, then NDEP can perform a review. Otherwise, in light of the focus of human health risk assessment for the BMI sites on uranium, thorium and radium isotopes only, there is no need to pursue this issue further.

Summary

The path forward for radionuclide analysis seems clear based on the analysis presented in this report. Uranium and thorium isotopic analysis should be performed using alpha spectroscopy following HF acid dissolution. This approach is clearly more reliable than alternative approaches for these two elements, and is consistent with how the background data were obtained.

To resolve analytical issues with past data, BRC proposed a "correction factor" approach. Datasets flagged as potentially impacted by the analytical methods used for uranium and thorium were both qualitatively and quantitatively assessed to more comprehensively evaluate this proposed solution. The finding is that the proposed corrective factor approach should not be used. The side-by-side study that is used as the basis for the correction factor approach involved analysis of 19 samples for uranium isotopes. Although a simple correction factor approach was devised, the effect of method differences appears to be more complicated. Reported radioactivity for the uranium isotopes varies considerably when a non-HF acid dissolution was used. Possible explanations are the type of acid used and the amount of acid used for dissolution. Regardless, the correction factor estimated from the 19-sample study cannot be applied reliably to all affected datasets. In addition, correction factors were not developed for the thorium chain for BRC Parcel 4B and the BRC northeast area wells datasets, both of which failed the statistical test for secular equilibrium. An approach to resolving historical datasets is presented in Figure 1. NDEP requires that this approach be followed for historical data sets that are affected by analytical method issues. The approach basically allows the datasets to be evaluated (compared to background) based on uranium as a metal, and, usually, the radium isotopes. This is because the analytical problems are usually associated with the uranium and thorium analytical methods, whereas, the radium data, despite some analytical issues, appear to be comparatively reliable. NDEP also requires that appropriate methods as described in Table 4 are used for future investigations.

For the radium isotopes the situation is not as clear. It appears that Ra-226 analysis by alpha spectroscopy is marginally more reliable than analysis by gamma spectroscopy. The inter-isotope correlations within the uranium decay chain when alpha spectroscopy is used are often stronger than those when gamma spectroscopy is used. A more compelling argument to use alpha spectroscopy for Ra-226 is comparability with the background data. It should be noted, however, that HF acid dissolution was not used for the Ra-226 analyses in the background investigations. The Ra-226 results in background nevertheless seem reasonable (for example, they match results for other isotopes in the uranium chain). A possible explanation is that radium is more soluble than thorium and uranium, or that it is not so tightly bound in the soil matrix, so that a weaker acid dissolution is sufficient. It is not possible to draw firm conclusions in this regard without further information. For example, this could be achieved through a side-by-side study in which dissolution method is the variable of interest, including complete understanding of the acids used in the radiochemical analysis for radium. For radium-228 the situation is more difficult. The gamma spectroscopy results for the five sites included in this report seem reasonable, and, in two instances (BRC upgradient groundwater wells and BRC northeast area wells soils investigations) provide some of the highest correlations with the thorium isotopes from the thorium chain. However, the correlations are low in the other eight investigations presented in this report. In addition, the side-by-side study performed by TIMET does not provide a compelling argument for using gamma spectroscopy analysis for radium-228. The regression between the gamma spectroscopy results and the GFPC method does not provide a very good fit to the data, and the range of the data is smaller than the range of the background data, further reducing the effectiveness of the regression model for prediction

from gamma spectroscopy data. The overriding issue again is that the background data were collected using beta spectroscopy, in which case this analytical method should also be applied to the site investigations.

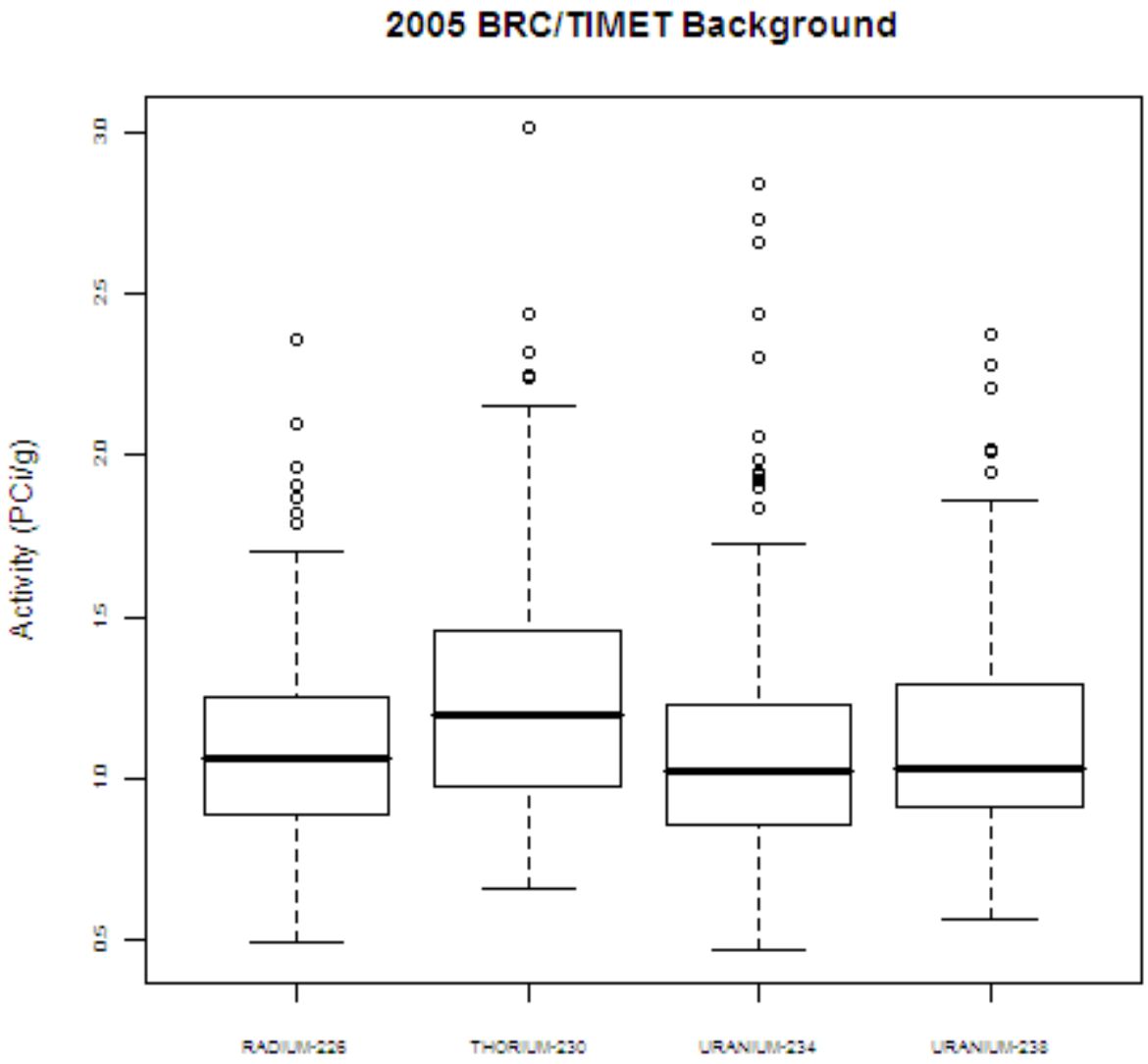
TIMET's side-by-side study for radium-228 analysis leads to a regression equation that relates gamma spectroscopy data to beta spectroscopy data. The regression model is not a very good fit to the data. The purpose of the investigation was to determine if beta spectroscopy data could be predicted from gamma spectroscopy data for radium-228. An implicit assumption was that the beta spectroscopy data are reliable. However, this assumption is not borne out by the analysis of the data from the three background and seven site investigations. The regression analysis and lack of correlation with radum-228 in many of the datasets might be suggestive of a sensitivity issue with the beta spectroscopy method. However, insufficient information is available to test this hypothesis. Also, the regression equation proposed is limited by the underlying data. The range of the radium-228 data in the side-by-side study is small compared to the range of the background and site investigations data. Extrapolation of regression equations is often difficult to defend. The regression proposed is not adequate for correcting existing gamma spectroscopy data without first addressing issues associated with the range of the data.

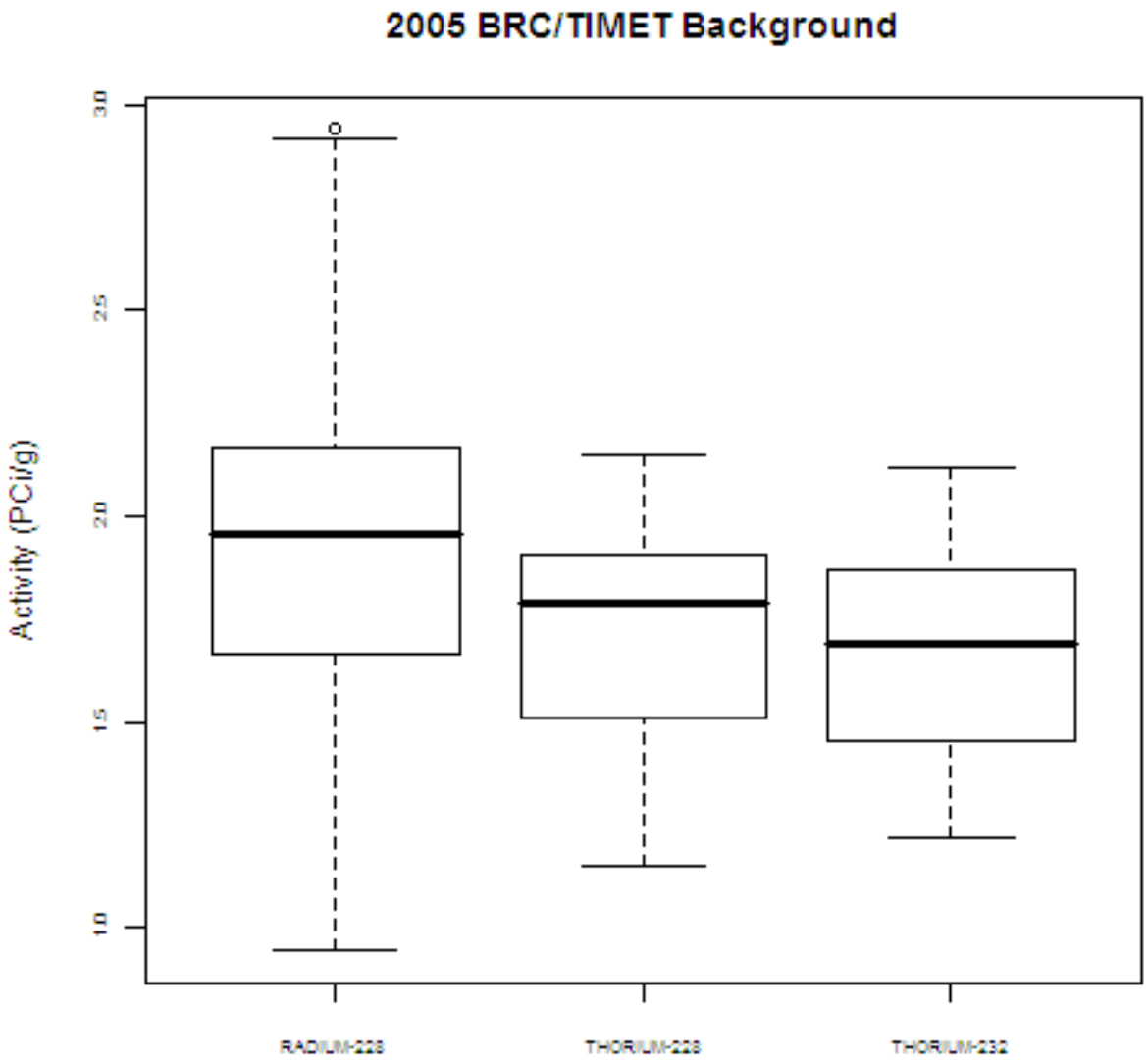
A full understanding of the analytical issues is not possible without recourse to some further information. Side-by-side studies across a greater range of radioactivities are needed to better form regression models and correlations between results. In addition, a study involving standards or performance evaluation samples would resolve many issues regarding the reliability of the analytical methods. Such a study should be performed blind to the laboratories involved. It also appears as though there are some sensitivity issues, at least for the radium-228 analytical methods. One issue with sensitivity that is always difficult is the role that ambient background subtractions play in the reported values. Ambient background data that are used in reporting data should also be reported and captured in the Companies databases. The following analytical methods are recommended for future site investigations:

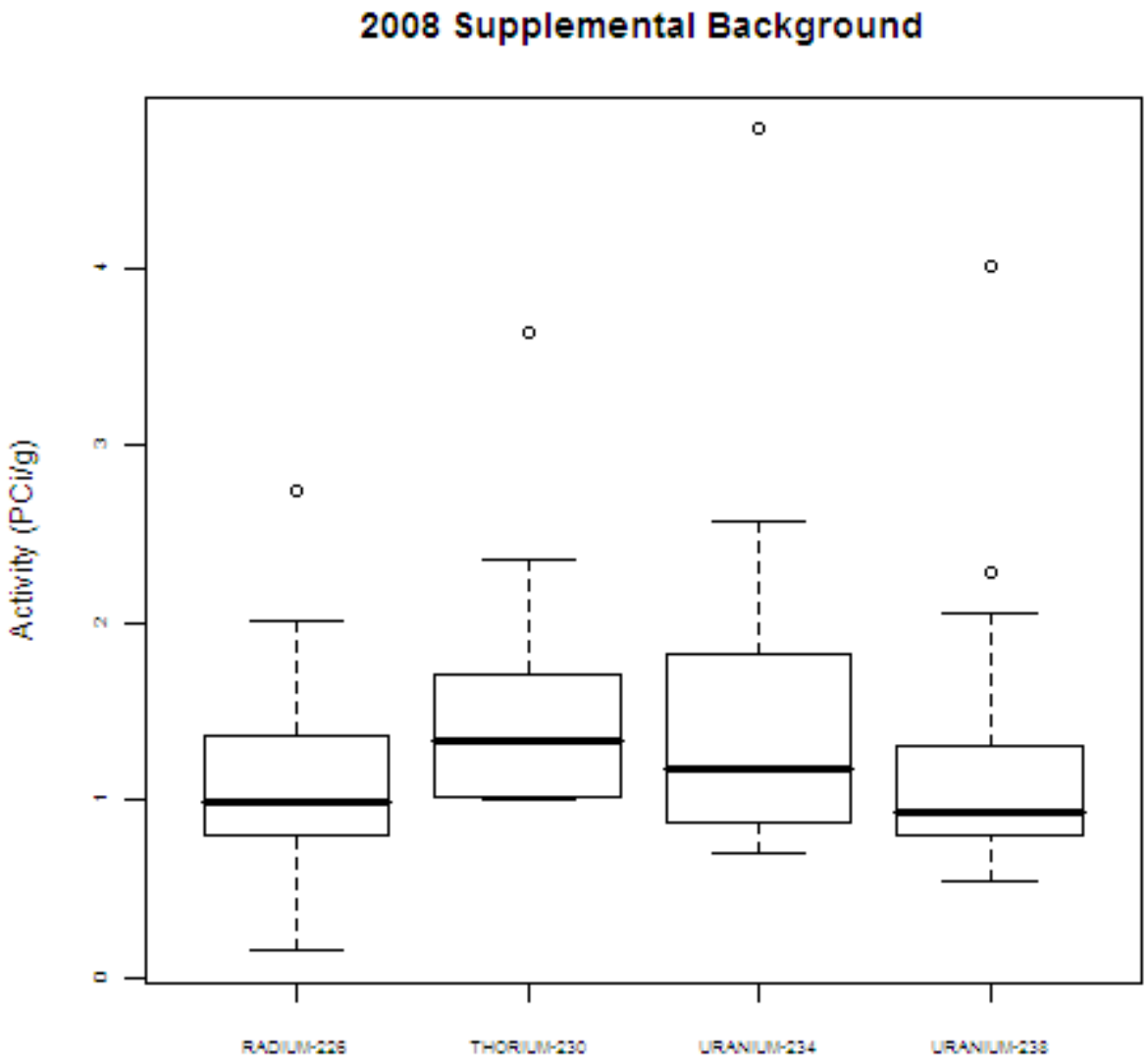
Table 4: Recommended Radiochemical Analytical Methods

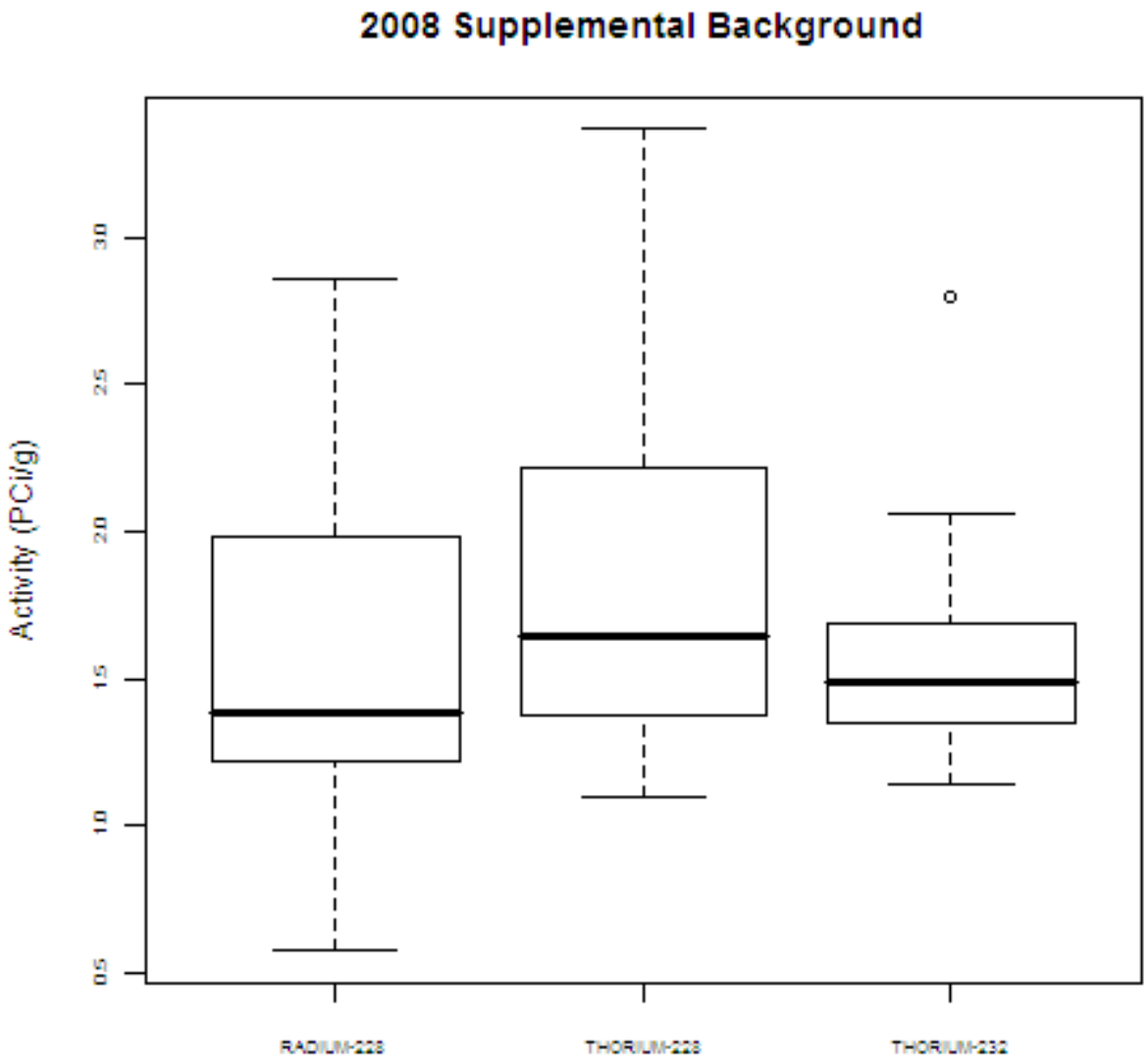
Radionuclide	Preparation Method	Analytical Method
Uranium isotopes	HF dissolution	Alpha spectroscopy consistent with DOE EML HASL-300 for isotopic uranium.
Thorium isotopes	HF dissolution	Alpha spectroscopy consistent with DOE EML HASL-300for isotopic thorium.
Radium-226	Requires further investigation	Alpha spectroscopy consistent with EPA methods 903.0/903.1 and 9315 with isotopically labeled barium as the tracer
Radium-228	Requires further investigation	Beta spectroscopy consistent with EPA methods 904.0 and 9320 with isotopically labeled barium as the tracer

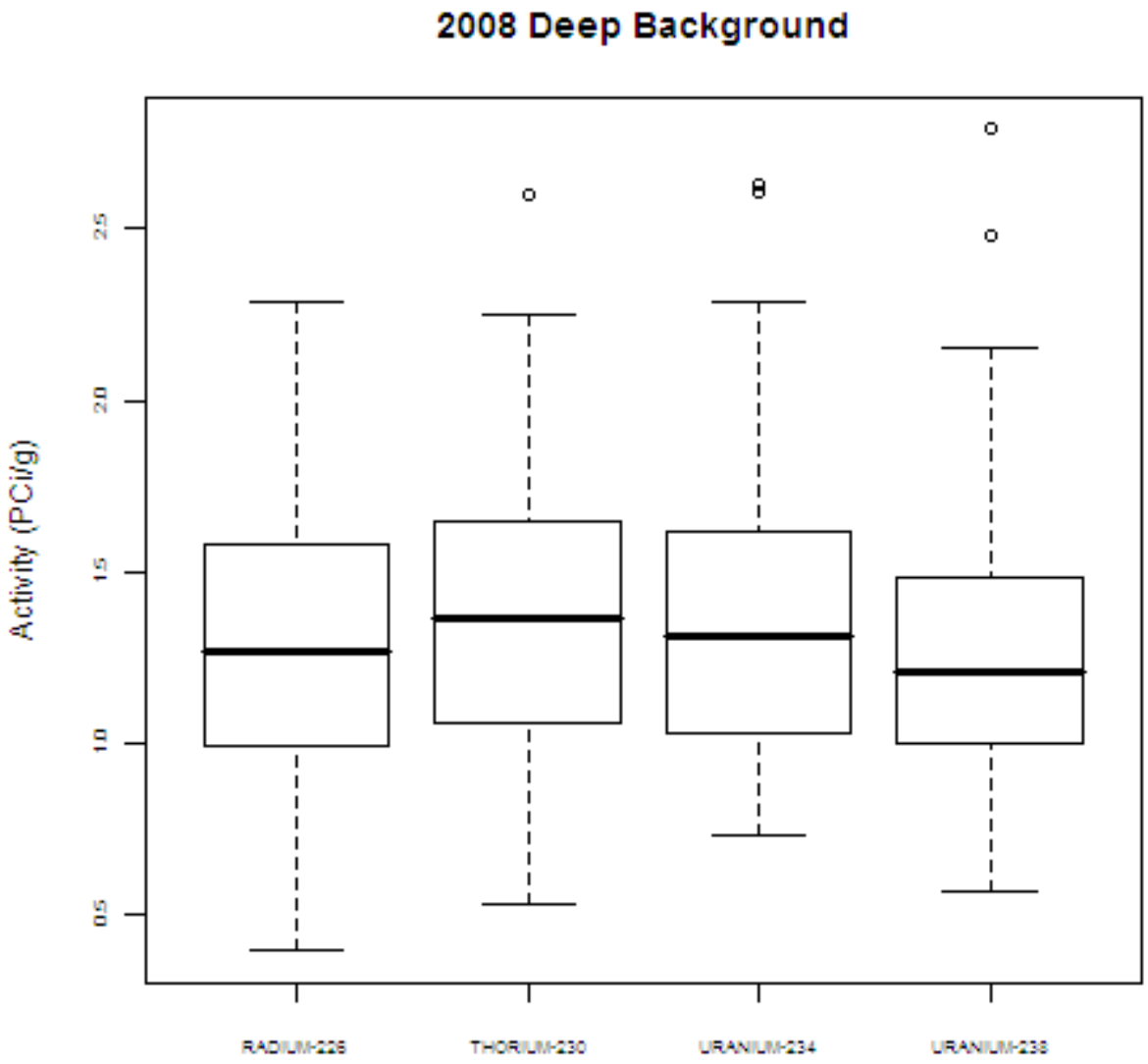
Appendix A

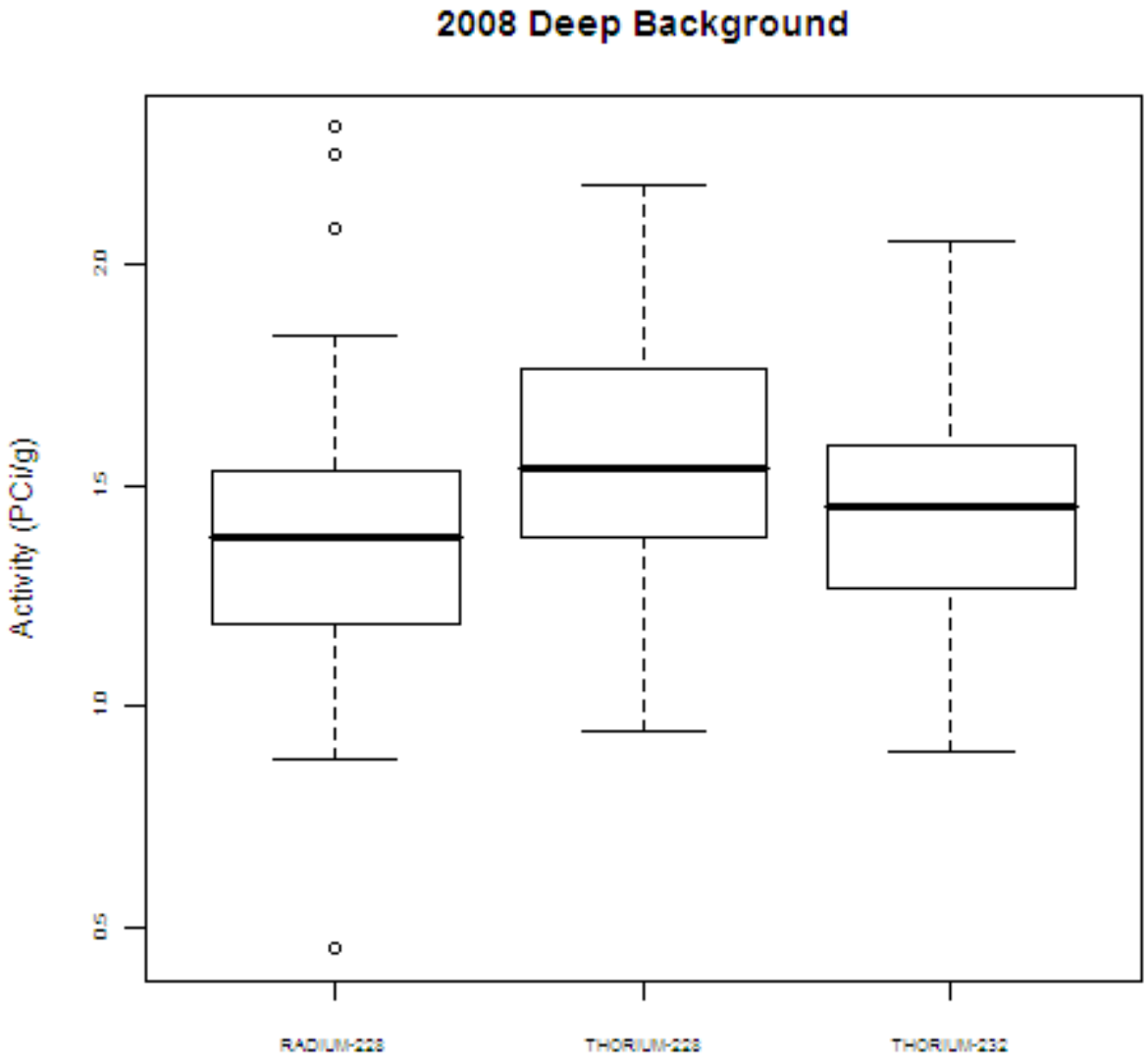

2005 BRC/TIMET Background
Activity (PCi/g)
0.5
1.0
1.5
2.0
2.5
3.0
RADIUM-226
THORIUM-230
URANIUM-234
URANIUM-238

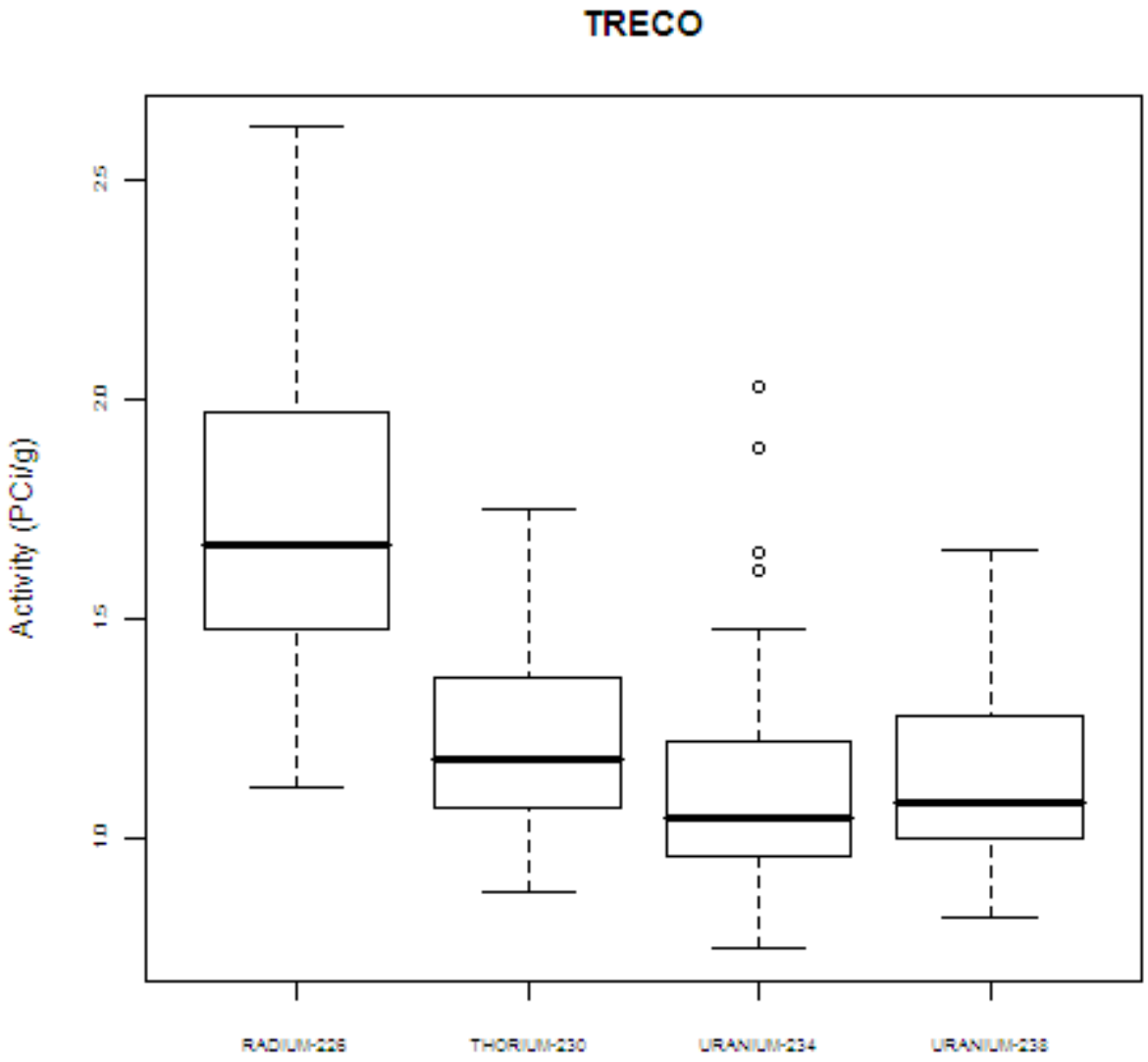

2005 BRC/TIMET Background
Activity (PCi/g)
30
25
20
15
10
RADIUM-228
THORIUM-228
THORIUM-232

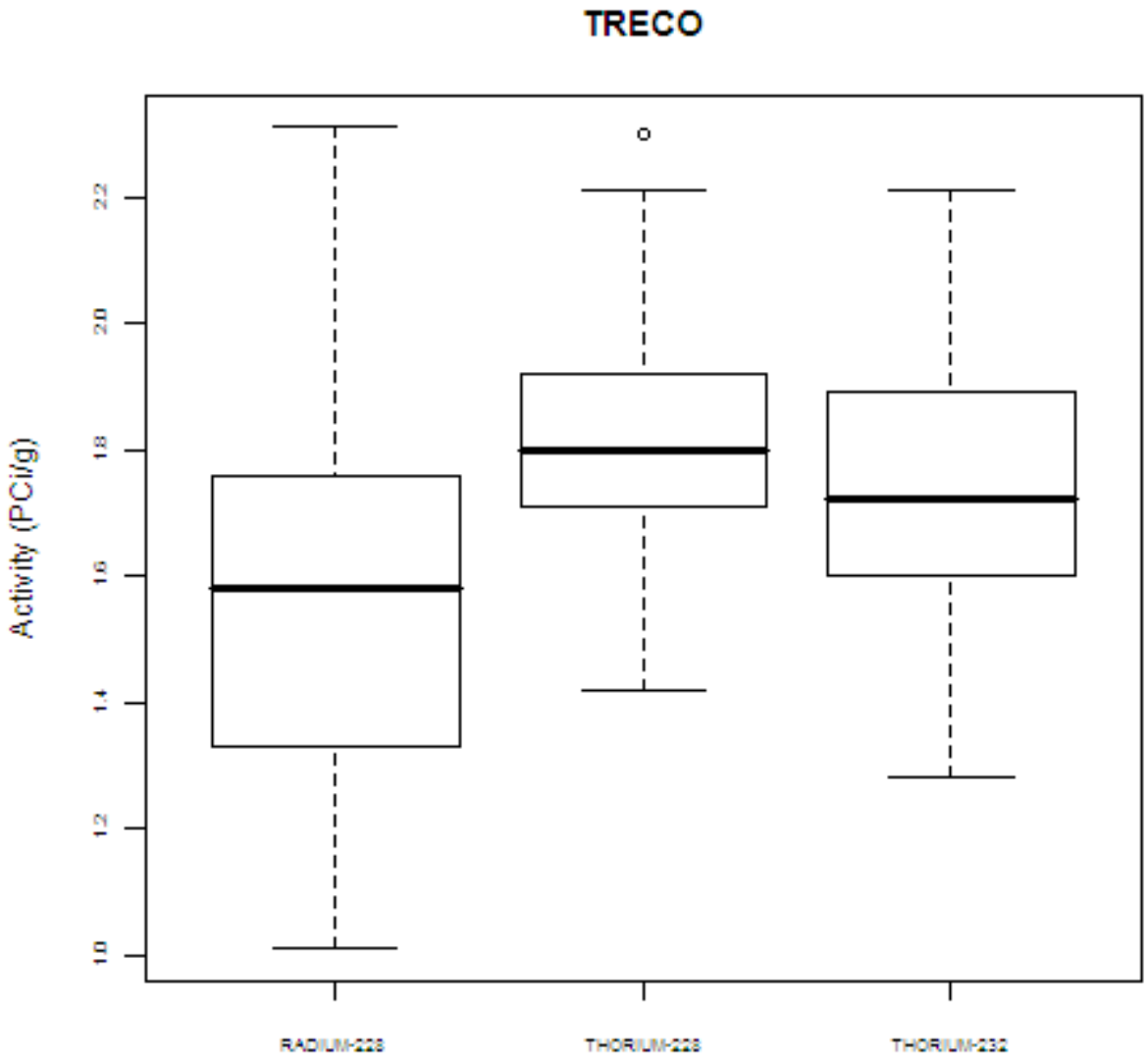

2008 Supplemental Background
Activity (PCi/g)
0
1
2
3
4
RADIUM-226
THORIUM-230
URANIUM-234
URANIUM-238

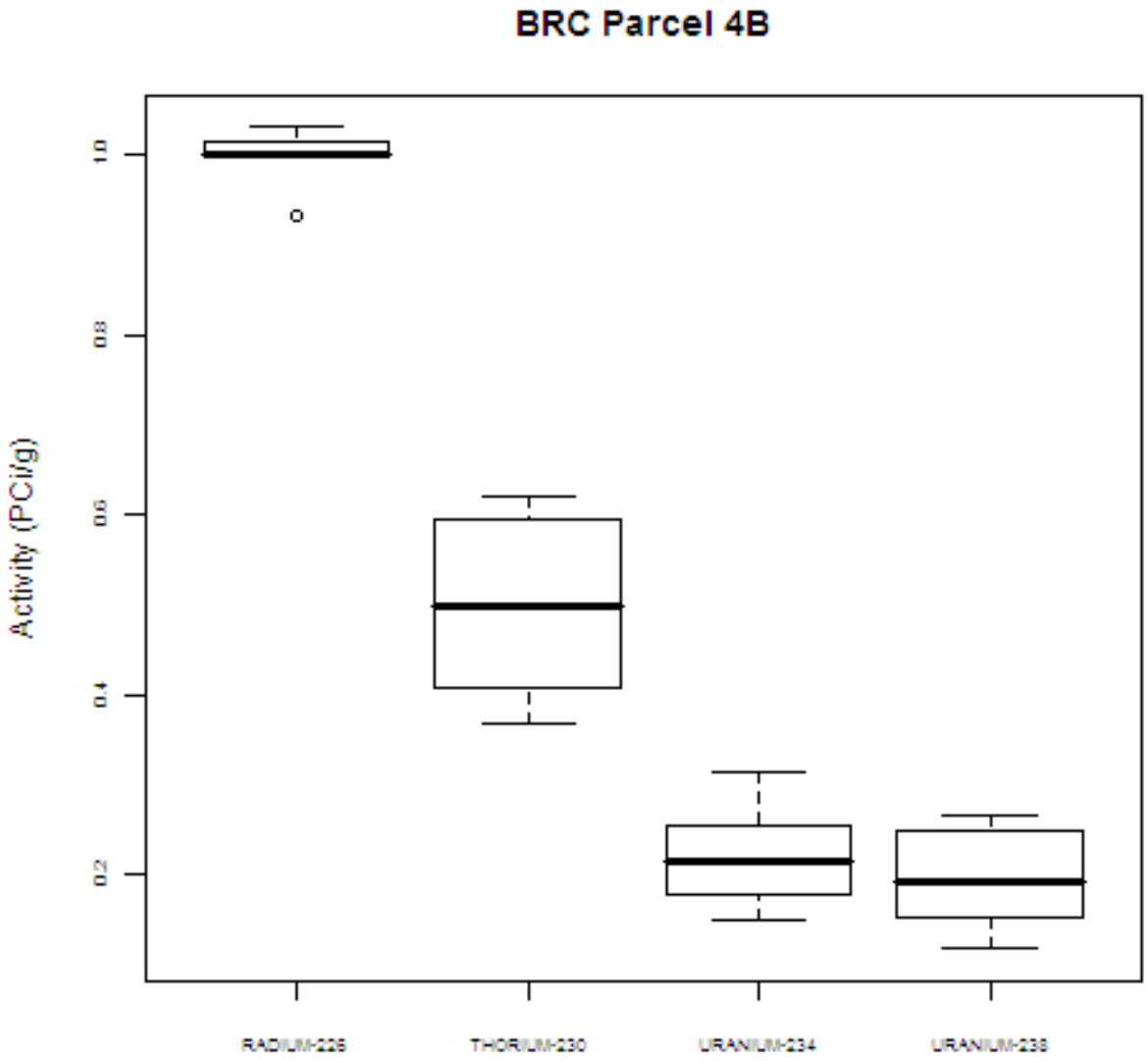

2008 Supplemental Background
Activity (PCi/g)
05
10
15
20
25
30
RADIUM-228
THORIUM-228
THORIUM-232

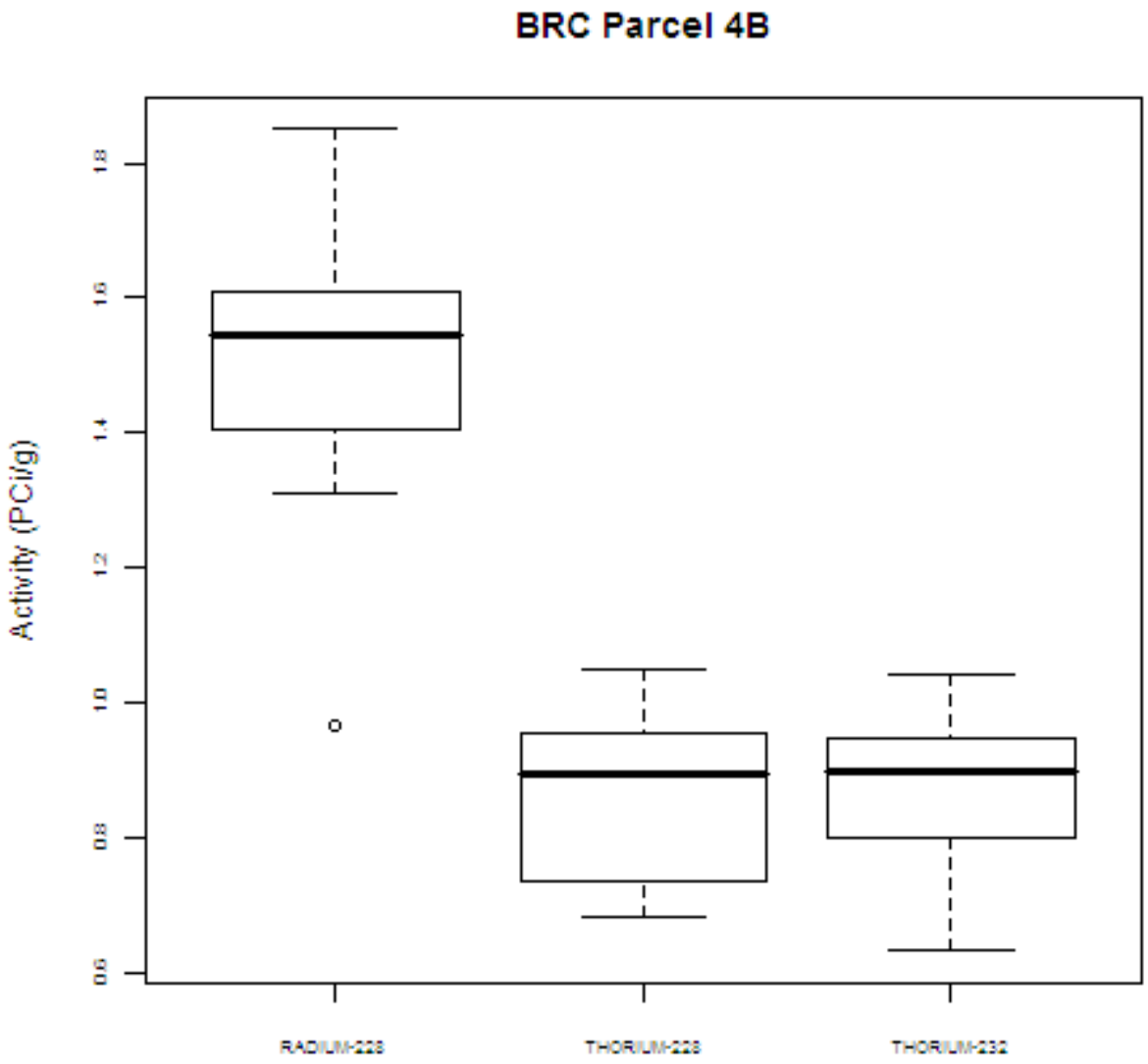

2008 Deep Background
Activity (PCi/g)
0.5
1.0
1.5
2.0
2.5
RADIUM-226
THORIUM-230
URANIUM-234
URANIUM-238

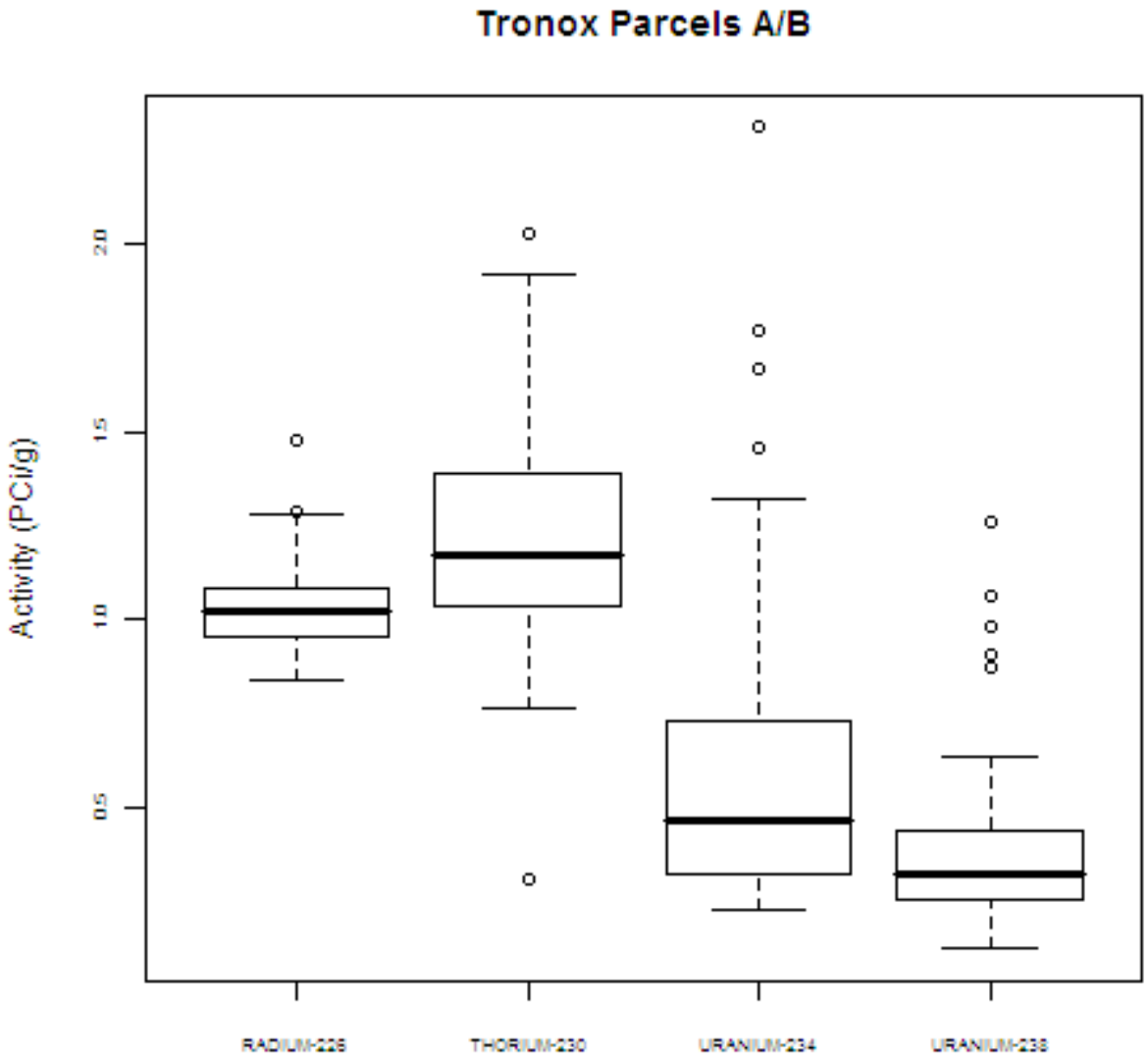

2008 Deep Background
Activity (PCi/g)
0.5
1.0
1.5
2.0
RADIUM-228
THORIUM-228
THORIUM-232

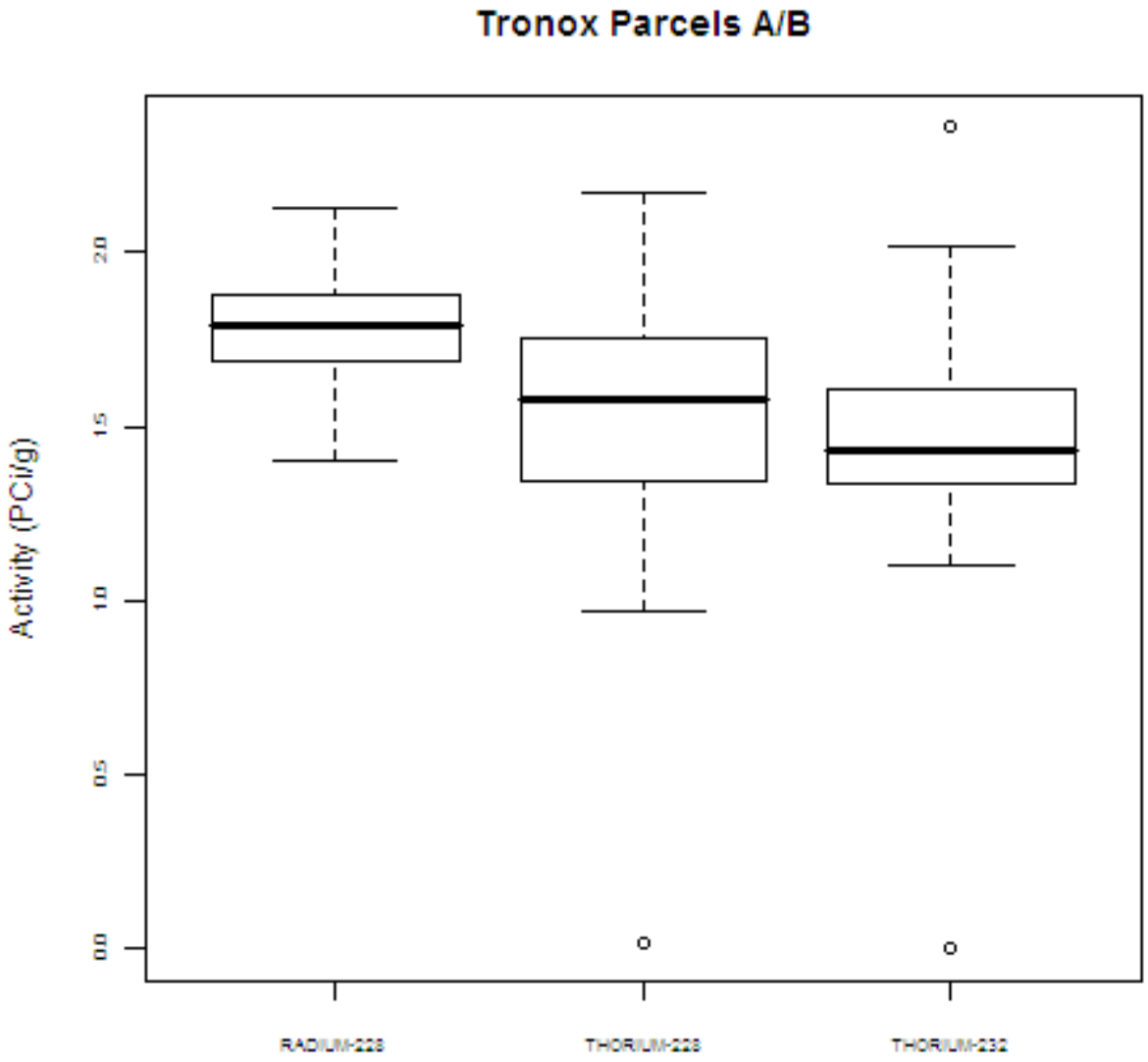

TRECO
Activity (PCi/g)
2.5
2.0
1.5
1.0
RADIUM-226
THORIUM-230
URANIUM-234
URANIUM-238

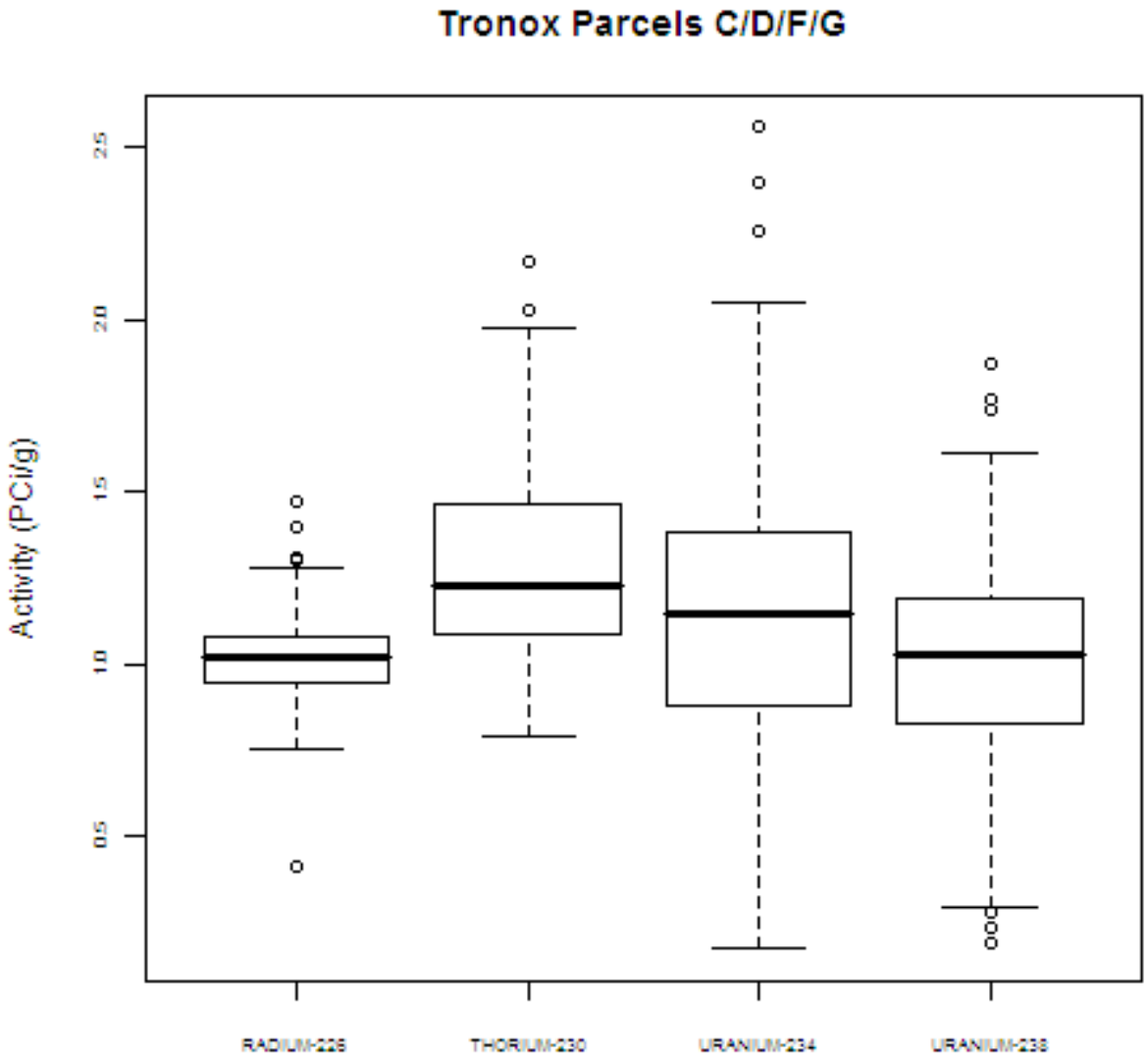

TRECO
Activity (PCi/g)
10
12
14
16
18
20
22
RADIUM-228
THORIUM-228
THORIUM-232

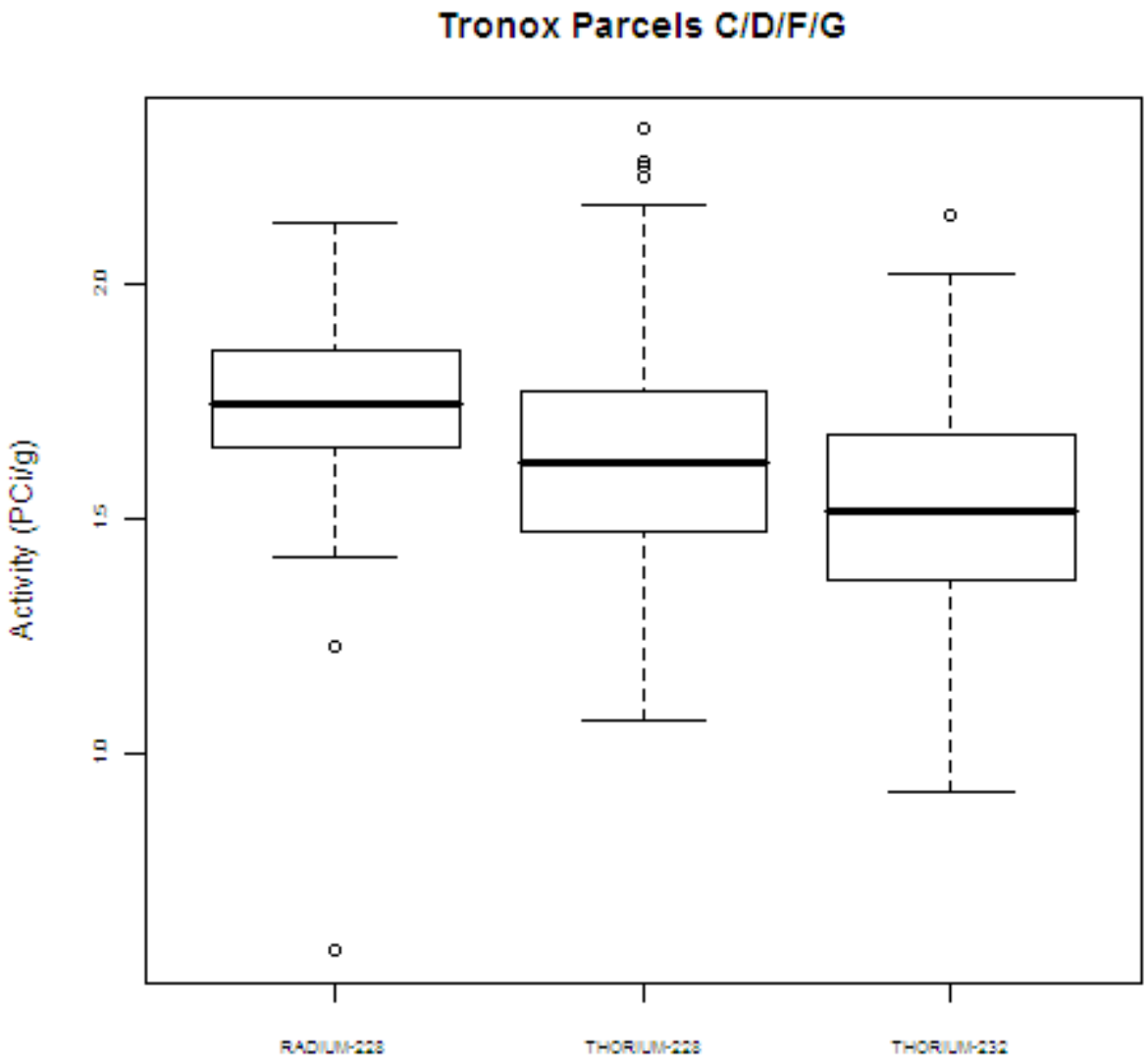

BRC Parcel 4B
Activity (PCi/g)
0.2
0.4
0.6
0.8
1.0
RADIUM-226
THORIUM-230
URANIUM-234
URANIUM-238

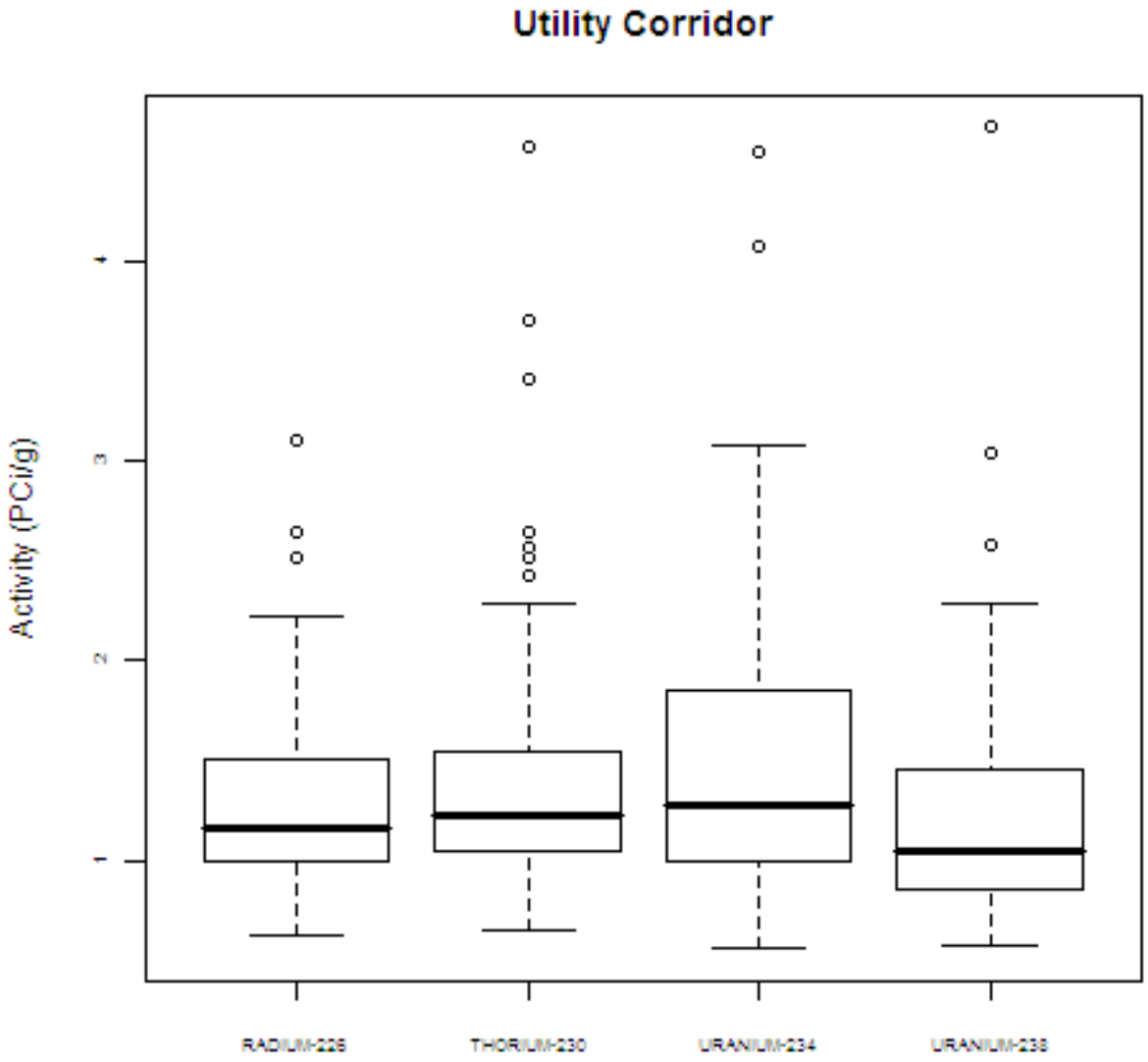

BRC Parcel 4B
Activity (PCi/g)
0.6
0.8
1.0
1.2
1.4
1.6
1.8
RADIUM-228
THORIUM-228
THORIUM-232

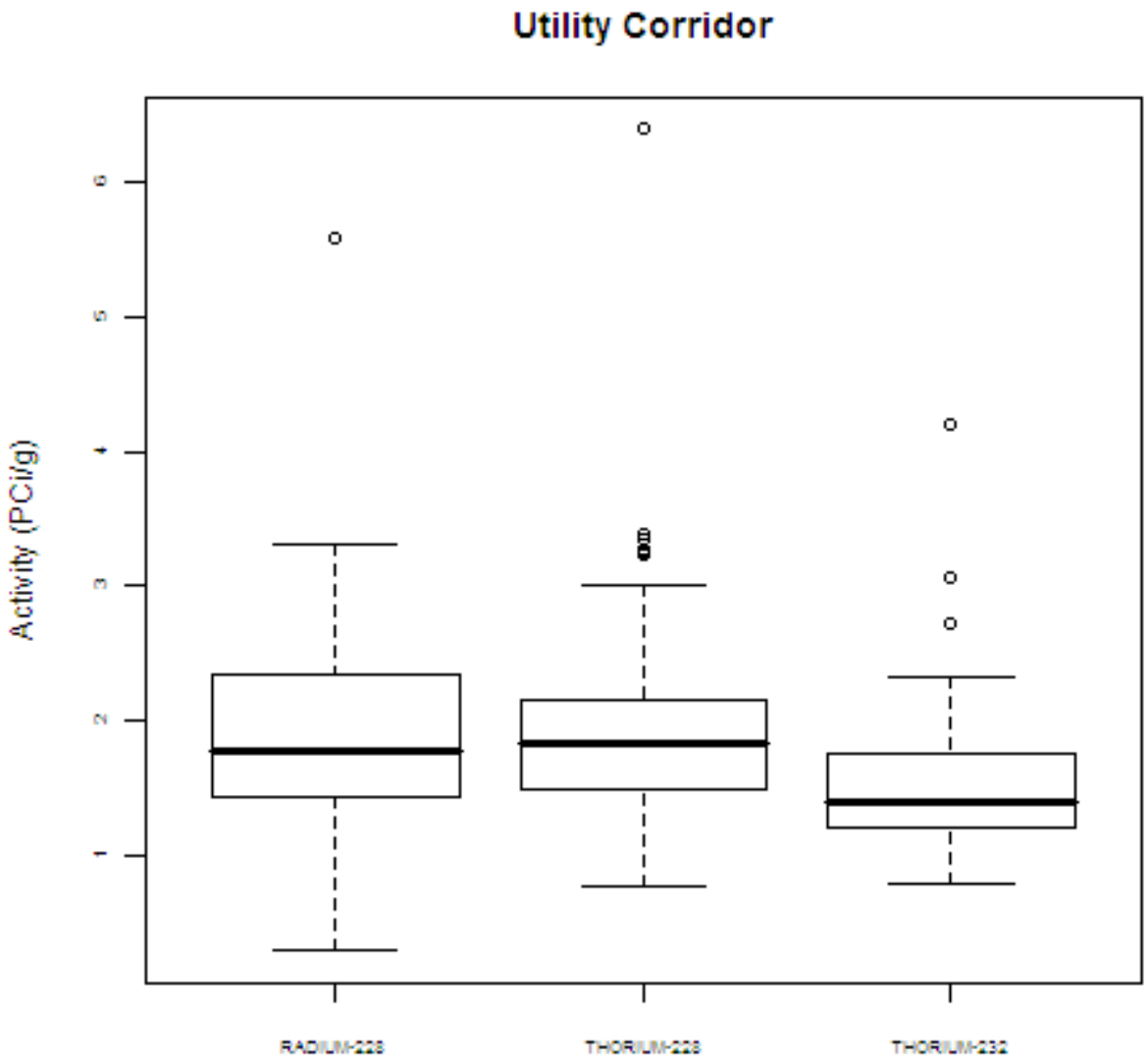

Tronox Parcels A/B
Activity (PCi/g)
0.5
1.0
1.5
2.0
RADIUM-226
THORIUM-230
URANIUM-234
URANIUM-238

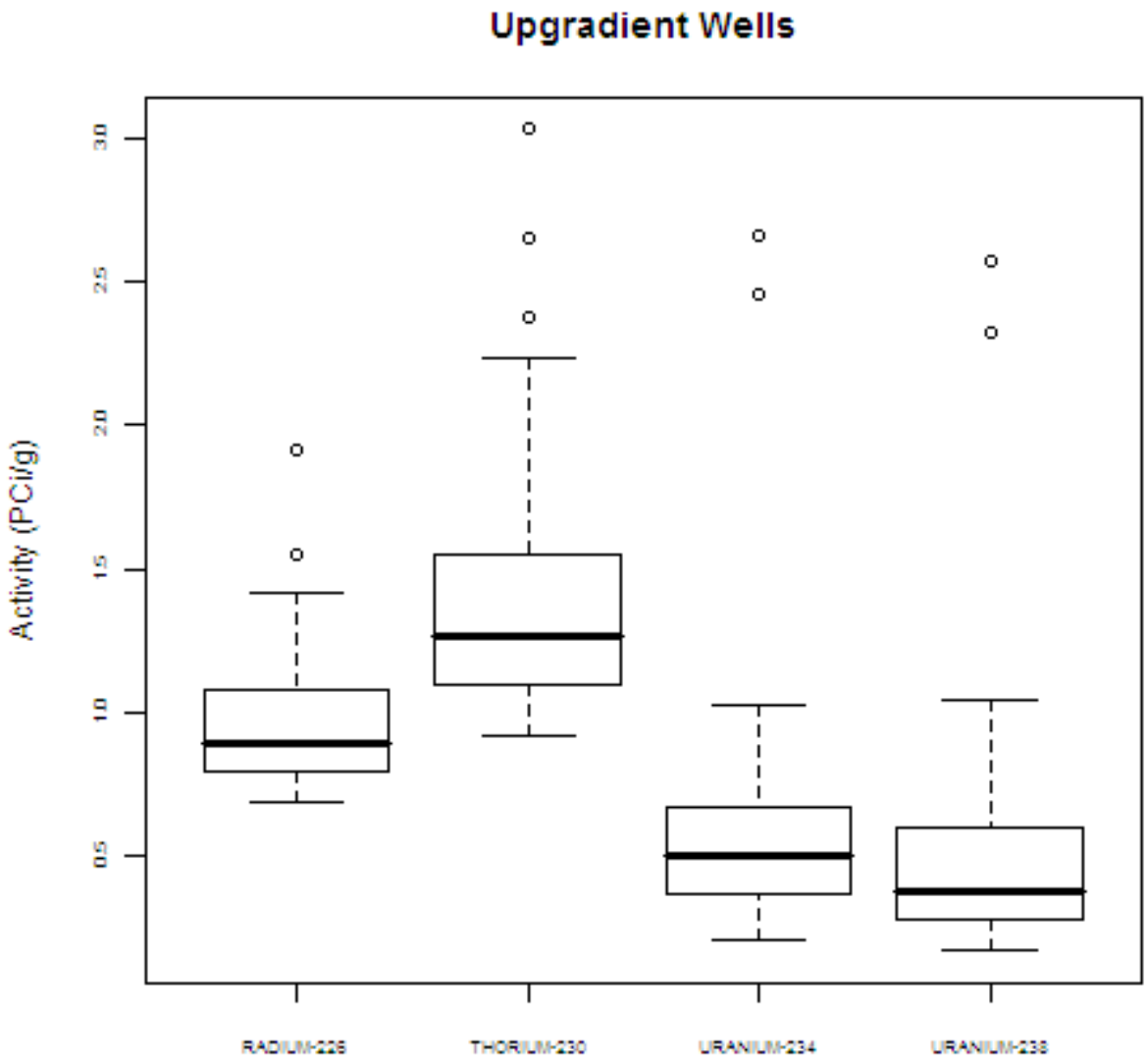

Tronox Parcels A/B
Activity (PCi/g)
0.0
0.5
1.0
1.5
2.0
RADIUM-228
THORIUM-228
THORIUM-232

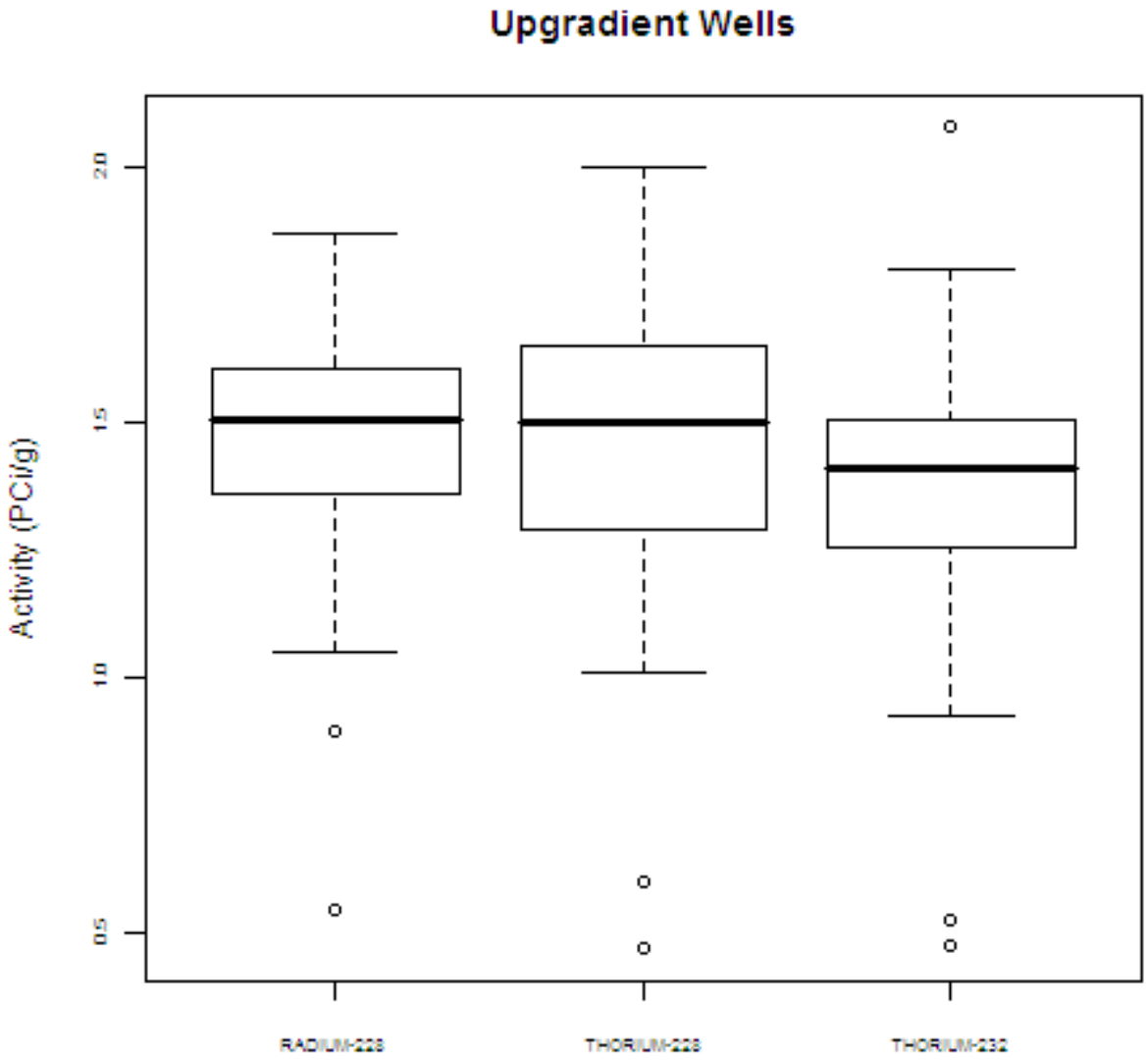

Tronox Parcels C/D/F/G
Activity (PCi/g)
0.5
1.0
1.5
2.0
2.5
RADIUM-226
THORIUM-230
URANIUM-234
URANIUM-238

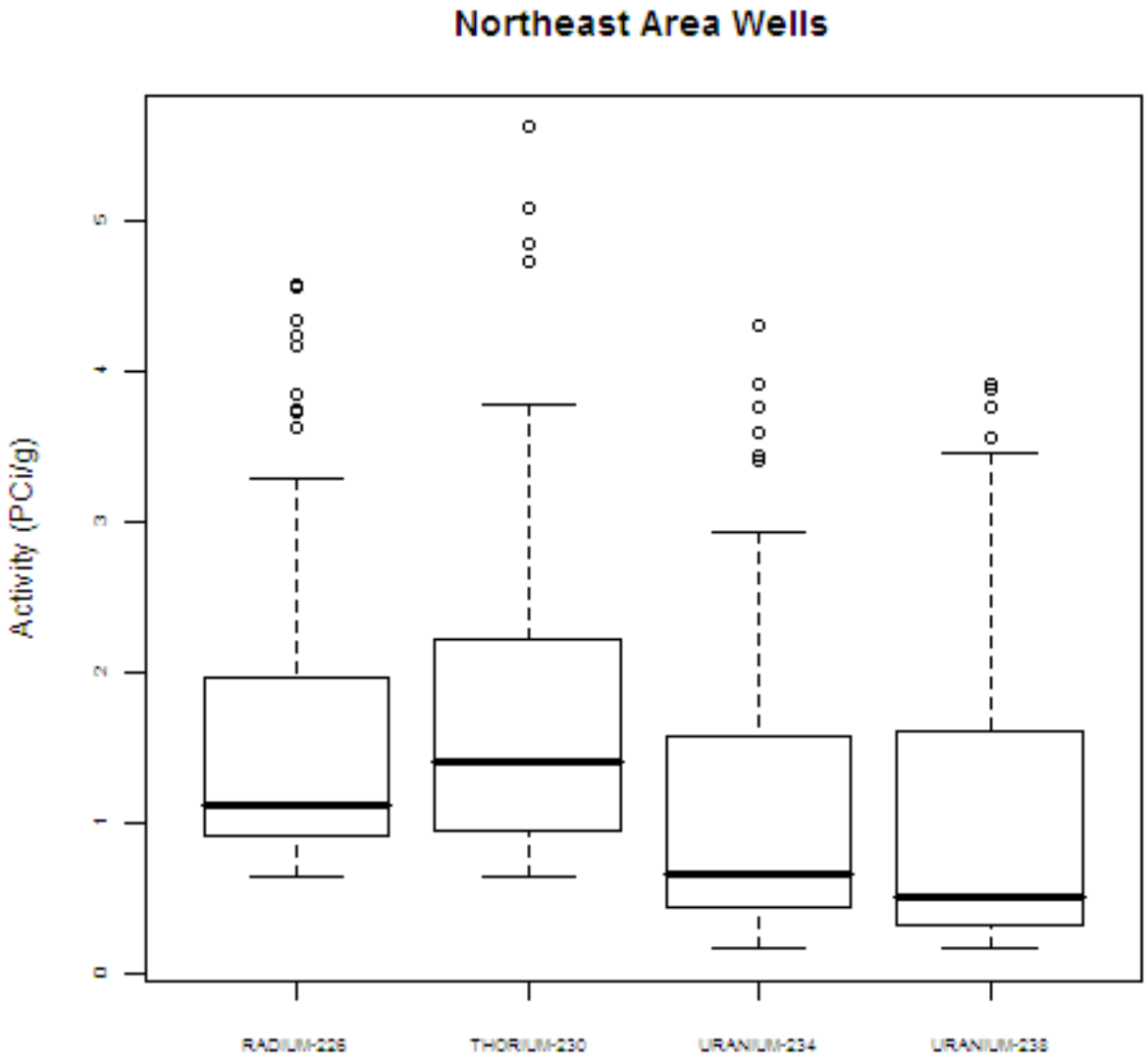

Tronox Parcels C/D/F/G
Activity (PCi/g)
10
15
20
RADIUM-228
THORIUM-228
THORIUM-232

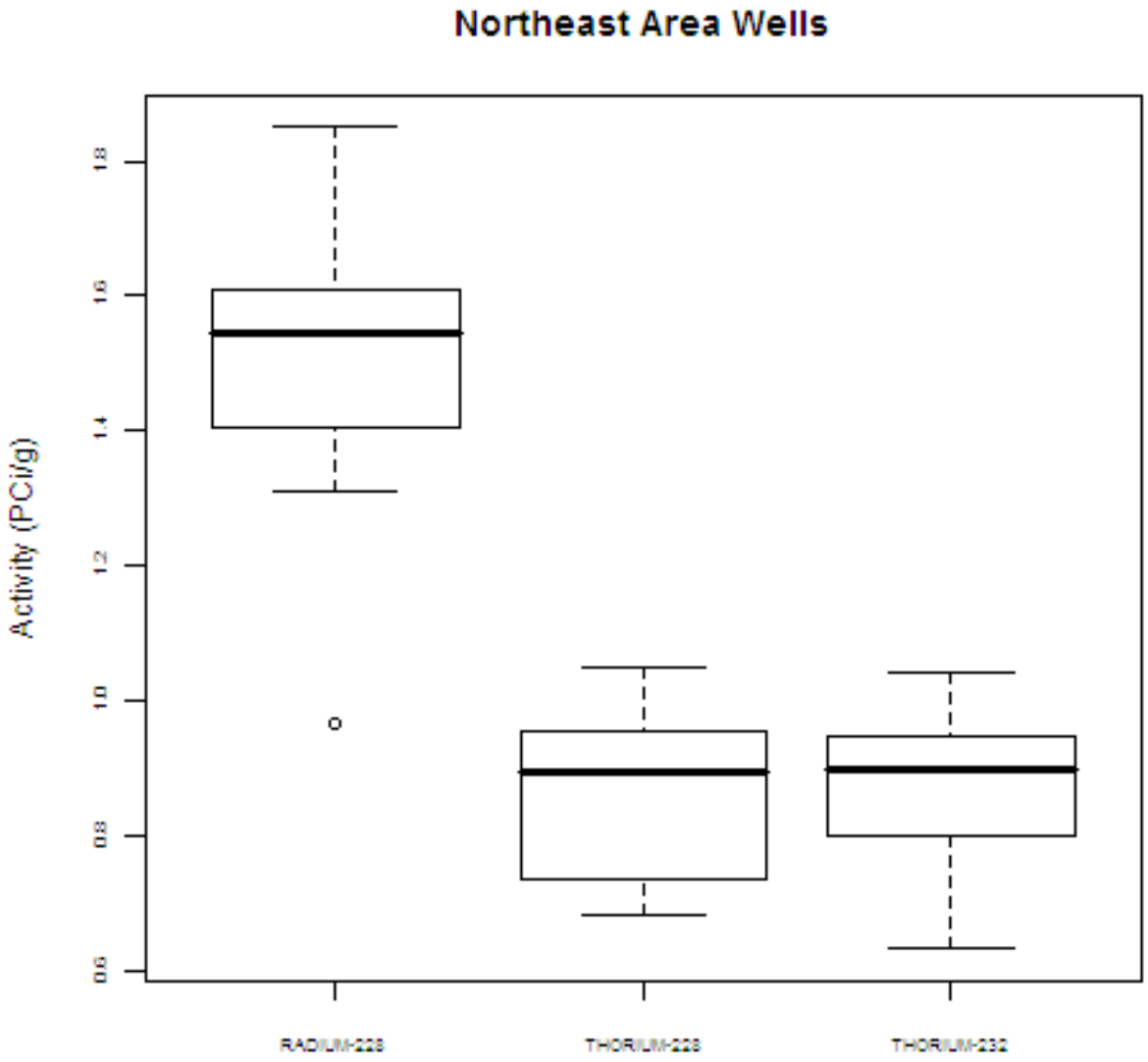

Utility Corridor
Activity (PCi/g)
1
2
3
4
RADIUM-226
THORIUM-230
URANIUM-234
URANIUM-238


Utility Corridor
Activity (PCi/g)
1
2
3
4
5
6
RADIUM-228
THORIUM-228
THORIUM-232


Upgradient Wells
Activity (PCi/g)
0.5
10
15
20
25
30
RADIUM-226
THORIUM-230
URANIUM-234
URANIUM-238


Upgradient Wells
Activity (PCi/g)
0.5
1.0
1.5
2.0
RADIUM-228
THORIUM-228
THORIUM-232


Northeast Area Wells
Activity (PCi/g)
0
1
2
3
4
5
RADIUM-226
THORIUM-230
URANIUM-234
URANIUM-238


Northeast Area Wells
Activity (PCi/g)
0.6
0.8
1.0
1.2
1.4
1.6
1.8
RADIUM-228
THORIUM-228
THORIUM-232

Appendix B – Summary Statistics for the Uranium and Thorium Chains

	N	Mean	Std.Dev.	Min	Median	Max
2005 BRC/ TIMET Shallow Background						
Radium-226	104	1.1122	0.3472	0.4940	1.0650	2.3600
Thorium-230	104	1.2651	0.4034	0.6600	1.2000	3.0100
Uranium-233/234	104	1.1607	0.4659	0.4700	1.0250	2.8400
Uranium-238	104	1.1352	0.3706	0.5700	1.0350	2.3700
Radium-228	84	1.9157	0.4046	0.9460	1.9600	2.9400
Thorium-228	84	1.7290	0.2552	1.1500	1.7900	2.1500
Thorium-232	84	1.6563	0.2553	1.2200	1.6900	2.1200
2008 Supplemental Shallow Background						
Radium-226	33	1.1008	0.5054	0.1530	0.9920	2.7500
Thorium-230	33	1.4948	0.5693	1.0000	1.3400	3.6400
Uranium-233/234	33	1.4618	0.8145	0.7000	1.1700	4.7800
Uranium-238	33	1.1976	0.6718	0.5450	0.9380	4.0100
Radium-228	33	1.5450	0.5490	0.5730	1.3800	2.8600
Thorium-228	33	1.7855	0.5074	1.1000	1.6400	3.3700
Thorium-232	33	1.5448	0.3228	1.1400	1.4900	2.8000
2008 Deep Soil Background						
Radium-226	92	1.2974	0.4232	0.3940	1.2650	2.2900
Thorium-230	92	1.3670	0.4254	0.5300	1.3650	2.6000
Uranium-233/234	92	1.3620	0.3938	0.7290	1.3150	2.6300
Uranium-238	92	1.2890	0.3745	0.5700	1.2050	2.7900
Radium-228	99	1.3744	0.2903	0.4520	1.3800	2.3100
Thorium-228	99	1.5820	0.2772	0.9440	1.5400	2.1800
Thorium-232	99	1.4546	0.2561	0.8980	1.4500	2.0500
TRECO						
Radium-226	57	1.7333	0.3927	1.1200	1.6700	2.6200
Thorium-230	57	1.2142	0.2061	0.8800	1.1800	1.7500
Uranium-233/234	57	1.1279	0.2549	0.7500	1.0500	2.0300
Uranium-238	57	1.1400	0.1854	0.8200	1.0800	1.6600
Radium-228	57	1.5602	0.2751	1.0100	1.5800	2.3100
Thorium-228	57	1.8333	0.1839	1.4200	1.8000	2.3000
Thorium-232	57	1.7519	0.2104	1.2800	1.7200	2.2100
Tronox Parcels A/B						
Radium-226	64	1.0376	0.1295	0.8370	1.0200	1.4800
Thorium-230	64	1.2070	0.3035	0.3080	1.1700	2.0300
Uranium-233/234	64	0.5908	0.4021	0.2250	0.4670	2.3100
Uranium-238	64	0.3832	0.2227	0.1250	0.3260	1.2600
Radium-228	64	1.7777	0.1560	1.4000	1.7900	2.1300
Thorium-228	64	1.5508	0.3327	0.0167	1.5800	2.1700
Thorium-232	64	1.4630	0.2983	0.0000	1.4300	2.3600

Appendix B (continued) – Summary Statistics for the U-238 and Th-232 Chains

	N	Mean	Std.Dev.	Min	Median	Max
Tronox Parcels C/D/F/G						
Radium-226	104	1.0179	0.1382	0.4120	1.0200	1.4700
Thorium-230	104	1.2972	0.2966	0.7920	1.2250	2.1700
Uranium-233/234	104	1.1701	0.4463	0.1730	1.1450	2.5600
Uranium-238	104	0.9907	0.34768	0.186	1.03	1.87
Radium-228	104	1.7425	0.1912	0.5800	1.7450	2.1300
Thorium-228	104	1.6340	0.2552	1.0700	1.6200	2.3300
Thorium-232	104	1.5296	0.2318	0.9200	1.5150	2.1500
Utility Corridor						
Radium-226	70	1.3517	0.5398	0.6240	1.1650	3.1000
Thorium-230	70	1.4361	0.7061	0.6440	1.2300	4.5700
Uranium-233/234	70	1.5353	0.7762	0.5570	1.2750	4.5500
Uranium-238	70	1.2404	0.6534	0.5700	1.0500	4.6700
Radium-228	70	1.8969	0.7880	0.2860	1.7700	5.5900
Thorium-228	70	1.9655	0.8309	0.7640	1.8200	6.4000
Thorium-232	70	1.5237	0.5442	0.7910	1.3950	4.2100
Upgradient Groundwater Wells						
Radium-226	44	0.9836	0.2834	0.6850	0.8950	1.9100
Thorium-230	44	1.4171	0.4756	0.9150	1.2650	3.0300
Uranium-233/234	44	0.6211	0.4782	0.2100	0.5035	2.6600
Uranium-238	44	0.5268	0.4749	0.1710	0.3745	2.5700
Radium-228	44	1.4574	0.2369	0.5440	1.5050	1.8700
Thorium-228	44	1.4442	0.2931	0.4680	1.5000	2.0000
Thorium-232	44	1.3643	0.2874	0.4720	1.4100	2.0800
BRC Parcel 4B						
Radium-226	8	0.9989	0.0306	0.9310	1.0000	1.0300
Thorium-230	8	0.4983	0.0983	0.3670	0.4970	0.6210
Uranium-233/234	8	0.2201	0.0550	0.1510	0.2155	0.3150
Uranium-238	8	0.1968	0.0558	0.1180	0.1930	0.2670
Radium-228	8	1.4918	0.2607	0.9640	1.5450	1.8500
Thorium-228	8	0.8616	0.1310	0.6810	0.8930	1.0500
Thorium-232	8	0.8700	0.1294	0.6320	0.8985	1.0400
Northeast Area Wells						
Radium-226	141	1.5190	0.8963	0.6400	1.1200	4.5700
Thorium-230	141	1.7226	0.9858	0.6300	1.4100	5.6200
Uranium-233/234	141	1.1061	0.9381	0.1700	0.6500	4.3100
Uranium-238	141	1.0252	0.9499	0.1600	0.5000	3.9200
Radium-228	59	1.1702	0.3201	0.3300	1.2700	1.7200
Thorium-228	59	1.1068	0.3723	0.1500	1.2100	1.8900

Appendix C – Correlation Matrices for the U-238 and Th-232 Chains

2005 BRC/ TIMET Shallow Background

	Ra-226	*Th-230*	*U-233/234*	*U-238*
Ra-226	1.0000	0.6632	0.6911	0.7068
Th-230	0.6632	1.0000	0.7838	0.7796
U-233/234	0.6911	0.7838	1.0000	0.8763
U-238	0.7068	0.7796	0.8763	1.0000

	Ra-228	*Th-228*	*Th-232*
Ra-228	1.0000	0.2967	0.3049
Th-228	0.2967	1.0000	0.7323
Th-232	0.3049	0.7323	1.0000

2008 Supplemental Soil Background

	Ra-226	*Th-230*	*U-233/234*	*U-238*
Ra-226	1.0000	0.7019	0.7857	0.8115
Th-230	0.7019	1.0000	0.8305	0.8393
U-233/234	0.7857	0.8305	1.0000	0.9314
U-238	0.8115	0.8393	0.9314	1.0000

	Ra-228	*Th-228*	*Th-232*
Ra-228	1.0000	0.0101	-0.1041
Th-228	0.0101	1.0000	0.5484
Th-232	-0.1041	0.5484	1.0000

2008 Deep Soil Background

	Ra-226	*Th-230*	*U-233/234*	*U-238*
Ra-226	1.0000	0.7550	0.7646	0.7508
Th-230	0.7550	1.0000	0.8300	0.8024
U-233/234	0.7646	0.8300	1.0000	0.9335
U-238	0.7508	0.8024	0.9335	1.0000

	Ra-228	*Th-228*	*Th-232*
Ra-228	1.0000	0.2016	0.2570
Th-228	0.2016	1.0000	0.6722
Th-232	0.2570	0.6722	1.0000

TRECO

	Ra-226	*Th-230*	*U-234*	*U-238*
Ra-226	1.0000	0.3294	0.1671	0.1148
Th-230	0.3294	1.0000	0.5555	0.5760
U-234	0.1671	0.5555	1.0000	0.6645
U-238	0.1148	0.5760	0.6645	1.0000

	Ra-228	*Th-228*	*Th-232*
Ra-228	1.0000	0.2316	0.2295
Th-228	0.2316	1.0000	0.5647
Th-232	0.2295	0.5647	1.0000

Tronox Parcels A/ B

	Ra-226	*Th-230*	*U-233/234*	*U-238*
Ra-226	1.0000	0.6548	0.4585	0.4636
Th-230	0.6548	1.0000	0.5058	0.5069
U-233/234	0.4585	0.5058	1.0000	0.9819
U-238	0.4636	0.5069	0.9819	1.0000

	Ra-228	*Th-228*	*Th-232*
Ra-228	1.0000	0.2626	0.0036
Th-228	0.2626	1.0000	0.6560
Th-232	0.0036	0.6560	1.0000

Tronox Parcels C/ D/ F/ G

	Ra-226	*Th-230*	*U-233/234*	*U-238*
Ra-226	1.0000	0.4141	0.3186	0.2439
Th-230	0.4141	1.0000	0.4961	0.3746
U-233/234	0.3186	0.4961	1.0000	0.9028
U-238	0.2439	0.3746	0.9028	1.0000

	Ra-228	*Th-228*	*Th-232*
Ra-228	1.0000	0.2062	0.2237
Th-228	0.2062	1.0000	0.5664
Th-232	0.2237	0.5664	1.0000

Utility Corridor

	Ra-226	*Th-230*	*U-233/234*	*U-238*
Ra-226	1.0000	0.6224	0.5992	0.5520
Th-230	0.6224	1.0000	0.7368	0.7290
U-233/234	0.5992	0.7368	1.0000	0.8330
U-238	0.5520	0.7290	0.8330	1.0000

	Ra-228	*Th-228*	*Th-232*
Ra-228	1.0000	0.3163	0.1109
Th-228	0.3163	1.0000	0.6544
Th-232	0.1109	0.6544	1.0000

Upgradient Wells

	Ra-226	*Th-230*	*U-233/234*	*U-238*
Ra-226	1.0000	0.8075	0.8322	0.8423
Th-230	0.8075	1.0000	0.7793	0.7995
U-233/234	0.8322	0.7793	1.0000	0.9850
U-238	0.8423	0.7995	0.9850	1.0000

	Ra-228	*Th-228*	*Th-232*
Ra-228	1.0000	0.7280	0.6814
Th-228	0.7280	1.0000	0.7009
Th-232	0.6814	0.7009	1.0000

BRC Parcel 4B

	Ra-226	*Th-230*	*U-234*	*U-238*
Ra-226	1.0000	-0.2998	-0.4563	-0.0389
Th-230	-0.2998	1.0000	0.3565	0.3748
U-234	-0.4563	0.3565	1.0000	0.0298
U-238	-0.0389	0.3748	0.0298	1.0000

	Ra-228	*Th-228*	*Th-232*
Ra-228	1.0000	0.6190	0.1974
Th-228	0.6190	1.0000	0.8198
Th-232	0.1974	0.8198	1.0000

Northeast Area Wells

	Ra-226	*Th-230*	*U-233/234*	*U-238*
Ra-226	1.0000	0.9349	0.9208	0.9206
Th-230	0.9349	1.0000	0.9038	0.9072
U-233/234	0.9208	0.9038	1.0000	0.9859
U-238	0.9206	0.9072	0.9859	1.0000

	Ra-228	*Th-228*	*Th-232*
Ra-228	1.0000	0.8674	0.8154
Th-228	0.8674	1.0000	0.9047
Th-232	0.8154	0.9047	1.0000

References for the Henderson Site Datasets

2005 BRC/TIMET background

Background Shallow Soil Summary Report, BMI Complex and Common Areas Vicinity, TIMET and BRC, July 2007. Approved by NDEP on July 26, 2007.

2008 supplemental shallow background

Data Validation Summary Report, SUPPLEMENTAL SHALLOW SOIL BACKGROUND SAMPLING EVENT, APRIL 2008 (DATASET 34b), BMI COMMON AREAS, CLARK COUNTY, NEVADA, ERM, June 2008. Approved by NDEP on June 9, 2008.

2008 deep background

Data Validation Summary Report, DEEP BACKGROUND SOIL INVESTIGATION, AUGUST-OCTOBER 2007 (DATASET 34c), BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA, ERM, JUNE 2008. Approved by NDEP on June 25, 2008.

TRECO

Basic Environmental Company's (BEC) submittals dated March 10, 2006 and April 5, 2006 regarding: *Risk Assessment Report– TRECO Property*. Approved by NDEP on April 19, 2006

TRX Parcels A/B

Data Validation Summary Report, Parcels A/B Investigation, August – September 2007, BMI Industrial Complex, Clark County, Nevada Dated November 28, 2007. Approved by NDEP on December 6, 2007.

TRX Parcels C/D/F/G

Data Validation Summary Report (DVSR), *Tronox Parcels C, D, F, G and H Supplemental Investigations, - June-July 2008, BMI Industrial Complex, Clark County, Nevada,* Dated January 7, 2009. Approved by NDEP on January 12, 2009

Utility Corridor

Data Validation Summary Report, SEWER ALIGNMENT EXCAVATION SOIL INVESTIGATION, APRIL AND AUGUST 2008 (DATASET 50), BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA, ERM, October 2008. Approved by NDEP on October 17, 2008

Data Validation Summary Report, SEWER ALIGNMENT EXCAVATION SOIL INVESTIGATION RE-ANALYSIS –AUGUST AND OCTOBER 2008 (DATASET 50a), BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA, ERM, January 2009. Approved by NDEP on January 8, 2009.

Upgradient Groundwater Wells

Data Validation Summary Report, UPGRADIENT WELL INSTALLATION INVESTIGATION, JULY-AUGUST 2007 (DATASET 47), BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA, ERM, December 2007. Approved by NDEP on February 22, 2008

BRC Parcel 4B4b

Data Validation Summary Report, 2007 PARCEL 4A/4B INVESTIGATION (DATASET 43), BMI COMMON AREAS EASTSIDE, CLARK COUNTY NEVADA, ERM, August 2007. Approved by NDEP on August 21, 2007.

Data Validation Summary Report, 2006-2007 VARIOUS SUPPLEMENTAL INVESTIGATIONS, (DATASET 45), BMI COMMON AREAS, CLARK COUNTY, NEVADA, ERM, October 2007. Approved by NDEP on October 22, 2007

Data Validation Summary Report, 2008 SUPPLEMENTAL PARCEL 4A/4B INVESTIGATION, (DATASET 45e, BMI COMMON AREAS (EASTSIDE), CLARK COUNTY, NEVADA, ERM, June 2008. Approved by NDEP on June 6, 2008.

Northeast Area Wells

Data Validation Summary Report, *NORTHEAST AREA INVESTIGATION JUNE-JULY 2007 (DATASET 46),BMI COMMON AREAS, CLARK COUNTY, NEVADA, ERM, November 2008.* Approved by NDEP on December 6, 2007.

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations
Jim Gibbons, Governor
Allen Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

February 17, 2009

Mr. Mark Paris
Basic Remediation Company
875 West Warm Springs Road
Henderson, NV 89011

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, NV 89009

Mr. Curt Richards
Olin Corporation
3855 North Ocoee Street, Suite 200,
Cleveland, TN 37312

Mr. Joe Kelly
Montrose Chemical Corp of CA
600 Ericksen Ave NE, Suite 380
Bainbridge Island, WA 98110

Mr. Brian Spiller
Stauffer Management Co LLC
1800 Concord Pike
Wilmington, DE 19850-6438

Mr. Craig Wilkinson
Titanium Metals Corporation
PO Box 2128
Henderson, NV 89009

Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Basic Comparison Levels User's Guide and Tables

Dear Sirs and Madam:

All of the parties listed above shall be referred to as "the Companies" for the purposes of this letter. Attachment A provides the User's Guide and Table for the revised Basic Comparison Levels (BCLs). Please utilize this guidance and these tables in the development of all future Deliverables. These BCLs are to supersede the previously issued version of the BCLs dated December 18, 2008.

Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

Brian A Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions

BAR:s

CC: Jim Najima, NDEP, BCA, Carson City
Marysia Skorska, NDEP, BCA, Las Vegas

Shannon Harbour, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Greg Lovato, NDEP, BCA, Carson City
Barry Conaty, Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1333 New Hampshire Avenue, N.W., Washington, D.C. 20036
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Ebrahim Juma, Clark County DAQEM, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021
Lee Erickson, Stauffer Management Company LLC, P.O. Box 18890 Golden, CO 80402
Keith Bailey, Environmental Answers, 3229 Persimmon Creek Drive, Edmond, OK 73013
Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr., Henderson, NV 89014
Mike Skromyda, Tronox LLC, PO Box 55, Henderson, Nevada 89009
Jeff Gibson, AMPAC, 3770 Howard Hughes Parkway, Suite 300, Las Vegas, Nevada 89109
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Cindi Byrns, Olin Chlor Alkali, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 3846 Estate Drive, Stockton, California 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Robert Infelise, Cox Castle Nicholson, 555 California Street, 10th Floor, San Francisco, CA 94104-1513
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004
Dave Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544
Paul Black, Neptune and Company, Inc., 8550 West 14th Street, Suite 100, Lakewood, CO 80215
Teri Copeland, 5737 Kanan Rd., #182, Agoura Hills, CA 91301
Paul Hackenberry, Hackenberry Associates, 550 West Plumb Lane, B425, Reno, NV, 89509

Attachment A

February 27, 2009

Mr. Mark Paris
Basic Remediation Company
875 West Warm Springs Road
Suite 200,
Henderson, NV 89011

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, NV 89009

Mr. Curt Richards
Olin Corporation
3855 North Ocoee Street,
Cleveland, TN 37312

Mr. Joe Kelly
Montrose Chemical Corp of CA
Corporation
600 Ericksen Ave NE, Suite 380
Bainbridge Island, WA 98110

Mr. Brian Spiller
Stauffer Management Co LLC
1800 Concord Pike
Wilmington, DE 19850-6438

Mr. Craig Wilkinson
Titanium Metals
PO Box 2128
Henderson, NV
89009

Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Guidance on Uniform Electronic Data Deliverables

Dear Sirs and Madam:

All of the parties listed above shall be referred to as "the Companies" for the purposes of this letter. Attached is a document which prescribes the format of electronic data deliverables that the Nevada Division of Environmental protection (NDEP) expects from the Companies. NDEP would like to solicit input from the Companies on this proposed format. Please provide all comments to the NDEP **by April 10, 2009**.

Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

Brian A Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions
Fax: (702) 486-5733

BAR:s

CC: Jim Najima, NDEP, BCA, Carson City
Marysia Skorska, NDEP, BCA, Las Vegas
Shannon Harbour, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Greg Lovato, NDEP, BCA, Carson City
Barry Conaty, Holland & Hart LLP, 975 F Street, N.W., Suite 900,Washington, D.C. 20004
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Ebrahim Juma, Clark County DAQEM, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021
Lee Erickson, Stauffer Management Company LLC, P.O. Box 18890 Golden, CO 80402
Keith Bailey, Environmental Answers, 3229 Persimmon Creek Drive, Edmond, OK 73013
Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr., Henderson, NV 89014
Mike Skromyda, Tronox LLC, PO Box 55, Henderson, Nevada 89009
Jeff Gibson, AMPAC, 3770 Howard Hughes Parkway, Suite 300, Las Vegas, Nevada 89109
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Cindi Byrns, Olin Chlor Alkali, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 10733 Wave Crest Court Stockton, CA 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Robert Infelise, Cox Castle Nicholson, 555 California Street, 10th Floor, San Francisco, CA 94104-1513
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004
Dave Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544
Paul Black, Neptune and Company, Inc., 8550 West 14th Street, Suite 100, Lakewood, CO 80215
Teri Copeland, 5737 Kanan Rd., #182, Agoura Hills, CA 91301
Paul Hackenberry, Hackenberry Associates, 550 West Plumb Lane, B425, Reno, NV, 89509

Attachment A

Uniform Electronic Data Deliverable (EDD)

The objective of this guidance is to specify the design of the format for the submission of electronic data from the Companies to NDEP. The goal is to streamline the uploading of the Companies electronic data into the Regional Database. This task requires defining each element of the EDD(s) so that they are provided in a consistent format. Provided below are the required elements of the EDD format and descriptions of the elements. Recommended formats and codes are provided in appendices, which should be followed to the extent possible. Additions to the fields should be provided as comments to this guidance or in formal communications if they are developed later in the project. Each field and record should contain either a specified value or "N/A" (i.e., blanks should be populated with N/A).

The EDD should be delivered as a Microsoft Access database with the data organized into several tables. The fields to be included in each table are described in the Appendices.
It is understood that the database developed for the data validation summary report (DVSR) will include additional fields and records (e.g. quality control (QC) data). However, these additional fields and records should be provided in a separate table from the format described here. All native samples, including replicates should be included in this EDD but QC results will not be incorporated into the Regional Database at this time.

EDD Requirements

Required Fields:

Critical Field	Field Name	Description
DVSR Identification	dvsr_id	A unique ID for each DVSR, from each company. The ID should contain elements that make it clear which company supplied the DVSR, the year of submittal, and a unique number designation. Format: ZZZZZ-YYYY-XXXX where ZZZZZ = company, or background (BKG), YYYY = number of the DVSR, XXXX = year.
Sub-area or parcel designation	sub_area	A unique designation for each sub-area or parcel.
LOU designation	lou	A designation for LOU associated with the sample. If no LOU is associated with the sample this field should be N/A.
Sample depth	sample_depth	Sample depth in feet
Northing Coordinate	northing	Northing coordinate of the sample in NAD 1983 State Plane Nevada East feet

Critical Field	Field Name	Description
Easting Coordinate	easting	Easting coordinate of the sample in NAD 1983 State Plane Nevada East feet
Sample Identification - Field	sample_id_field	The ID used on the Chain of Custody, or similar field record. This ID should be unique to the sample and also consistent (identical) for all records associated with that sample. For example, where multiple analytes are reported the sample ID should be identical for all.
Sample Identification - Laboratory	sample_id_lab	The ID of the sample used at the laboratory. This ID should be unique to the sample and also consistent (identical) for all records associated with that sample. For example, where multiple analytes are reported the sample ID should be identical for all.
Laboratory Identification/ code	lab_id	A unique identification of each laboratory, down to the laboratory location. For example, TestAmerica-Richland, Washington should have a designation that differs from other TestAmerica locations. Companies should provide a recommended ID for each laboratory currently used or expected. A designation for field analysis should be included.
SDG- Sample Delivery Group	sdg_id	The Sample Delivery Group identification supplied by the laboratory.
Analytical Batch Identification	batch_id	The analytical batch identification supplied by the laboratory.
Location Identification	location_id	An identification of the well or location where the sample was taken, when applicable. The ID should be unique to that well or location and should be used in all future reports and EDDs.
hydrogeologic	hydro	The designation of the water-bearing zone associated with the sample: Shallow Zone, Middle Zone, or Deep Zone. This hydrogeologic nomenclature is described in the January 6, 2009 letter (*Hydrogeologic and Lithologic Nomenclature Unification)* from NDEP to the Companies.
lithologic	litho	The designation of the lithologic nomenclature tags: Qal (Quaternary Alluvium), xMCf (transitional Muddy Creek formation), or UMCf (Upper Muddy Creek formation). This lithologic nomenclature is described in the January 6, 2009 letter (*Hydrogeologic and Lithologic Nomenclature Unification)* from NDEP to the Companies.
Sample Matrix Identification/ code	matrix	A short code that designates the matrix of the sample. A recommended set is provided in Appendix B.

Critical Field	Field Name	Description
Sample Type Identification/ code	sample_type	A short code that designates the sample type (e.g. Field Duplicate as FD). A recommended set is provided in Appendix C.
Analytical Method Name/code	analytical_method	An identifier for the analytical method used for that suite of analyses. The identifier should include the version of the method. For example, many of the SW-846 methods have a letter at the end to indicate the version (e.g. 8330B). A recommended format is provided in Appendix D.
Preparation Method Name/code	preparation_method	An identifier for the preparation method used for that suite of analyses. Use the same guidelines as found in Appendix D.
Analytical Suite	analytical_suite	A short code that designates the analytical suite, such as SVOC. A recommended list is provided in Appendix E.
Analyst Name	analyst_name	The name of the analyst that performed the analysis. This field is required for asbestos results.
Total or Dissolved	filtered_flag	A flag T (true) or F (false) indicating whether the sample was filtered. T indicates the aqueous sample was filtered and is dissolved.
Asbestos Type	asbestos_type	Amphibole, Amisite, Chrysotile, Actinolite, N/A
Sample Date	sample_date	The Year, Month, and Day of sample collection. Requested format: XXXXYYZZ, where XXXX=year, YY= month, and ZZ = day of month. This same format shall be used for all dates.
Sample Time	sample_time	The Hour:Minute:Seconds sample was collected. A 24 hour format is requested: 12:15:00 indicates 15 minutes after Noon. One hour later would be 13:15:00.
Preparation Date	prep_date	The Year, Month, and Day of sample preparation. Requested format: XXXXYYZZ, where XXXX=year, YY= month, and ZZ = day of month. This same format shall be used for all dates.
Preparation Time	prep_time	The Hour:Minute:Seconds the sample was prepared. A 24 hour format is requested: 12:15:00 indicates 15 minutes after Noon. One hour later would be 13:15:00.
Analysis Date	analysis_date	The Year, Month, and Day of sample analysis. Requested format: XXXXYYZZ, where XXXX=year, YY= month, and ZZ = day of month. This same format shall be used for all dates.
Analysis Time	analysis_time	The Hour:Minute: Seconds the sample was analyzed. A 24 hour format is requested: 12:15:00 indicates 15 minutes after Noon. One hour later would be 13:15:00.

Critical Field	Field Name	Description
Chemical Name	analyte_name	A unique name for the analyte. This should indicate a single unique chemical with few exceptions (acceptable exceptions include Aroclor congeners that coelute, U-233/234, etc). For asbestos this field should contain one of the following six types: Total Chrysotile Protocol Structure, Long Chrysotile Protocol Structure, Long Amphibole Protocol Structure, Total Amphibole Protocol Structure, Long Asbestos Protocol Structure, Total Asbestos Protocol Structure. This field is also used to capture physical parameters. Appropriate physical parameters are provided in Appendix F.
CAS	cas_id	The Chemical Abstracts Society designation for the analyte (N/A if no CAS designation for the analyte in question).
Result Type Code	result_type	A short code to indicate the type of result for this record. Acceptable values include: TG (Target), SURR (Surrogate), IS (Internal Standard), SC (Spike Compound), TIC (tentatively Identified Compound). Others should be recommended by the Companies during review of this EDD guidance.
Initial or Reanalysis	reanalysis_flag	The field should contain either “Initial” or “Reanalysis” or similar designations to indicate whether the result is from the initial analysis or reanalysis.
Lab Reported Result	result_reported	The analytical value for that analyte (or physical parameter) as reported by the laboratory. For asbestos, this is the number of structures.
Result Units	result_units	Units associated with the reported value.
Reported Results Uncertainty	result_uncertainty	The uncertainty value associated with the laboratory reported results. This will apply to radionuclides and possibly other analytes (e.g. XRF analysis results). This field is not applicable to asbestos. The DVSR (or laboratory report within the DVSR) should define the uncertainty (e.g. one sigma).
Asbestos Sensitivity	asbestos_sensitivity	The analytical sensitivity associated with the asbestos results.
Asbestos Sensitivity Units	asbestos_sensitivity_units	The units associated with the asbestos sensitivity value (e.g. structures/area or volume).

Critical Field	Field Name	Description
Detect Flag	detect_flag	A flag, T (true) or F (false), to indicate whether the value is considered a detection or not. Values less than the Sample Quantitation Limit (SQL) are generally considered Not Detected. Radionuclides and other reported values that are not censored at the laboratory will be reported as T. For all radionuclide results, the flag will always equal T (true) indicating a value (positive or negative) was reported, regardless of the value relative to the MDA.
Method Detection Limit	method_detection_limit	The Method Detection Limit for the analyte. This definition should follow the December 3, 2008 guidance entitled *Detection Limits and Data Reporting*
Sample Quantitation Limit	sample_quantitation_limit	The SQL for the analytes. This definition should follow the December 3, 2008 NDEP guidance entitled *Detection Limits and Data Reporting*
Practical Quantitation Limit	practical_quantitation_limit	The Practical Quantitation Limit (PQL) for the analyte. This definition should follow the December 3, 2008 NDEP guidance entitled *Detection Limits and Data Reporting*
Minimum Detectable Activity	minimum_detectable_activity	The Minimum Detectable Activity, also known as Minimum Detectable Concentration. This is used for radionuclide results.
Percent Moisture	percent_moisture	The percentage of moisture of a solid sample.
Dilution Factor	dilution_factor	Any dilution factor used to arrive at the final reported value.
Laboratory Qualifier	lab_qualifier	The qualifier that may have been assigned to a reported value by the laboratory that performed the analysis.
Was result validated	validation_flag	A flag, T (true) or F (false). T indicates the value was validated after the laboratory reported the value.
Validation Level	validation_level	The level of data validation that was performed. Acceptable values are: “none”, III, IV, Tier 1A, 1B, 2, 3. The terms used need to be defined in the DVSR.
First Validation Qualifier	first_validation_qualifier	The non-laboratory qualifier applied to a value, other than the Level IV qualifier. For example, if the data was assessed as Level III, this is the qualifier that was applied.
Level IV Validation Qualifier	level4_validation_qualifier	The non-laboratory qualified applied as a result of level IV review.
Final Validation Qualifier	final_validation_qualifier	The final non-laboratory qualifier applied to the value.

Critical Field	Field Name	Description
Final Validation Reason Code	final_validation_reason_code	The reason code(s) that corresponds to the final Validation Qualifier. At this point there is no specified set of values. The companies may use their codes as long as all values are defined in the DVSR. All validation values should be consistent with the December 3, 2008 guidance entitled *Detection Limits and Data Reporting* document. For example, any reference to a sensitivity indicator (SQL, PQL etc) should be consistent with that guidance and only those sensitivity indicators should be used.
Final Validation Reason Description	final_validation_reason	The description of the reason code. For example, Holding Time Exceeded. The description should be consistent with the DVSR.
Comment Field (Sample)	sample_comment	A field to include comments associated with a specific sample.
Comment Field (Result)	result_comment	A field to include comments associated with a specific result.

Appendix A: EDD Database Tables

The EDD should be a Microsoft Access database containing at least three tables: a samples table, a results table, and a validation_reason table. The samples table will contain sample metadata and will have field_sample_id as its primary key. The results table will link to the samples table using field_sample_id as a foreign key. The validation reason will have rows consisting of the dvsr_id, the company-specific final_validation_reason_code, and the corresponding reason description.

For convenience, the EDD database should also contain a view that links the three tables, allowing a "flat-file" view of the data.

Details of the fields included in each table are shown in the table below. The data type of all fields should be text, except where indicated below

Field Name	Table(s)
dvsr_id	**samples**(foreign key, references validation_reason table) **validation_reason**(forms primary key in combination with final_validation_reason_code)
final_validation_reason	**validation_reason**
final_validation_reason_code (number)	**validation_reason** (forms primary key in combination with dvsr_id) **results**(foreign key, references validation_reason table)
sub_area lou sample_depth (number) northing (number) easting (number) sample_id_lab lab_id sdg_id batch_id location_id hydro litho matrix sample_type filtered_flag sample_date (date) sample_time (time) prep_date (date) prep_time (time) percent_moisture (number) sample_comment	**samples**

Field Name	Table(s)
sample_id_field	**samples**(primary key) **results**(foreign key, references sample_id field in samples table)
analytical_method preparation_method analytical_suite analyst_name asbestos_type analysis_date (date) analysis_time (time) analyte_name cas_id result_type reanalysis_flag result_reported (number) result_units result_uncertainty (number) asbestos_sensitivity (number) asbestos_sensitivity_units detect_flag method_detection_limit (number) sample_quantitation_limit (number) practical_quantitation_limit (number) minimum_detectable_activity (number) dilution_factor (number) lab_qualifier validation_flag validation_level first_validation_qualifier level4_validation_qualifier final_validation_qualifier result_comment	**results**

Appendix B: Sample Matrix Identification/Code

matrix	Sample Matrix Identification
AO	Outdoor Air
AI	Indoor Air
AG	Soil Gas
AF	Flux Chamber Air
SD	Sediment
SO	Soil
SW	Swab or Wipe
TA	Animal Tissue
TP	Plant Tissue
WS	Surface Water
WG	Ground Water

Appendix C: Sample Type Identification/Code

Sample Type Code	Description
AB	Ambient Conditions Blank
BD	Blank Spike Duplicate
BS	Blank Spike
DIL	Diluted Sample
DIL2	Additional Diluted Sample
DUPDATA	Duplicate Data Entry
EB	Equipment Blank
FB	Field Blank
FD	Field Duplicate Sample
FR	Field Replicate
FS	Field Spike
KD	Known (External Reference Material) Duplicate
LB	Lab Blank
LCS	Lab Control Spike
LCSD	Lab Control Spike Duplicate
LR	Lab Replicate
MB	Material Blank
MBD	Material Blank Duplicate
MS	Lab Matrix Spike
MSD	Lab Matrix Spike and Spike Duplicate pair considered as one sample
N	Normal Environmental Sample
ORIG	Original analysis
PB	Prep Blank
RB	Material Rinse Blank
RD	Regulatory Duplicate
RE	Re-analysis
RM	Known (External Reference Material) Rinsate
RN	Rinsate
SD	Lab Matrix Spike Duplicate considered as separate from spike
TB	Trip Blank
TBD	Trip Blank Duplicate
WT	Waste

Appendix D: Analytical Method Name/Code Guidance

Recommended format and guidance for analytical names:

- If the method is based on the United Stated Environmental Protection Agency (EPA) SW-846, start the name with "SW-" followed by the number and any applicable letter: XXXXc such as 8260b (SW-8260b).
- If the method is based on an EPA method that includes a digit after the period (e.g. Clean Water Act methods), be sure to include that, even if the digit is zero. Start the name with EPA: EPA 300.0
- If the method is based on an EPA document and citing that document is sufficient to understand the method used, include the document number: EPA-540-R97-028.
- If the method is based on an ASTM method, include ASTM- prior to the letter and number designation: ASTM D5755-03. Be sure to include the Based Designation (D5755) and Edition-Version (-03).
- If the method is based on Standard Methods for the Examination of Water and Wastewater, include "SM" prior to the number along with the Base Designation (7500) and the method version (-Ra). The results would be "SM7500-Ra." The DVSR should include the edition (e.g. 18th edition) or year the method was approved.
- Proprietary methods specific to a laboratory should have a designation that can be traced to the DVSR and method SOP. The version of the method needs be included in the DVSR and may also be incorporated into the EDD.

Preparation methods are not required in the EDD. However, all preparation methods that are distinct from the determination method must be included in the DVSR report. If preparation methods are included in the EDD they need to be in a separate column.

A designation indicating that method is a modified version (e.g. mod) is recommended but not required. However, the DVSR should indicate if the method is a modified version of a published method.

Appendix E: Analytical Suite Name/Code

Analytical Method Code	Description
ALDH	Aldehyde analysis
ASB	Asbestos
CRVL	Hexavalent chromium
CYAN	Cyanide
DIO_FUR	Dioxin and Furan
FIELD	Field measurements
GENERAL	Wet chemistry type measurements such as pH, anions, hardness, bicarbonate, alkalinity, perchlorate, ammonia, bromide, TKN, etc
HERB	Herbicides
METALS	Metals and elements using ICP, AA, ICP-MS
ORG_ACID	Organic Acids analysis
PCB	PCB analysis, aroclors or congeners.
PCTMST	Percentage of Moisture
OCPEST	Organo-chlorine pesticide
OPPEST	Organo-phosphate pesticide
SOLIDS	TDS, TSS
SVOC	Semi-Volatile Organic Compounds, exclusive of Pesticides, PCBs, and PAHs.
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons, all molecular weights
VOC	Volatile Organic Compounds
XRFMetals	Metals and elements using XRF.
RADS	Radionuclides
PAH	Polyaromatic Hydrocarbon
TEM	Transmission Electron Microscopy (asbestos)
PLM	Polarized Light Microscopy (asbestos)
XRD	X-ray Diffraction (asbestos and metals)

Appendix F: Physical and Field Parameters

analyte_name	Physical Parameters
DBD	Dry Bulk Density
VMC	Volumetric Moisture Content
FOC	Fraction Organic Carbon
CEC	Cation Exchange Capacity
SPH	Soil pH
DETWA	Depth to Water
TRANS	Transmissivity
HYCO	Hydraulic Conductivity
STOR	Storativitity
DO	Dissolved Oxygen
ORP	Oxidation Reduction Potential - Redox
SGR	Specific Gravity
TOP	Total Porosity
VWC	Volumetric Water Content

March 19, 2009

Mr. Mark Paris
Basic Remediation Company
875 West Warm Springs Road
Henderson, NV 89011

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, NV 89009

Mr. Curt Richards
Olin Corporation
3855 North Ocoee Street, Suite 200,
Cleveland, TN 37312

Mr. Joe Kelly
Montrose Chemical Corp of CA
600 Ericksen Ave NE, Suite 380
Bainbridge Island, WA 98110

Mr. Brian Spiller
Stauffer Management Co LLC
1800 Concord Pike
Wilmington, DE 19850-6438

Mr. Craig Wilkinson
Titanium Metals Corporation
PO Box 2128
Henderson, NV 89009

Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Supplemental Guidance on Data Validation

Dear Sirs and Madam:

All of the parties listed above shall be referred to as "the Companies" for the purposes of this letter. As the Companies should be aware, the United Stated Environmental Protection Agency (USEPA) has issued revisions to the National Functional Guidelines. In response to questions and comments received from the Companies, the NDEP has revisited the NDEP's *Supplemental Guidance on Data Validation* issued on February 26, 2009. The Nevada Division of Environmental Protection (NDEP) provides guidance in Attachment A regarding how these revisions should be applied to data validated for the BMI Complex and Common Areas projects. In addition, a red-line strike-out version of the document will be provided electronically so that the changes made be distinguished more easily.

Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

Brian A Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions
Fax: (702) 486-5733

BAR:s

CC: Jim Najima, NDEP, BCA, Carson City
Marysia Skorska, NDEP, BCA, Las Vegas
Shannon Harbour, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Greg Lovato, NDEP, BCA, Carson City
Barry Conaty, Holland & Hart LLP, 975 F Street, N.W., Suite 900,Washington, D.C. 20004
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Ebrahim Juma, Clark County DAQEM, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021
Lee Erickson, Stauffer Management Company LLC, P.O. Box 18890 Golden, CO 80402
Keith Bailey, Environmental Answers, 3229 Persimmon Creek Drive, Edmond, OK 73013
Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr., Henderson, NV 89014
Mike Skromyda, Tronox LLC, PO Box 55, Henderson, Nevada 89009
Jeff Gibson, AMPAC, 3770 Howard Hughes Parkway, Suite 300, Las Vegas, Nevada 89109
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Cindi Byrns, Olin Chlor Alkali, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 10733 Wave Crest Court Stockton, CA 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Robert Infelise, Cox Castle Nicholson, 555 California Street, 10th Floor, San Francisco, CA 94104-1513
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004
Dave Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544
Paul Black, Neptune and Company, Inc., 8550 West 14th Street, Suite 100, Lakewood, CO 80215
Teri Copeland, 5737 Kanan Rd., #182, Agoura Hills, CA 91301
Paul Hackenberry, Hackenberry Associates, 550 West Plumb Lane, B425, Reno, NV, 89509

Attachment A

Revisions to Data Validation of Organic Data based on June 2008 National Functional Guidelines for Superfund Organic Methods Data Review – USEPA-540-R-08-01.

The USEPA Office of Superfund Remediation and Technology Innovation released an updated version of the National Functional Guidelines (NFG) for Superfund Organic Methods Data Review in June, 2008. These updated guidelines contain several revisions with respect to how data is to be validated under the USEPA Contract Laboratory Program. The Companies currently collecting and validating data at the BMI Complex and Common Areas projects have generally followed these NFGs, though in general earlier versions of the guidance have been followed.

Significant changes to the NFGs are discussed below.

Holding Times

The new USEPA guidance revises the period of time allowed before data are qualified when a holding time has been exceeded.

If VOC data are one day past holding time, non-detects are qualified as unusable (R). Previously this was applied if the holding time was exceeded by a factor of two. The new guidance does not necessarily apply the same level of qualification to semi-volatile, pesticides, and Aroclor fractions. For these analyses the guidance is to qualify as estimated (UJ) or unusable, based on professional judgment, if holding times are exceeded by one day or more.

At this time NDEP recommends the current qualification algorithm (twice the holding time) continue to be used. Studies have shown that most chemicals are stable for that period if the samples are kept cold and preserved where applicable (aqueous samples). However, each time a batch of samples are analyzed past holding time, professional judgment should be used to arrive at the qualification and usability assessment. It is recommended that the Companies use historic results, where holding times were met, along with evidence from compound stability studies to arrive at the final usability assessment.

Sample Receipt Temperatures

The new guidance, which applies to all organic suites (volatile organic compounds (VOCs), semi-VOCs (SVOC), pesticides, and polychlorinated biphenyls (PCBs)), is to use professional judgment if sample coolers arrive at the laboratory below 2 °C or above 6 °C.

No change in the current qualification and usability is proposed by NDEP. Professional judgment should guide this assessment. It is noted that stability studies of volatile compounds indicate a number of the compounds at the site (e.g. chlorinated benzenes) can degrade when not kept cold and preserved. Again, the use of historic results, where cooler temperatures were met, is the best approach for arriving at the final data usability assessment.

Blank Contamination

The new guidance for qualifying VOC results based on blank contamination is provided in the table below. This table is generally consistent with the logic described in Section E of the Low/Medium Volatiles Data Review. Qualification is based upon a comparison with the associated blank. When professional judgment is used to censor a sample value, that logic used needs to be described in the Data Validation Summary Report. If an analyte is found in a blank but not in associated samples no qualification is required.

Blank Type	Blank Result	Sample Result	Action for Samples
If sample result is < SQL, Report SQL value with a U.			
Method, Storage, Field, Trip, Instrument	≤ PQL *	< PQL (down to SQL)*	If Blank ≥ Sample, Report Sample value with a U. If Blank < Sample, use professional judgment. Default is to Report Sample Result.
		≥ PQL*	Use professional judgment. Default is to Report Sample Result.
	> PQL *	< PQL (down to SQL)*	Report Sample value with a U.
		≥PQL* and < blank result	Use professional judgment. Default is to report the Sample result with a U.
		≥PQL* and ≥ blank result	Use professional judgment. Default is to Report Sample Result.

Report all detects down to the SQL in accordance with the NDEP Memo on Detection Limits and Data Reporting dated December 3, 2008.

* 2x the SQL for methylene chloride, 2-butanone and acetone.

NDEP recommends that this approach to qualifying VOCs be adopted. It is also important to compare any potential censored results, due to blank contamination, with the applicable standard such as USEPA maximum contaminant levels (MCLs) or NDEP Basic Comparison Levels (BCLs), during the data usability assessment.

Note that if other sensitivity indicators than SQL/PQL are used by the laboratories or validators the following substitutions should be made in this table. In place of SQL, use the applicable sensitivity indicator that is analogous to the Method Detection Limit that has been adjusted to reflect sample-specific actions, such as dilutions or use of smaller aliquot sizes, and take into account sample characteristics, sample preparation, and analytical adjustments. All sample-specific detection limit and all non-detected results are to be reported to this value. In place of PQL, use the applicable limit that is greater than the SQL analog and is generally described as a quantitation limit such as a QL and in some cases an RL. All detected results greater than the SQL analog (e.g. MDL), but less than the PQL analog (e.g. QL) can be qualified as estimated but are still reported.

The same approach is provided in the guidance for SVOC and other organic blank assessment and this also should be adopted with the same general steps outline in the table above. For SVOCs, 5 times the SQL for bis(2-ethylhexyl)phthalate is used. The pesticides and PCB blank analysis does not use a 2X/5X common contaminant factor but promotes professional judgment for any blank value above the CRQL (SQL is the appropriate indicator for the BMI Complex) with the potential for qualifying data as unusable (R).

System Monitoring Compounds

The new guidance revises the level where VOC surrogate recovery results in data qualification. If the recovery of a surrogate is < 20%, the "not-detected" results associated with the surrogate are considered unusable (R) and positive results are qualified as estimated. If the recovery is > 20%, but < lower QC limit, the "not-detected" and positive results are qualified as estimated. In the prior guidance the cutoff was 10%.

At this point NDEP does not require changing the cutoff from 10% to 20%. However, professional judgment should be used and problems with system monitoring compounds should be investigated when the recovery is less than 20%.

Matrix Spike/ Matrix Spike Duplicate (MS/MSD)

The prior USEPA guidance did not provide any substantive guidance for a usability assessment based on MS/MSD results. The new USEPA guidance does not recommend qualification based solely on MS/MSD results. However, professional judgment in conjunction with other quality control (QC) results should be considered to qualify results as follows:

The new guidance for VOCs is as follows:

> For any recovery or RPD **greater** than the upper QC limit: qualify positive results with a "J". "Not-detected" results should not be qualified.

For any recovery ≥ 20%, and less than the lower QC limit: qualify positive results with a "J". "Not-detected" results should be qualified "UJ".

For any recovery < 20%: qualify positive results with a "J." Not-detected" results use professional judgment.

At this point NDEP does not require changing the steps for qualifying VOC data based on these revisions to the MS/MSD assessment. Again, professional judgment is important and other QC results should be considered along with MS/MSD results.

Internal Standards

The revision to assessment of internal standards applies to all organics suites in the guidance (VOC, SVOC, pesticides, PCBs) where internal standards are utilized. The changes to the guidance are as follows:

If the sample internal standard area is 60% of the associated continuing calibration verification (CCV) internal standard area, positive sample results are qualified as estimated, and "not-detected" sample results are qualified as **unusable (R)**. Also, if the Retention Time of the internal standard differs by more than 20 seconds from the associated CCV, all positive and "not-detected" sample results should be qualified as unusable (R). However, caveats can be used based upon mass spectra criteria and partial rejection.

Internal standards are not always included in data validation but are required to be validated for at least 10% of the samples reported in a DVSR. At this point NDEP feels the cutoff of 60% is not warranted. However, a cutoff point of 25%, using the same logic as above, is recommended.

In cases where high resolution mass spectrometry is employed, such as for dioxin/furan and congener PCB analysis, we are not advocating the new internal standard rule be applied. At this time these results should continue to be validated using guidance most applicable to high-resolution MS. Applicable guidance includes the 2005 Dioxin National Functional Guidelines where ion abundance ratios and signal to noise ratios are considered.

Percent Moisture

The steps to qualify data based on high levels of percent moisture apply to all organic analysis in the new guidance. The 1999 USEPA guidance had no assessment with respect to percent moisture. The new guidance is:

If the sample percent moisture is >70% but <90%, qualify positive samples as estimated "J" and "not-detected" samples as estimated "UJ." If the sample percent moisture is ≥90%, qualify positive samples as estimated "J" and "not-detected" samples as unusable "R."

NDEP believes this approach is supported and should be utilizable for all analyses including metals, radionuclides and other inorganic analytes.

April 13, 2009

Mr. Mark Paris
Basic Remediation Company
875 West Warm Springs Road
Henderson, NV 89011

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, NV 89009

Mr. Curt Richards
Olin Corporation
3855 North Ocoee Street, Suite 200,
Cleveland, TN 37312

Mr. Joe Kelly
Montrose Chemical Corp of CA
600 Ericksen Ave NE, Suite 380
Bainbridge Island, WA 98110

Mr. Brian Spiller
Stauffer Management Co LLC
1800 Concord Pike
Wilmington, DE 19850-6438

Mr. Craig Wilkinson
Titanium Metals Corporation
PO Box 2128
Henderson, NV 89009

Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Supplemental Guidance on Data Validation

Dear Sirs and Madam:

All of the parties listed above shall be referred to as "the Companies" for the purposes of this letter. The Nevada Division of Environmental Protection (NDEP) provides supplemental guidance on data validation in Attachment A.

Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

Brian A Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions
Fax: (702) 486-5733

BAR:s

CC: Jim Najima, NDEP, BCA, Carson City
Marysia Skorska, NDEP, BCA, Las Vegas
Shannon Harbour, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Greg Lovato, NDEP, BCA, Carson City
Barry Conaty, Holland & Hart LLP, 975 F Street, N.W., Suite 900,Washington, D.C. 20004
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Ebrahim Juma, Clark County DAQEM, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021
Lee Erickson, Stauffer Management Company LLC, P.O. Box 18890 Golden, CO 80402
Keith Bailey, Environmental Answers, 3229 Persimmon Creek Drive, Edmond, OK 73013
Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr., Henderson, NV 89014
Mike Skromyda, Tronox LLC, PO Box 55, Henderson, Nevada 89009
Jeff Gibson, AMPAC, 3770 Howard Hughes Parkway, Suite 300, Las Vegas, Nevada 89109
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Cindi Byrns, Olin Chlor Alkali, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 10733 Wave Crest Court Stockton, CA 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Robert Infelise, Cox Castle Nicholson, 555 California Street, 10th Floor, San Francisco, CA 94104-1513
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004
Dave Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544
Paul Black, Neptune and Company, Inc., 8550 West 14th Street, Suite 100, Lakewood, CO 80215
Teri Copeland, 5737 Kanan Rd., #182, Agoura Hills, CA 91301
Paul Hackenberry, Hackenberry Associates, 550 West Plumb Lane, B425, Reno, NV, 89509

Attachment A

NDEP Data Verification and Validation Requirements – Supplement April, 2009

This supplemental guidance combines all previous data verification and validation guidance associated with the BMI Complex and Common Areas work and also incorporates recent United States Environmental Protection Agency (USEPA) guidance into a single document. This document supersedes the prior NDEP guidance: May 3, 2006, *Guidance on Data Validation Procedures* (1), and February 23, 2007, *Additional Guidance on Data Validation Procedures* (2). It also incorporates the *Supplemental Guidance on Data Validation* (3), dated February 26 and March 19, 2009.

The new guidance that is incorporated here is based on the USEPA document, *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (4), OSWER January, 2009. This new USEPA guidance is being incorporated into the verification and validation steps at the BMI Complex and Common Areas because it provides a consistent set of terms for each stage of data validation (DV). The prior BMI Complex and Common Areas DV guidance used terms based on the DRAFT *EPA Region 9 Superfund Data Evaluation/Validation Guidance* (5). This guidance has never been finalized since the 2001 draft.

New Guidance for Data Validation:

There are many terms used in verifying and validating environmental data that have an historical origin that are imprecise and in some cases outdated. These terms may be generally understood but no longer have a current reference point. The USEPA Guidance (1) incorporates terminology correlated with verification and validation steps that provide transparency and consistency in the DV process. For example, the new guidance categorizes DV Stages based upon sample specific and instrument specific quality control (QC). It provides explicit details as to what needs to be reported and what is to be validated at each Stage. There are differences between the analytical methods in the USEPA Contract Laboratory Program (CLP) Program (from which this new USEPA Guidance is derived) and the methods used at the BMI Complex and Common Areas (e.g. Resource Conservation and Recovery Act (RCRA) based), however, there is sufficient overlap such that the DV language is applicable to the BMI Complex and Common Areas methods and the use of the Stages language in this new USEPA guidance will be valuable to the BMI Complex and Common Areas quality assurance (QA) program.

This guidance does not propose any significant revisions with how data are validated, but we request use of the terminology in this new USEPA Guidance (4) as a common lexicon of terms to be used by the Companies when reporting validated data. Additional details are provided below describing how to use this new guidance for data collected at the BMI Complex and Common Areas.

We request that the Companies begin using the following Stages terminology in their Data Validation Summary Reports (DVSR) and electronic data deliverables (EDD) reports (where applicable):

Stages and Processes Used to Verify and Validate Lab Analytical Data:

Stage 1: Verification and validation based only on completeness and compliance of sample receipt conditions, sample characteristics, and basic analytical results

Stage 2A: Verification and validation based on completeness and compliance checks of sample receipt conditions and ONLY sample-related QC results

Stage 2B: Verification and validation based on completeness and compliance checks of sample receipt conditions and BOTH sample-related and instrument-related QC results

Stage 3: A verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, AND recalculation checks against the laboratory reported results

Stage 4: A verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, recalculation checks, AND the review of actual instrument outputs

The recommended minimum baseline checks that are to be followed for each stage of analytical data are shown in Appendix A of the USEPA Guidance. Using this new language, all data collected at the BMI Complex and Common Areas should be validated at least to Stage 2B . Also, items of particular note found in Appendix A of the USEPA Guidance (4) are identified below.

The QC acceptance criteria that are to be used in evaluation of the data will come from the NDEP Guidance [e.g. *Supplemental Guidance on Data Validation* (3)] along with Companies Work Plans, Quality Assurance Project Plans (QAPPs), standard operating procedures (SOPs), or Laboratory established criteria as described in the analytical methods. The origin of these criteria should be clearly documented in the data validation summary report (DVSR). For example, the DVSR should cite the document (e.g. SOP) that describes the specific acceptance criteria for continuing calibration.

For Requested Reporting Limits discussion in Section 1.1(5) of Appendix A of the USEPA Guidance (1). The Companies should ensure that the reporting limits are consistent with the NDEP Guidance *Detection Limits and Data Report* (December 3, 2008).

In addition, at least 10% of all data within a DVSR should be validated to Stage 4. Our 2006 guidance (1) on DV indicated this is calculated based on the number of data packages validated within a DVSR. To clarify, the criterion to use is calculated based on the total number of samples times the total number of analytical suites [e.g. semi-volatile organic compounds (SVOCs), radionuclides, organochlorine (OC) Pesticides]. If at least 10% of the samples with a similar number of analytical suites are chosen, this criterion is achieved.

This Updated Guidance is consistent with the NDEP's May 3, 2006 Guidance:

The requirement that all sample results be validated to Stage 2B and at least 10% are to be validated to Stage 4 is consistent with our prior guidance. Note that Stage 2B includes, among others items, the check of initial and continuing calibration information. Our guidance does not require 100% of this to be validated. Consistent with the previous guidance only a random check of 10-20% is required. The USEPA guidance uses the term Deuterated Monitoring Compound (DMC), which is analogous to a

surrogate compound as applied in most instances under the methods used at the BMI Complex and Common Areas. Also note that providing the reports specified in Stage 4 (instrument reports) in an electronic format for all results is requested to minimize the length of the DVSR hard copy reports.

At least 10% of all data are to be validated to Stage 4. Consistent with our previous guidance, only 10-20% of these samples need to have the recalculation checks (described in Stage 3 of the new USEPA guidance), and 5% of those samples should have the integration and mass spectrum match comparisons (described in Stage 4 of the new guidance). When calculating the percentage of data that need to be validated for recalculation and integration or mass spectrum matches, the algorithm is also based on the number of samples times the number of analytical suites. To meet this, choose a group of samples with a similar number of analytical suites and validate the appropriate percentage. The Companies are also encouraged to select data based upon historical results where a historically higher number of qualified data were observed.

This Updated Guidance is consistent with the NDEP's February 23, 2007 Guidance:

Validated data are to be provided in a summary report (hard copy and electronic format) along with a database (EDD) and laboratory reports (electronic format, include Chain-of-Custodies) for all samples validated. All laboratory reports should include a Case Narrative and other required reporting items consistent with the Nevada Laboratory Certification program. Any third party validation that was used to prepare the summary report should also be provided in electronic format. The database supplied with the summary report should only include the results that were validated (i.e., do not include historical data) and should also follow the *Guidance on Uniform Electronic Data Deliverables* (6). The data should also include the QC results (blanks, spikes, surrogates, etc) and other information desired by the Companies in separate database table(s). The EDD should specify the Stage of validation for each record in the validation level field. Please note that the revised EDD format is being developed by the NDEP based upon comments from the Companies. The revised EDD format will address this issue.

The following information is requested with the data validation summary reports:

- An Introduction with Purpose/Objective/Process. The report should describe the matrices sampled, along with the applicable sampling techniques or a reference to the exact work plan where this information can be found.
- Complete descriptions of the sensitivity indicator terms (sample quantitation limit (SQL), practical quantitation limit (PQL), quantitation limit (QL), etc.,) used in the report and EDD. See additional information on this topic in the NDEP *Guidance on Detection Limits and Data Reporting* (7), dated December 3, 2008.

- Details on the applicable samples and sample delivery group (SDG) identification numbers (IDs), that correspond to locations and sampling time, analyses performed (analytical suites), stage of validation performed (e.g.: 2B, 4). Any non-typical sampling or sample handling that was performed should be described (e.g. filtering).
- A data validation qualifier definition
- Reason codes that link results in the database to specific qualifier logic
- Data validation findings for each parameter based on the level of review. When non-conformances are identified they should be linked to the appropriate sample(s) and SDG.

When professional judgment is used to arrive at a decision, the logic should be clearly described. Please justify decisions (use of professional judgment) that don't follow the typical data validation algorithms.

- Evaluation of the Precision, Accuracy, Reproducibility, Comparability, Completeness, and Sensitivity (PARCCS) parameters
- Conclusions/Recommendations
- References
- The DVSRs should include tables that specify when a non-conformance has been identified during the data validation process. Providing these tables in both hardcopy and electronic (ideally in a spreadsheet or database format) will facilitate review of the DVSR and subsequent usability evaluation. These tables should be categorized by issue, for example, those samples qualified due to Laboratory Control Sample exceedances should be within the same table. Each table should specify the sample, SDG/lab package, the analyte(s), the data quality indicator and objective (e.g., % Recovery, Limits of 85-115%), the sample result(s) and the data validation qualifier(s). Both the qualifier based on this non-conformance issue and the overall qualifier applied to this datum should be provided to help understand the qualifiers supplied in the QC database table and EDD. This information is necessary to both properly evaluate the DVSR and will also facilitate data usability investigations. Each data quality indication, for example, percent recovery, percent difference, precision (relative percent difference (RPD)), area (for internal standards), raw level of blank value that is used to compare with analyte levels in the native samples, cooler temperature, holding time days and exceedance should be captured in these tables.

References

1) NDEP *Guidance on Data Validation Procedures*. May 3, 2006.
2) NDEP *Additional Guidance on Data Validation Procedures*. February 23, 2007,
3) NDEP *Supplemental Guidance on Data Validation*. February 26 and March 19, 2009
4) USEPA *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*, OSWER January, 2009. EPA 540-R-08-005.
5) USEPA *Region 9 Superfund Data Evaluation/Validation Guidance* (DRAFT). December 2001. R9QA/006.1.
6) NDEP *Guidance on Uniform Electronic Data Deliverables*. February 27, 2009 (revision pending).
7) NDEP *Guidance on Detection Limits and Data Reporting.* December 3, 2008.

STATE OF NEVADA
Jim Gibbons, Governor
Department of Conservation & Natural Resources
Allen Biaggi, Director
DIVISION OF ENVIRONMENTAL PROTECTION
Leo M. Drozdoff, P.E., Administrator

April 29, 2009

Mr. Mark Paris
Basic Remediation Company
875 West Warm Springs Road
Henderson, NV 89011

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, NV 89009

Mr. Curt Richards
Olin Corporation
3855 North Ocoee Street, Suite 200,
Cleveland, TN 37312

Mr. Joe Kelly
Montrose Chemical Corp of CA
600 Ericksen Ave NE, Suite 380
Bainbridge Island, WA 98110

Mr. Brian Spiller
Stauffer Management Co LLC
1800 Concord Pike
Wilmington, DE 19850-6438

Mr. Craig Wilkinson
Titanium Metals Corporation
PO Box 2128
Henderson, NV 89009

Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Supplement to the Guidance for Evaluating Radionuclide Data for the BMI Plant Sites and Common Areas Projects dated February 6, 2009

Dear Sirs and Madam:

All of the parties listed above shall be referred to as "the Companies" for the purposes of this letter.

This guidance provides supplemental information associated with the use of preparation methods for radium analysis. On February 6, 2009 NDEP provided the *Guidance for Evaluating Radionuclide Data for the BMI Plant Sites and Common Areas Projects.* Table 4 of that document indicated the Recommended Preparation Methods for Radium-226 and Radium-228 were under further investigation. After additional review of historic data sets and discussions with the laboratories associated with those data it is recommended that all future preparation methods for these two analytes include hydrofluoric acid (complete dissolution). This recommendation is based on the appearance that the majority of the historic data is based on use of these complete dissolution steps for preparation of soil samples for these analytes. In addition, it is believed that this is a conservative recommendation (in that it avoids low bias in the analyses). In particular, both the 2005 Basic Remediation Company and Titanium Metals Corporation Shallow Background Study (analyses completed by STL-St. Louis) and the 2008 Supplemental Background Study (analyses completed by GEL) appear to have used hydrofluoric acid (HF) for preparing samples for Radium-226 and Radium-228 analysis. The 2008 Deep Background study (analyses completed by STL-Richland) apparently did not include HF, but use of the Figure 1 flowchart in the *Guidance for Evaluating Radionuclide Data for the BMI Plant Sites and Common Areas Projects* provides a pathway for comparing data to this historic background dataset.

Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

Brian A Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions
Fax: (702) 486-5733

BAR:s

CC: Jim Najima, NDEP, BCA, Carson City
Marysia Skorska, NDEP, BCA, Las Vegas
Shannon Harbour, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Greg Lovato, NDEP, BCA, Carson City
Barry Conaty, Holland & Hart LLP, 975 F Street, N.W., Suite 900,Washington, D.C. 20004
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Ebrahim Juma, Clark County DAQEM, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021
Lee Erickson, Stauffer Management Company LLC, P.O. Box 18890 Golden, CO 80402
Keith Bailey, Environmental Answers, 3229 Persimmon Creek Drive, Edmond, OK 73013
Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr., Henderson, NV 89014
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Mike Skromyda, Tronox LLC, PO Box 55, Henderson, Nevada 89009
Jeff Gibson, AMPAC, 3883ward Hughes Parkway, Suite 70, Las Vegas, Nevada 89109
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Cindi Byrns, Olin Chlor Alkali, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 10733 Wave Crest Court Stockton, CA 95209
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Robert Infelise, Cox Castle Nicholson, 555 California Street, 10th Floor, San Francisco, CA 94104-1513
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004

ndep
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION

Jim Gibbons, Governor
Allen Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

May 11, 2009

Mr. Mark Paris
Basic Remediation Company (BRC)
875 West Warm Springs
Henderson, NV 89011

Re.: Nevada Division of Environmental Protection Response to:
BRC Standard Operating Procedure (SOP) 40, Data Review/Validation, Revision 4
dated May 7, 2009
NDEP Facility ID# H-000688

Dear Mr. Paris:

The NDEP has received and reviewed BRC's document identified above and finds that the document is acceptable.

Should you have any questions or concerns, please do not hesitate to contact me at (702) 486-2850 x247 or brakvica@ndep.nv.gov.

Sincerely,

Brian A. Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions
Fax: (702) 486-5733

BAR:s

cc: Jim Najima, NDEP, BCA, Carson City
Barry Conaty, Holland & Hart LLP, 975 F Street, N.W., Suite 900,Washington, D.C. 20004
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Ebrahim Juma, Clark County Comprehensive Planning, PO Box 551741, Las Vegas, NV, 89155-1741
Robert Williams, Clark County Fire Department, 575 East Flamingo Road, Las Vegas, Nevada 89119
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Rex Heppe, 2925 East Patrick Lane, Suite M, Las Vegas, NV 89120-2457
David Sadoff, AIG Consultants, Inc., 121 Spear Street, 3rd Floor, San Francisco, CA 94105
Leslie Hill, U.S. Department of Justice, PO Box 23896, Washington, DC 20026-3986
Craig Wilkinson, TIMET, PO Box 2128, Henderson, Nevada, 89009-7003
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021
Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr., Henderson, NV 89014
Susan Crowley, Tronox LLC, PO Box 55, Henderson, Nevada 89009
Mike Skromyda, Tronox LLC, PO Box 55, Henderson, Nevada 89009
Keith Bailey, Environmental Answers, 3229 Persimmon Creek Dr, Edmond, Oklahoma 73013
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Lee Erickson, Stauffer Management Company, P.O. Box 18890, Golden, Co 80402
Michael Bellotti, Olin Corporation, 3855 North Ocoee Street, Suite 200, Cleveland, TN 37312
Curt Richards, Olin Corporation, 3855 North Ocoee Street, Suite 200, Cleveland, TN 37312
Paul Sundberg, Montrose Chemical Corporation, 10733 Wave Crest Court Stockton, CA 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Robert Infelise, Cox Castle Nicholson, 555 California Street, 10th Floor, San Francisco, CA 94104-1513
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations
Jim Gibbons, Governor
Allen Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

May 11, 2009

Mr. Mark Paris
Basic Remediation Company
875 West Warm Springs Road
Henderson, NV 89011

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, NV 89009

Mr. Curt Richards
Olin Corporation
3855 North Ocoee Street, Suite 200,
Cleveland, TN 37312

Mr. Joe Kelly
Montrose Chemical Corp of CA
600 Ericksen Ave NE, Suite 380
Bainbridge Island, WA 98110

Mr. Brian Spiller
Stauffer Management Co LLC
1800 Concord Pike
Wilmington, DE 19850-6438

Mr. Craig Wilkinson
Titanium Metals Corporation
PO Box 2128
Henderson, NV 89009

Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Unification of Electronic Data Deliverables (EDD), NDEP-Required EDD Format

Dear Sirs and Madam:

All of the parties listed above shall be referred to as "the Companies" for the purposes of this letter.

Attachment A provides the revised EDD format which the NDEP will require the Companies to conform to for all future Deliverables. Attachment B provides an annotated response to the issues and questions raised by the Companies regarding the draft EDD format.

It is expected that a response from Olin Corporation will result in a modification to Appendix B of Attachment A. Appendix B will be reissued as an errata once this information is received. NDEP requests that Olin Corporation provide this information **by May 26, 2009**.

Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

Brian A Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions
Fax: (702) 486-5733

BAR:s

CC: Jim Najima, NDEP, BCA, Carson City
Marysia Skorska, NDEP, BCA, Las Vegas
Shannon Harbour, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Greg Lovato, NDEP, BCA, Carson City
Barry Conaty, Holland & Hart LLP, 975 F Street, N.W., Suite 900,Washington, D.C. 20004
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Ebrahim Juma, Clark County DAQEM, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021
Lee Erickson, Stauffer Management Company LLC, P.O. Box 18890 Golden, CO 80402
Keith Bailey, Environmental Answers, 3229 Persimmon Creek Drive, Edmond, OK 73013
Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr., Henderson, NV 89014
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Mike Skromyda, Tronox LLC, PO Box 55, Henderson, Nevada 89009
Jeff Gibson, AMPAC, 3883ward Hughes Parkway, Suite 70, Las Vegas, Nevada 89109
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Cindi Byrns, Olin Chlor Alkali, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 10733 Wave Crest Court Stockton, CA 95209
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Robert Infelise, Cox Castle Nicholson, 555 California Street, 10th Floor, San Francisco, CA 94104-1513
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004
Dave Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544
Paul Black, Neptune and Company, Inc., 8550 West 14th Street, Suite 100, Lakewood, CO 80215
Teri Copeland, 5737 Kanan Rd., #182, Agoura Hills, CA 91301
Paul Hackenberry, Hackenberry Associates, 550 West Plumb Lane, B425, Reno, NV, 89509

Attachment A

Unified EDD Format

The objective of this guidance is to specify the design of the format for the submission of electronic data from the Companies to NDEP. The goal is to streamline the uploading of the Companies' electronic data into the regional database maintained by the NDEP. This task requires defining each element of the EDD(s) so that they are provided in a consistent format. Provided below are the required elements of the EDD format and descriptions of the elements. Requested formats and codes are provided in appendices, which should be followed to the extent possible. Additions to the fields should be provided as comments to this guidance or in formal communications if they are developed later in the project. Due to the resources required to modify the EDD for each Company it is the desire of the NDEP to modify this EDD as infrequently as possible.

The EDD should be delivered as a Microsoft Access database (file format Access 2000 or later) with the data organized into several tables. The fields to be included in each table are described in Appendix A.

It is understood that the database developed for the data validation summary report (DVSR) will include additional fields and records (e.g. quality control (QC) data). However, these additional fields and records should be provided in a separate table from the format described here. All native samples, including replicates should be included in this EDD but QC results (other than replicates) will not be incorporated into the regional database at this time.

It is understood that not all fields will contain a value. Empty fields will be represented as "NULLs" in the Microsoft Access database.

Non-Analytical Data

There are some data which will be stored in the regional database but which do not fit into the same format as the analytical data. Examples of these data are hydraulic parameters and soil material properties as described in Appendices G and H. Separate data tables will be developed to hold these data, which are not part of the standard EDD deliveries.

EDD Requirements

Required Fields:

Short Description	Field Name	Detailed Description
DVSR Identification	dvsr_id	A unique ID for each DVSR, from each company. The ID should contain elements that make it clear which company supplied the DVSR, the year of submittal, and a unique number designation. Format: ZZZZZ-YYYY-XXXX where ZZZZZ = company, or background (BKG), YYYY = number of the DVSR, XXXX = year.

Short Description	Field Name	Detailed Description
Sub-area or parcel designation	sub_area	A unique designation for each sub-area or parcel.
LOU designation	lou	A designation for LOU associated with the sample. If no LOU is associated with the sample this field should be labeled as "NULL".
Sample top depth	sample_top_depth	Sample top depth in feet. For Companies which only record a single sample depth, this value should go in both the sample_top_depth and sample_bottom_depth fields.
Sample bottom depth	sample_bottom_depth	Sample bottom depth in feet. For Companies which only record a single sample depth, this value should go in both the sample_top_depth and sample_bottom_depth fields.
Northing Coordinate	northing	Northing coordinate of the sample in NAD 1983 State Plane Nevada East feet
Easting Coordinate	easting	Easting coordinate of the sample in NAD 1983 State Plane Nevada East feet
Sample Identification - Field	sample_id_field	The ID used on the Chain of Custody, or similar field record. This ID should be unique to the sample and also consistent (identical) for all records associated with that sample. For example, where multiple analytes are reported the sample ID should be identical for all.
Sample Identification - Laboratory	sample_id_lab	The ID of the sample used at the laboratory. This ID should generally be unique to the sample and also consistent for all records associated with that sample. For example, where multiple analytes are reported the sample ID should be identical for all. There are instances where a different name may be required (e.g. reanalysis) but the use of multiple names should be minimized as much as possible.
Sample Collection Information	sample_collection_comment	Field for capturing information about how the sample was collected, for example, when groundwater samples have been collected from open boreholes using a bailer or from direct push equipment versus collecting the sample from a well using a submersible pump. This field should be populated only in cases where the sample was collected in a "non-standard" manner.

Short Description	Field Name	Detailed Description
Laboratory Identification/ code	lab_id	A unique identification of each laboratory, down to the laboratory location. For example, TestAmerica-Richland, Washington should have a designation that differs from other TestAmerica locations. Companies should provide a recommended ID for each laboratory currently used or expected. A designation for field analysis should be included.
SDG- Sample Delivery Group	sdg_id	The Sample Delivery Group identification supplied by the laboratory.
Analytical Batch Identification	batch_id	The analytical batch identification supplied by the laboratory.
Location Identification	location_id	An identification of the well or location where the sample was taken. The ID should be unique to that well or location and should be used in all future reports and EDDs. This identifier will be considered to be Company-specific; as part of the development of the regional database, a location table will be developed which will allow locations to be uniquely identified across companies.
hydrogeologic	hydro	The designation of the water-bearing zone associated with the sample: Shallow Zone, Middle Zone, or Deep Zone. This hydrogeologic nomenclature is described in the January 6, 2009 letter (*Hydrogeologic and Lithologic Nomenclature Unification)* from NDEP to the Companies.
lithologic	litho	The designation of the lithologic nomenclature tags: Qal (Quaternary Alluvium), xMCf (transitional Muddy Creek formation), or UMCf (Upper Muddy Creek formation). This lithologic nomenclature is described in the January 6, 2009 letter (*Hydrogeologic and Lithologic Nomenclature Unification)* from NDEP to the Companies.
Sample Matrix Identification/ code	matrix	A short code that designates the matrix of the sample. A recommended set is provided in Appendix B.
Sample Type Identification/ code	sample_type	A short code that designates the sample type (e.g. Field Duplicate as FD). A recommended set is provided in Appendix C.
Analytical Method Name/code	analytical_method	An identifier for the analytical method used for that suite of analyses. The identifier should include the version of the method. For example, many of the SW-846 methods have a letter at the end to indicate the version (e.g. 8330B). A recommended format is provided in Appendix D.
Preparation Method Name/code	preparation_method	An identifier for the preparation method used for that suite of analyses. Use the same guidelines as found in Appendix D.

Short Description	Field Name	Detailed Description
Analytical Suite	analytical_suite	A short code that designates the analytical suite, such as SVOC. A recommended list is provided in Appendix E.
Analyst Name	analyst_name	The name, or initials, of the analyst that performed the analysis. This field is required for asbestos results.
Total or Dissolved	filtered_flag	A flag T (true) or F (false) indicating whether the sample was filtered. T indicates the aqueous sample was filtered and is dissolved.
Sample Date	sample_date	The Year, Month, and Day of sample collection. Requested format: XXXXYYZZ, where XXXX=year, YY= month, and ZZ = day of month. This same format shall be used for all dates.
Sample Time	sample_time	The Hour:Minute:Seconds sample was collected. A 24 hour format is requested: 12:15:00 indicates 15 minutes after Noon. One hour later would be 13:15:00.
Preparation Date	prep_date	The Year, Month, and Day of laboratory sample preparation. Requested format: XXXXYYZZ, where XXXX=year, YY= month, and ZZ = day of month. This same format shall be used for all dates.
Preparation Time	prep_time	The Hour:Minute:Seconds the sample was prepared. A 24 hour format is requested: 12:15:00 indicates 15 minutes after Noon. One hour later would be 13:15:00.
Analysis Date	analysis_date	The Year, Month, and Day of sample analysis. Requested format: XXXXYYZZ, where XXXX=year, YY= month, and ZZ = day of month. This same format shall be used for all dates.
Analysis Time	analysis_time	The Hour:Minute: Seconds the sample was analyzed. A 24 hour format is requested: 12:15:00 indicates 15 minutes after Noon. One hour later would be 13:15:00.
CAS id or short code	cas_id	The Chemical Abstracts Society designation for the analyte, or a suitable code if no CAS designation for the analyte in question. Approved codes are listed in Appendix I. Asbestos types are treated as chemicals, in that each asbestos type (Total Chrysotile Protocol Structure, Long Chrysotile Protocol Structure, Long Amphibole Protocol Structure, Total Amphibole Protocol Structure, Long Asbestos Protocol Structure, Total Asbestos Protocol Structure) has its own code This field is also used to capture physical parameters. Appropriate physical parameters are provided in Appendix F.

Short Description	Field Name	Detailed Description
Chemical Name	analyte_name	A unique name for the analyte which corresponds to the code in the cas_id field. Approved names are listed in Appendix I.
Result Type Code	result_type	A short code to indicate the type of result for this record. Acceptable values include: TG (Target), SURR (Surrogate), IS (Internal Standard), SC (Spike Compound), TIC (tentatively Identified Compound). Others should be recommended by the Companies during review of this EDD guidance.
Initial or Reanalysis	reanalysis_flag	The field should contain either "Initial" or "Reanalysis" or similar designations to indicate whether the result is from the initial analysis or reanalysis. A sample that requires dilution and subsequent reanalysis would be so designated as would a sample that required re-extraction.
Lab Reported Result	result_reported	The analytical value for that analyte (or physical parameter) as reported by the laboratory. For asbestos, this is the number of structures.
Result Units	result_units	Units associated with the reported value.
Reported Results Uncertainty	result_uncertainty	The uncertainty value associated with the laboratory reported results. This will apply to radionuclides and possibly other analytes (e.g. XRF analysis results). This field is not applicable to asbestos. The DVSR (or laboratory report within the DVSR) should define the uncertainty (e.g. one sigma).
Asbestos Sensitivity	asbestos_analytical_sensitivity	The analytical sensitivity associated with the asbestos results. This should be the Mean value, not a 95% UCL value.
Asbestos Sensitivity Units	asbestos_sensitivity_units	The units associated with the asbestos sensitivity value (structures/gram usually as S/g PM10).
Detect Flag	detect_flag	A flag, T (true) or F (false), to indicate whether the value is considered a detection or not. Values less than the Sample Quantitation Limit (SQL) are generally considered Not Detected. Radionuclides and other reported values that are not censored at the laboratory will be reported as T. For all radionuclide results, the flag will always equal T (true) indicating a value (positive or negative) was reported, regardless of the value relative to the MDA.
Method Detection Limit	method_detection_limit	The Method Detection Limit for the analyte. This definition should follow the December 3, 2008 NDEP guidance entitled *Detection Limits and Data Reporting*
Sample Quantitation Limit	sample_quantitation_limit	The SQL for the analytes. This definition should follow the December 3, 2008 NDEP guidance entitled *Detection Limits and Data Reporting*

Short Description	Field Name	Detailed Description
Practical Quantitation Limit	practical_quantitation_limit	The Practical Quantitation Limit (PQL) for the analyte. This definition should follow the December 3, 2008 NDEP guidance entitled *Detection Limits and Data Reporting*
Minimum Detectable Activity	minimum_detectable_activity	The Minimum Detectable Activity, also known as Minimum Detectable Concentration. This is used for radionuclide results.
Percent Moisture	percent_moisture	The percentage of moisture of a solid sample. Please provide this record as a whole number, such as 95 for 95% moisture (no decimal).
Dilution Factor	dilution_factor	Any dilution factor used to arrive at the final reported value.
Laboratory Qualifier	lab_qualifier	The qualifier that may have been assigned to a reported value by the laboratory that performed the analysis.
Was result validated	validation_flag	A flag, T (true) or F (false). T indicates the value was validated after the laboratory reported the value.
Validation Stage	validation_stage	The stage to which the data has been validated. This stage designation should be consistent with the NDEP Guidance dated April 19, 2009. Stage 2B or 4 are the anticipated values. The terms used need to be defined in the DVSR.
Final Validation Qualifier	final_validation_qualifier	The final non-laboratory qualifier applied to the value.
Final Validation Reason Codes	final_validation_reason_codes	The reason code(s) that corresponds to the final Validation Qualifier (if more than one code, should be represented as a comma-separated list of codes). At this point there is no specified set of values. The companies may use their codes (and combination of codes) as long as all values are defined in the DVSR. All validation values should be consistent with the December 3, 2008 NDEP guidance entitled *Detection Limits and Data Reporting* document. For example, any reference to a sensitivity indicator (SQL, PQL etc) should be consistent with that guidance and only those sensitivity indicators should be used.
Validation Reason Code	validation_reason_code	Individual validation reason code used in lookup table.
Final Validation Reason Description	final_validation_reason	The description of the reason code. For example, Holding Time Exceeded. The description should be consistent with the DVSR.
Comment Field (Sample)	sample_comment	A field to include comments associated with a specific sample.

Short Description	Field Name	Detailed Description
Comment Field (Result)	result_comment	A field to include comments associated with a specific result.

Appendix A: EDD Database Tables

The EDD should be a Microsoft Access database containing at least four tables: a samples table, a results table, a locations table, and a validation_reason table. The samples table will contain sample metadata and will have field_sample_id as its primary key. The results table will link to the samples table using field_sample_id as a foreign key. The validation reason will have rows consisting of the dvsr_id, the company-specific validation_reason_code, and the corresponding reason description.

For convenience, the EDD database should also contain a query that links the samples, location, and result tables, allowing a "flat-file" view of the data.

Details of the fields included in each table are shown in the table below. The data type of all fields should be text, except where indicated below.

Field Name	Table(s)
dvsr_id	**samples**(foreign key, references validation_reason table) **validation_reason**
final_validation_reason	**validation_reason**
final_validation_reason_code	**validation_reason** (forms primary key in combination with dvsr_id) **results**(foreign key, references validation_reason table)
sub_area lou northing (number) easting (number) hydro litho	**locations**
location_id	**locations(primary key)** **samples(foreign key, references locations table)**
sample_top_depth (number) sample_bottom_depth (number) matrix sample_type filtered_flag sample_date (date) sample_time (time) percent_moisture (number) sample_collection_comment sample_comment	**samples**
sample_id_field	**samples**(primary key) **results**(foreign key, references sample_id field in samples table)

Field Name	Table(s)
analytical_method	
preparation_method	
analytical_suite	
analyst_name	
asbestos_type	
analysis_date (date)	
analysis_time (time)	
prep_date (date)	
prep_time (time)	
analyte_name	
cas_id	
result_type	
reanalysis_flag	
result_reported (number)	
result_units	
result_uncertainty (number)	
asbestos_sensitivity (number)	
asbestos_sensitivity_units	
detect_flag	
method_detection_limit (number)	
sample_quantitation_limit (number)	
practical_quantitation_limit (number)	
minimum_detectable_activity (number)	
dilution_factor (number)	
sample_id_lab	
lab_id	
sdg_id	
batch_id	
lab_qualifier	
validation_flag	
validation_stage	
final_validation_qualifier	
result_comment	**results**

Appendix B: Sample Matrix Identification/Code

matrix	Sample Matrix Identification
AO	Outdoor Air
AI	Indoor Air
AG	Soil Gas
AF	Flux Chamber Air
SD	Sediment
SO	Soil
SW	Swab or Wipe
TA	Animal Tissue
TP	Plant Tissue
WS	Surface Water
WG	Ground Water
NAPL	Non-aqueous phase liquid
BW	Blank Water

Appendix C: Sample Type Identification/Code

Sample Type Code	Description
AB	Ambient Conditions Blank
BD	Blank Spike Duplicate
BS	Blank Spike
DIL	Diluted Sample
EB	Equipment Blank
ER	Equipment Rinse
FB	Field Blank
FD	Field Duplicate Sample
FR	Field Replicate
FS	Field Spike
FLD	Field analyses such as pH, temperature, specific conductance
KD	Known (External Reference Material) Duplicate
LB	Lab Blank
LD	Lab Duplicate
LCS	Lab Control Spike
LCSD	Lab Control Spike Duplicate
LR	Lab Replicate
MB	Material/Method Blank
MBD	Material/Method Blank Duplicate
MS	Matrix Spike Lab
MSD	Lab Matrix Spike and Spike Duplicate pair considered as one sample
NORM	Normal Environmental Sample taken in field
ORIG	Original sample in laboratory
SPB	Soil Prep Blank
WPB	Water Prep Blank
RD	Regulatory Duplicate
RE	Re-analysis
RM	Known (External Reference Material) Rinsate
RN	Rinsate
SD	Lab Matrix Spike Duplicate considered as separate from spike
SPT	A field split sample
TB	Trip Blank
TBD	Trip Blank Duplicate

WT	Waste
FDMS	A combination field duplicate matrix spike

Appendix D: Analytical Method Name/Code Guidance

Recommended format and guidance for analytical names:

- If the method is based on the United Stated Environmental Protection Agency (EPA) SW-846, start the name with "SW-" followed by the number and any applicable letter: XXXXc such as 8260b (SW-8260b).
- If the method is based on an EPA method that includes a digit after the period (e.g. Clean Water Act methods), be sure to include that, even if the digit is zero. Start the name with EPA: EPA 300.0
- If the method is based on an EPA document and citing that document is sufficient to understand the method used, include the document number: EPA-540-R97-028.
- If the method is based on an ASTM method, include ASTM- prior to the letter and number designation: ASTM D5755-03. Be sure to include the Based Designation (D5755) and Edition-Version (-03).
- If the method is based on Standard Methods for the Examination of Water and Wastewater, include "SM" prior to the number along with the Base Designation (7500) and the method version (-Ra). The results would be "SM7500-Ra." The DVSR should include the edition (e.g. 18th edition) or year the method was approved.
- Proprietary methods specific to a laboratory should have a designation that can be traced to the DVSR and method standard operating procedure (SOP). The version of the method needs be included in the DVSR and may also be incorporated into the EDD.

Preparation methods are not absolutely required in the EDD but a field (preparation_method) is included in the EDD structure to provide this information. However, all preparation methods that are distinct from the determination method must be included in the DVSR report. If preparation methods are included in the EDD they need to be in a separate column.

A designation indicating that method is a modified version (e.g. mod) is recommended but not required. However, the DVSR should indicate if the method is a modified version of a published method.

Appendix E: Analytical Suite Name/Code

Analytical Method Code	Description
ALDH	Aldehyde analysis
ASB	Asbestos
CRVL	Hexavalent chromium
CYAN	Cyanide
DIO_FUR	Dioxin and Furan
FIELD	Field measurements
GENERAL	Wet chemistry type measurements anions, hardness, bicarbonate, alkalinity, perchlorate, ammonia, bromide, TKN, etc
HERB	Herbicides
METALS	Metals and elements using ICP, AA, ICP-MS
ORG_ACID	Organic Acids analysis
PCB	PCB analysis, aroclors or congeners.
WPH	pH of aqueous sample
OCPEST	Organo-chlorine pesticide
OPPEST	Organo-phosphate pesticide
SOLIDS	TDS, TSS
SVOC	Semi-Volatile Organic Compounds, exclusive of Pesticides, PCBs, and PAHs.
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons, all molecular weights
VOC	Volatile Organic Compounds
XRFMetals	Metals and elements using XRF.
RADS	Radionuclides
PAH	Polyaromatic Hydrocarbon
TEM	Transmission Electron Microscopy (asbestos)
PLM	Polarized Light Microscopy (asbestos)
XRD	X-ray Diffraction (asbestos and metals)

Appendix F: Field Measurements

cas_id	Physical Parameter (analyte_name)
DETWA	Depth to Water
DO	Dissolved Oxygen
TEMP	Groundwater Temperature (°C)
EC	Electrical Conductivity
ORP	Oxidation Reduction Potential - Redox
WPH	Aqueous pH

Appendix G: Hydraulic Parameters

ID	Description
HYCO	Hydraulic Conductivity
STOR	Storativitity
TRANS	Transmissivity

Appendix H: Soil Material Properties

ID	Description
CEC	Cation Exchange Capacity
DBD	Dry Bulk Density
GSD	Grain Size Distribution
USCS	Unified Soil Classification System Description
FOC	Fraction Organic Carbon
MSC	Munsell Soil Color
SGR	Specific Gravity
SPH	Soil pH
TOP	Total Porosity
VMC	Volumetric Moisture Content
VWC	Volumetric Water Content

Appendix I: CAS IDS/ANALYTE CODES

cas_id	analyte_name
#100 SIEVE	#100 SIEVE
#16 SIEVE	#16 SIEVE
#200 SIEVE	#200 SIEVE
#30 SIEVE	#30 SIEVE
#4 SIEVE	#4 SIEVE
#50 SIEVE	#50 SIEVE
#8 SIEVE	#8 SIEVE
Z7HEX	[Z]-7-Hexadecene
630-20-6	1,1,1,2-Tetrachloroethane
71-55-6	1,1,1-Trichloroethane
79-34-5	1,1,2,2-Tetrachloroethane
79-00-5	1,1,2-Trichloroethane
782-08-1	1,1-Bis[4-chlorophenyl]chloromethane
513-88-2	1,1-Dichloroacetone
75-34-3	1,1-Dichloroethane
75-35-4	1,1-Dichloroethene
563-58-6	1,1-Dichloropropene
75-37-6	1,1-Difluoroethane
608-73-1	1,2,3,4,5,6-Hexachlorocyclohexane
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin
1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-HpCDD
1,2,3,4,6,7,8-HpCDF	1,2,3,4,6,7,8-HpCDF
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin
1,2,3,4,7,8-HxCDF	1,2,3,4,7,8-HxCDF
634-66-2	1,2,3,4-Tetrachlorobenzene
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin
1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-HxCDD
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin
1,2,3,7,8-PeCDD	1,2,3,7,8-PeCDD
1,2,3,7,8-PeCDF	1,2,3,7,8-PeCDF
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin
87-61-6	1,2,3-Trichlorobenzene
96-18-4	1,2,3-Trichloropropane
95-94-3	1,2,4,5-Tetrachlorobenzene
95-94-3i	1,2,4,5-Tetrachlorobenzene Isomer
291-22-5	1,2,4,5-Tetrathiane
120-82-1	1,2,4-Trichlorobenzene
95-63-6	1,2,4-Trimethylbenzene
289-16-7	1,2,4-Trithiolane

cas_id	analyte_name
6576-93-8	1,2,5-Trithiepane
84-69-5	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester
100014-25-3	1,2-Bis[bis[2-chloroethyl]phos
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane
430-58-0	1,2-Dichloro-1-fluoroethylene
95-50-1	1,2-Dichlorobenzene
107-06-2	1,2-Dichloroethane
17060-07-0	1,2-Dichloroethane-d4
540-59-0	1,2-Dichloroethene
78-87-5	1,2-Dichloropropane
624-73-7	1,2-Diiodoethane
122-66-7	1,2-Diphenylhydrazine
540-63-6	1,2-Ethanedithiol
163	1,3 & 1,4 Dichlorobenzenes
108-70-3	1,3,5-Trichlorobenzene
108-67-8	1,3,5-Trimethylbenzene
106-99-0	1,3-Butadiene
55880-77-8	1,3-Butadiene, pentachloro-
534-07-6	1,3-Dichloroacetone
541-73-1	1,3-Dichlorobenzene
142-28-9	1,3-Dichloropropane
542-75-6	1,3-Dichloropropene
1193-11-9	1,3-Dioxolane, 2,2,4-trimethyl
144-19-4	1,3-Pentanediol
100012-68-9	1,4,7-Androstatrien-3,17-dione
14D22CEBZ	1,4-dichloro-2-[2-chloroethenyl]-benzene
106-46-7	1,4-Dichlorobenzene
3855-82-1	1,4-Dichlorobenzene-d4
123-91-1	1,4-Dioxane
17647-74-4	1,4-Dioxane-d8
3650-28-0	1,4-Methanoindan, hexahydro-7-isopropyl-4-methyl-8-methylene
SIEVE_1/2-IN	1/2-IN SIEVE
6285-05-8	1-[4-chlorophenyl]-1-Propanone
SIEVE_1-1/2-IN	1-1/2-IN SIEVE
109719-83-7	13C-1,2,3,4,6,7,8-HpCDD
109719-84-8	13C-1,2,3,4,6,7,8-HpCDF
114423-98-2	13C-1,2,3,4,7,8-HXCDF
109719-81-5	13C-1,2,3,6,7,8-HxCDD
109719-79-1	13C-1,2,3,7,8-PeCDD
109719-77-9	13C-1,2,3,7,8-PeCDF
76523-40-5	13C-2,3,7,8-TCDD
89059-46-1	13C-2,3,7,8-TCDF
114423-97-1	13C-Octachlorodibenzodioxin
127062-51-5	13-Hexyloxacyclotridec-10-EN-2
17351-34-7	14-Pentadecenoic acid
4764-72-1	15-Octadecenoic acid, methyl e
6971-40-0	17-Pentatriacontene
2642-80-0	1-Chloro-2,2-bis(p-chlorophenyl)ethane

cas_id	analyte_name
628-34-2	1-Chloro-2-ethoxyethane
544-10-5	1-Chlorohexane
629-96-9	1-Eicosanol
95-14-7	1H-Benzotriazole
1H1PP2	1-hydroxy,1-phenyl,propanon-2
SIEVE_1-IN	1-IN SIEVE
590-67-0	1-Methylcyclohexanol
108-03-2	1-Nitropropane
6570-87-2	1-Pentanol, 3,4-dimethyl-
5155-70-4	1-Phenanthrenecarboxylic acid
78-83-1	1-Propanol, 2-methyl-
69102-77-8	1-Propene, pentachloro-
112-34-5	2-(2-Butoxyethoxy)ethanol
706-14-9	2(3H)-Furanone, 5-hexyldihydro-
208263-75-6	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl-C13
234432-92-9	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl-C13
105600-26-8	2,2',3,3',5,5',6,6'-Octachlorobiphenyl-C13
232919-67-4	2,2',3,3',5,5',6-Heptachlorobiphenyl-C13
234432-91-8	2,2',3,4',5,6,6'-Heptachlorobiphenyl-C13
464-06-2	2,2,3-Trimethylbutane
234432-90-7	2,2',4,4',6,6'-Hexachlorobiphenyl-C13
234432-89-4	2,2',4,6,6'-Pentachlorobiphenyl-C13
540-84-1	2,2,4-Trimethylpentane
234432-88-3	2,2',6,6'-Tetrachlorobiphenyl-C13
234432-87-2	2,2',6-Trichlorobiphenyl-C13
DCBZL	2,2'-/4,4'-Dichlorobenzil
234432-86-1	2,2'-Dichlorobiphenyl-C13
594-20-7	2,2-Dichloropropane
100014-71-4	2,2'-Dichlorostilbene
590-35-2	2,2-Dimethylpentane
1003-17-4	2,2-Dimethyltetrahydrofuran
234446-64-1	2,3,3',4,4',5,5',6-Octachlorobiphenyl-C13
208263-73-4	2,3,3',4,4',5,5'-Heptachlorobiphenyl-C13
208263-68-7	2,3,3',4,4',5-Hexachlorobiphenyl-C13
208263-62-1	2,3,3',4,4'-Pentachlorobiphenyl-C13
235416-29-2	2,3,3',5,5'-Pentachlorobiphenyl-C13
208263-69-8	2,3',4,4',5,5'-Hexachlorobiphenyl-C13
208263-63-2	2,3,4,4',5-Pentachlorobiphenyl-C13
208263-64-3	2',3,4,4',5-Pentachlorobiphenyl-C13
104130-40-7	2,3',4,4',5-Pentachlorobiphenyl-C13
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran
2346TCP	2,3,4,6-Tetrachloropyridine
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran
921-47-1	2,3,4-trimethylhexane
2402-79-1	2,3,5,6-Tetrachloropyridine
2,3,7,8-TCDF	2,3,7,8-TCDF
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran
TCDD2378CL37	2,3,7,8-tetrachlorodibenzo-p-dioxin-CL37
1746-01-6	2,3,7,8-Tetrachlororodibenzo-p-dioxin

cas_id	analyte_name
31566-10-6	2,3-Dicarbaheptaborane[7], 2,3-dimethyl-
565-59-3	2,3-Dimethylpentane
4808-48-4	2,3-Diphenylmaleic anhydride
208263-76-7	2,4,4'-Trichlorobiphenyl-C13
93-76-5	2,4,5-T
93-72-1	2,4,5-TP [Silvex]
95-95-4	2,4,5-Trichlorophenol
118-79-6	2,4,6-Tribromophenol
88-06-2	2,4,6-Trichlorophenol
94-75-7	2,4-D
94-82-6	2,4-DB
53-19-0	2,4-DDD
3424-82-6	2,4-DDE
789-02-6	2,4'-DDT
789-05-6i	2,4'-DDT isomer
120-83-2	2,4-Dichlorophenol
19719-28-9	2,4-Dichlorophenylacetic acid
108-08-7	2,4-Dimethylpentane
105-67-9	2,4-Dimethylphenol
51-28-5	2,4-Dinitrophenol
121-14-2	2,4-Dinitrotoluene
1618-26-4	2,4-Dithiapentane
1618-26-4[1]	2,4-Dithiapentane isomer 1
1921-70-6	2,6,10,14-Tetramethylpentadecane
28469-92-3	2,6-Dichlorostyrene
1072-05-5	2,6-Dimethylheptane
606-20-2	2,6-Dinitrotoluene
128-37-0	2,6-Di-tert-Butyl-p-Cresol
112-07-2	2-Butoxyethyl acetate
126-99-8	2-Chloro-1,3-butadiene
118-91-2	2-Chlorobenzoic acid
609-65-4	2-Chlorobenzoyl chloride
611-19-8	2-Chlorobenzylchloride
234432-85-0	2-Chlorobiphenyl-C13
110-75-8	2-Chloroethyl vinyl ether
91-58-7	2-Chloronaphthalene
95-57-8	2-Chlorophenol
95-49-8	2-Chlorotoluene
1121-05-7	2-Cyclopenten-1-one, 2,3-dimethyl-
3913-81-3	2-Decenal, [e]-
110-80-5	2-Ethoxyethanol
111-15-9	2-Ethoxyethyl acetate
104-76-7	2-Ethyl-1-hexanol
149-57-5	2-Ethylhexanoic acid
103-09-3	2-Ethylhexyl acetate
24468-13-1	2-ethylhexyl chloroformate
403-19-0	2-Fluoro-4-nitrophenol
1526-17-6	2-Fluoro-6-nitrophenol
321-60-8	2-Fluorobiphenyl

cas_id	analyte_name
367-12-4	2-Fluorophenol
591-78-6	2-Hexanone
149-30-4	2-Mercaptobenzothiazole
994-05-8	2-Methoxy-2-methyl-butane
55045-07-3	2-Methyl-6-propyldodecane
591-76-4	2-Methylhexane
91-57-6	2-Methylnaphthalene
88-74-4	2-Nitroaniline
88-75-5	2-Nitrophenol
79-46-9	2-Nitropropane
3760-11-0	2-Nonenoic acid
111-13-7	2-Octanone
75207-54-4	2-Pentacosanone
58175-57-8	2-Propyl-1-pentanol
2463-77-6	2-Undecenal
208263-70-1	3,3',4,4',5,5'-Hexachlorobiphenyl-C13
208263-65-4	3,3',4,4',5-Pentachlorobiphenyl-C13
105600-23-5	3,3',4,4'-Tetrachlorobiphenyl-C13
91-94-1	3,3-Dichlorobenzidine
562-49-2	3,3-Dimethylpentane
208461-24-9	3,4,4',5-Tetrachlorobiphenyl-C13
208263-79-0	3,4,4'-Trichlorobiphenyl-C13
926-82-9	3,5-Dimethylheptane
591-22-0	3,5-dimethyl-pyridine
100014-71-3	3,6-Dichloro-benzene-1,2-diol
SIEVE_3/4-IN	3/4-IN SIEVE
SIEVE_3/8-IN	3/8-IN SIEVE
2037-31-2	3-chlorobenzenethiol
535-80-8	3-Chlorobenzoic acid
620-20-2	3-Chlorobenzylchloride
4867-37-2	3-Chlorothioanisole
617-78-7	3-Ethylpentane
3HEX25D	3-Hexene-2,5-dione
6418-41-3	3-Methyl tridecane
72218-58-7	3-Methylheptyl acetate
589-34-4	3-Methylhexane
99-09-2	3-Nitroaniline
565-80-0	3-Pentanone, 2,4-dimethyl-
465-80-0	3-pentanone, 2,4-dimetyl-
625-33-2	3-Penten-2-one
72-54-8	4,4-DDD
72-55-9	4,4-DDE
50-29-3	4,4-DDT
44DCBZL	4,4-Dichlorobenzil
90-98-2	4,4'-Dichlorobenzophenone
208263-67-6	4,4'-Dichlorobiphenyl-C13
5181-10-2	4,4'-Dichlorodiphenylsulphide
534-52-1	4,6-Dinitro-2-methylphenol
481216-TMH	4,8,12,16-Tetramethylheptadecan-4-olide

cas_id	analyte_name
1918-02-1	4-Amino-3,5,6-trichloropicolinic acid
460-00-4	4-Bromofluorobenzene
101-55-3	4-Bromophenyl phenyl ether
59-50-7	4-Chloro-3-methylphenol
98-66-8	4-Chlorobenzene sulfonic acid
74-11-3	4-Chlorobenzoic acid
104-83-6	4-Chlorobenzylchloride
208263-77-8	4-Chlorobiphenyl-C13
22711-23-5	4-Chlorodibenzoyl
106-48-9	4-Chlorophenol
98-57-7	4-Chlorophenyl methyl sulfone
7005-72-3	4-Chlorophenyl phenyl ether
123-09-1	4-Chlorothioanisole
106-54-7	4-Chlorothiophenol
106-43-4	4-Chlorotoluene
622-96-8	4-Ethyltoluene
108-10-1	4-Methyl-2-pentanone [MIBK]
100-01-6	4-Nitroaniline
100-02-7	4-Nitrophenol
3744-02-3	4-Penten-2-One, 4-Methyl-
5166-53-01	5-methyl-3-hexen-2-one
100014-00-7	6S-2,3,8,8-tetramethyltricyclo
82-05-3	7H-Benz[de]anthracen-7-one
7225-66-3	7-Hexly Tridecane
7225-66-3[1]	7-Hexly Tridecane Isomer
7225-66-3[2]	7-Hexly Tridecane Isomer 1
605-48-1	9,10-Dichloroanthracene
60-33-3	9,12-Octadecadienoic acid (Z,Z)-
301-02-0	9-Octadecenamide, (z)-
3906-30-7	9-Octadecenamide, n,n-dimethyl
112-79-8	9-Octadecenoic acid, [e]-
83-32-9	Acenaphthene
208-96-8	Acenaphthylene
75-07-0	Acetaldehyde
822-23-1	Acetic acid, Octadecyl ester
1878-66-6	Acetic acid, p-chlorophenyl-
67-64-1	Acetone
75-05-8	Acetonitrile
98-86-2	Acetophenone
532-27-4	Acetophenone, 2-chloro-
107-02-8	Acrolein
107-13-1	Acrylonitrile
14952-40-0	Actinium-227
14331-83-0	Actinium-228
15972-60-8	Alachlor
309-00-2	Aldrin
ALKB	Alkalinity, Bicarbonate [As CaCO3]
ALKC	Alkalinity, Carbonate [As CaCO3]
107-05-1	Allyl chloride

cas_id	analyte_name
12587-46-1	ALPHA activity
319-84-6[1]	Alpha Lindane Isomer 1
319-84-6[2]	Alpha Lindane Isomer 2
A2PPBZMETH	alpha-2-propenylbenzenemethanol
319-84-6	alpha-BHC
6753-98-6	alpha-Caryophyllene
5103-71-9	alpha-Chlordane
7429-90-5	Aluminum
14596-10-2	Americium-241
NH3NH3	Ammonia [as Ammonium]
NH3_N	Ammonia [as N]
7664-41-7	Ammonia [as N]
14798-03-9	Ammonium
62-53-3	Aniline
120-12-7	Anthracene
7440-36-0	Antimony
Apparent Color	Apparent Color
12674-11-2	Aroclor 1016
11104-28-2	Aroclor 1221
11141-16-5	Aroclor 1232
53469-21-9	Aroclor 1242
12672-29-6	Aroclor 1248
11097-69-1	Aroclor 1254
11096-82-5	Aroclor 1260
37324-23-5	Aroclor 1262
11100-14-4	Aroclor 1268
7440-38-2	Arsenic
22541-54-4	Arsenic III
17428-41-0	Arsenic V
1332-21-4	Asbestos
3244-90-4	Aspon
1912-24-9	Atrazine
2642-71-9	Azinphos-ethyl
86-50-0	Azinphos-methyl
103-33-3	Azobenzene
7440-39-3	Barium
100-52-7	Benzaldehyde
134-96-3	Benzaldehyde, 4-hydroxy-3,5-dimethoxy-
55-21-0	Benzamide
39193-06-1	Benzamide, 4-chloro-n-[4-chlor
71-43-2	Benzene
53172-84-2	Benzene, (1-methyl-1-butenyl)-
622-38-8	Benzene, [ethylthio]-
1193-82-4	Benzene, [methylsulfinyl]-
1520-42-9	Benzene, 1,1',1''-(1-ethanyl-2-ylidene)tris-
3085-42-5	Benzene, 1,1'-sulfinylbis[4-chloro-
54935-00-1	Benzene, 1,4-dichloro-2-[2-chloroethenyl]
1123-84-8	Benzene, 1,4-dichloro-2-ethenyl-
45892-47-5	Benzene, 2,4-dichloro-1-[2-chl

cas_id	analyte_name
1078-71-3	Benzene, heptyl-
101-41-7	Benzeneacetic acid, methyl ester
5597-50-2	Benzenepropanoic acid, 4-hydro
103-25-3	Benzenepropanoic acid, methyl
98-64-6	Benzenesulfonamide, 4-chloro-
98-11-3	Benzenesulfonic acid
92-87-5	Benzidine
56-55-3	Benzo[a]anthracene
50-32-8	Benzo[a]pyrene
B[b&k]F	Benzo[b,k]fluoranthene
205-99-2	Benzo[b]fluoranthene
191-24-2	Benzo[g,h,i]perylene
207-08-9	Benzo[k]fluoranthene
65-85-0	Benzoic acid
1421-49-4	Benzoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-
2905-65-9	Benzoic acid, m-chloro-
119-61-9	Benzophenone
119-61-9	Benzophenone
33093-42-4	Benzophenone, 3,4,4'-trichloro
100-51-6	Benzyl alcohol
100-44-7	Benzyl chloride
7440-41-7	Beryllium
12587-47-2	BETA activity
319-85-7	beta-BHC
71-52-3	Bicarbonate alkalinity
141-66-2	Bidrin
BOD	Biochemical Oxygen Demand
92-52-4	Biphenyl
1142-19-4i	Bis(4-chlorophenyl) disulfide isomer
2393-97-7	Bis(4-chlorophenylthio)methane
111-91-1	bis[2-Chloroethoxy]methane
111-44-4	bis[2-Chloroethyl] ether
108-60-1	bis[2-Chloroisopropyl] ether
117-81-7	bis[2-Ethylhexyl] phthalate
103-23-1	bis[2-ethylhexyl]adipate
103-23-1	bis[2-ethylhexyl]adipate
80-07-9	bis[p-Chlorophenyl] sulfone
1142-19-4	bis[p-Chlorophenyl]disulfide
3561-67-9	Bis[phenylthio]methane
7440-69-9	Bismuth
14331-79-4	Bismuth-210
15229-37-5	Bismuth-211
14913-49-6	Bismuth-212
14733-03-0	Bismuth-214
80-05-7	Bisphenol A
35400-43-2	Bolstar (Sulprofos)
7440-42-8	Boron
314-40-9	Bromacil
24959-67-9	Bromide

cas_id	analyte_name
7726-95-6	Bromine
108-86-1	Bromobenzene
75-27-4	Bromodichloromethane
75-25-2	Bromoform
74-83-9	Bromomethane
23184-66-9	Butachlor
78-78-4	Butane, 2-methyl-
85-68-7	Butylbenzyl phthalate
7440-43-9	Cadmium
58-08-2	Caffeine
7440-70-2	Calcium
CTIC	Calculated Inorganic Carbon
334-48-5	Capric acid
124-07-2	Caprylic acid
86-74-8	Carbazole
7440-44-0	Carbon
124-38-9	Carbon dioxide
75-15-0	Carbon disulfide
56-23-5	Carbon tetrachloride
3812-32-6	Carbonate alkalinity
786-19-6[1]	Carbophenothion
786-19-6	Carbophenothion
100015-81-8	Caryophyllene
CEC	Cation Exchange Capacity
7440-46-2	Cesium
13967-70-9	Cesium-134
10045-97-3	Cesium-137
COD	Chemical Oxygen Demand
75-87-6	Chloral
7790-93-4	Chlorate
12789-03-6	Chlordane
57-74-9	Chlordane
470-90-6	Chlorfenvinfos
16887-00-6	Chloride
7782-50-5	Chlorine
13898-47-0	Chlorite
24934-91-6	Chlormephos
C2CEB	chloro[2-chloroethyl]-benzene
107-20-0	Chloroacetaldehyde
108-90-7	Chlorobenzene
74-97-5	Chlorobromomethane
124-48-1	Chlorodibromomethane
75-00-3	Chloroethane
67-66-3	Chloroform
593-71-5	Chloroiodomethane
74-87-3	Chloromethane
5598-13-0	Chloropyrifos-methyl
2921-88-2	Chlorpyrifos
ChlorpyrophosME	Chlorpyrophos methyl ester

cas_id	analyte_name
7440-47-3	Chromium
18540-29-9	Chromium [VI]
218-01-9	Chrysene
156-59-2	cis-1,2-Dichloroethene
10061-01-5	cis-1,3-Dichloropropene
7440-48-4	Cobalt
13981-50-5	Cobalt-57
13981-38-9	Cobalt-58
10198-40-0	Cobalt-60
COBBLES	COBBLES
7440-50-8	Copper
56-72-4	Coumaphos
7700-17-6	Crotoxyphos
57-12-5	Cyanide, Total
2597-49-1	Cyclobutane, ethenyl-
293-96-9	Cyclodecane
1501-82-2	Cyclododecene
110-82-7	Cyclohexane
10498-35-8	Cyclohexane, 1,2-dichloro-, cis-
822-86-6	Cyclohexane, 1,2-dichloro-, trans-
1122-82-3	Cyclohexane, isothiocyanato-
108-87-2	Cyclohexane, Methyl-
80-53-5	Cyclohexanemethanol, 4-hydroxy
108-94-1	Cyclohexanone
55255-41-9	Cyclopentane, [trichloroethenyl]
2453-00-1	Cyclopentane, 1,3-dimethyl-
2532-58-3	Cyclopentane, 1,3-dimethyl-, cis-
1640-89-7	Cyclopentane, ethyl-
96-37-7	Cyclopentane, methyl-
541-02-6	Cyclopentasiloxane, decamethyl
99-87-6	Cymene [Isopropyltoluene]
D15_COEFF	D15 COEFF
D30_COEFF	D30 COEFF
D50_COEFF	D50 COEFF
D60_COEFF	D60 COEFF
D85_COEFF	D85 COEFF
75-99-0	Dalapon
8017-34-3	DDT, Technical
105600-27-9	Decachlorobiphenyl-C13
DTN	decahydro-trans-Napthalene
6975-98-0	Decane, 2-methyl-
13151-34-3	Decane, 3-methyl-
119-07-3	Decyl octyl phthalate
319-86-8i	Delta Lindane Isomer
319-86-8	delta-BHC
11B-delta	DELTA-BORON 11
8065-48-3	Demeton
298-03-3	Demeton-O
126-75-0	Demeton-S

cas_id	analyte_name
123-42-2	Diacetone alcohol
333-41-5	Diazinon
53-70-3	Dibenzo[a,h]anthracene
132-64-9	Dibenzofuran
132-65-0	Dibenzothiophene
73506-94-2	Dibromochloroethane
124-48-1	Dibromochloromethane
96-12-8	Dibromochloropropane
1868-53-7	Dibromofluoromethane
74-95-3	Dibromomethane
1918-00-9	Dicamba
DICBTOT	DiCB-[12]+[13]
97-17-6	Dichlorfenthion
79-02-7	Dichloroacetaldehyde
594-04-7	Dichloroiodomethane
75-09-2	Dichloromethane [Methylene chloride]
120-36-5	Dichloroprop
62-73-7	Dichlorvos
60-57-1	Dieldrin
110-81-6	Diethyl disulfide
84-66-2	Diethyl phthalate
352-93-2	Diethyl sulfide
108-20-3	Diisopropyl ether
60-51-5	Dimethoate
131-11-3	Dimethyl phthalate
67-68-5	Dimethyl sulfoxide
624-92-0	Dimethyldisulfide
84-74-2	Di-n-butyl phthalate
117-84-0	Di-n-octyl phthalate
88-85-7	Dinoseb
TEQ_DF	Dioxins/Furans TEQ
78-34-2	Dioxothion
882-33-7	Diphenyl disulfide
139-66-2	Diphenyl sulfide
127-63-9	Diphenyl sulfone
501-65-5	Diphenylethyne
101-81-5	Diphenylmethane
DPPT	diphenyl-propanetrione
7782-44-7	dissolved oxygen
298-04-4	Disulfoton
5989-27-5	D-Limonene
127-19-5	DMAC
629-97-0	Docosane
3891-98-3	Dodecane, 2,6,10-trimethyl-
143-07-7	Dodecanoic acid
544-85-4	Dotriacontane
DRO_C10C22	DRO [C10-C22]
PHCC8C24	DRO [C8-C24]
EFH_C13C40	EFH [C13 - C40]

cas_id	analyte_name
PHCC8C40	EFH [C8 - C40]
112-95-8	Eicosane
EC	Electrical Conductivity
959-98-8	Endosulfan I
33213-65-9	Endosulfan II
1031-07-8	Endosulfan sulfate
72-20-8	Endrin
7421-93-4	Endrin aldehyde
53494-70-5	Endrin ketone
2104-64-5	EPN
112-84-5	Erucylamide
74-84-0	Ethane
624-89-5	Ethane, [methylthio]-
619-33-0	Ethane, 1,1-dichloro-2,2-diethoxy-
6628-18-8	Ethane, 1,2-bis(methylthio)-
106-93-4	Ethane, 1,2-dibromo-
27-72-1	Ethane, hexachloro-
134-81-6	Ethanedione, diphenyl-
75-08-1	Ethanethiol
64-17-5	Ethanol
111-90-0	Ethanol, 2-(2-ethoxyethoxy)-
115-20-8	Ethanol, 2,2,2-trichloro-
111-46-6	Ethanol, 2,2'-oxybis-
563-12-2	Ethion
13194-48-4	Ethoprop
100022-54-1	Ethyl 2-chloro-2-[3-chlorobenzene]
141-78-6	Ethyl acetate
60-29-7	Ethyl ether
97-63-2	Ethyl methacrylate
56-38-2	Ethyl parathion
637-92-3	Ethyl tert-butyl ether
100-41-4	Ethylbenzene
74-85-1	Ethylene
107-21-1	Ethylene glycol
111-76-2	Ethylene glycol monobutyl ether
25550-14-5	Ethyltoluene
470-82-6	Eucalyptol
7440-53-1	Europium
52-85-7	Fampphur
115-90-2	Fensulfothion
55-38-9	Fenthion
7439-89-6 [2+]	Ferrous Iron
Q376	Flashpoint
206-44-0	Fluoranthene
86-73-7	Fluorene
16984-48-8	Fluoride
944-22-9	Fonofos
50-00-0	Formaldehyde
75-69-4	Freon-11 [Trichlorofluoromethane]

cas_id	analyte_name
76-13-1	Freon-113 [1,1,2-Trifluoro-1,2,2-trichloroethane]
75-71-8	Freon-12 [Dichlorodifluoromethane]
28903-24-4	gamma-2,3,4,5,6-Pentachlorocyclohexene
58-89-9	gamma-BHC [Lindane]
5103-74-2	gamma-Chlordane
8006-61-9	Gasoline
GW_ELEVATION	GW_ELEVATION
HARD	Hardness, Total
Q2240	HEM Oil/Grease
629-94-7	Heneicosane
76-44-8	Heptachlor
1024-57-3	Heptachlor epoxide
38998-75-3	Heptachlorodibenzofuran, Total
37871-00-4	Heptachlorodibenzo-p-dioxin, Total
593-49-7	Heptacosane
62016-79-9	Heptacosane, 1-chloro-
629-78-7	Heptadecane
13287-23-5	Heptadecane, 8-methyl-
7225-64-1	Heptadecane, 9-octyl
111-71-7	Heptanal
142-82-5	Heptane
3074-71-3	Heptane, 2,3-dimethyl-
2213-23-2	Heptane, 2,4-dimethyl
2216-30-0	Heptane, 2,5-dimethyl
111-14-8	Heptanoic Acid
118-74-1	Hexachlorobenzene
87-68-3	Hexachlorobutadiene
77-47-4	Hexachlorocyclopentadiene
55684-94-1	Hexachlorodibenzofuran, Total
34465-46-8	Hexachlorodibenzo-p-dioxin
67-72-1	Hexachloroethane
HCH	Hexachlorohexane
630-01-3	Hexacosane
629-54-9	Hexadecanamide
638-36-8	Hexadecane, 2,6,10,14-tetramethyl-
57-10-3	Hexadecanoic acid
23470-00-0	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester
111-06-8	Hexadecanoic acid, Butyl ester
541-05-9	Hexamethylcyclotrisiloxane
680-31-9	Hexamethylphosphoramide
66-25-1	Hexanal
123-05-7	Hexanal, 2-ethyl-
110-54-3	Hexane
4337-65-9	hexanedioic acid, mono[2-ethylhexyl]ester
630-06-8	Hexatriacontane
107-41-5	Hexylene glycol
7647-01-0	Hydrochloric acid
14280-30-9	Hydroxide
OH-ALK	Hydroxide alkalinity

cas_id	analyte_name
118-29-6	Hydroxymethyl phthalimide
Ignitability	Ignitability
193-39-5	Indeno[1,2,3-cd]pyrene
20461-54-5	Iodide
7553-56-2	Iodine
Q901	Ion Balance Difference
7439-89-6	Iron
115-11-7	Isobutylene
78-59-1	Isophorone
67-63-0	Isopropyl alcohol
98-82-8	Isopropylbenzene
872-56-0	Isopropylcyclobutane
25155-15-1	Isopropyltoluene
Lab Cond	Laboratory conductivity
Lab pH	Laboratory pH
LI 25deg	Langelier Index - 25 degree
7439-91-0	Lanthanum
7439-92-1	Lead
14255-04-0	Lead-210
15816-77-0	Lead-211
15092-94-1	Lead-212
15067-28-4	Lead-214
21609-90-5	Leptophos
7439-93-2	Lithium
12172-73-5L	Long Amphibole Protocol Structure
1332-21-4L	Long Asbestos Protocol Structure
12001-29-5L	Long Chrysotile Protocol Structure
19890-84-7	Longifolenaldehyde
65794-96-9	m,p-Cresols
136777-61-2	m,p-Xylene
7439-95-4	Magnesium
121-75-5	Malathion
7439-96-5	Manganese
MBAS	MBAS
94-74-6	MCPA
93-65-2	MCPP
7085-19-0	Mecoprop
7439-97-6	Mercury
150-50-5	Merphos
141-79-7	Mesityl oxide
122-14-5	Metathione
74-82-8	Methane
74-93-1	Methanethiol
67-56-1	Methanol
33146-57-5	Methanone, (4-chlorophenyl)(2,4-dichlorophenyl)
134-85-0	Methanone, (4-chlorophenyl)phenyl-
72-43-5	Methoxychlor
79-20-9	Methyl Acetate
953-17-3	Methyl carbophenothion

cas_id	analyte_name
20333-39-5	Methyl ethyl disulphide
78-93-3	Methyl ethyl ketone [2-Butanone]
74-88-4	Methyl iodide
110-12-3	Methyl isoamyl ketone
22967-92-6	Methyl mercury
80-62-6	Methyl methacrylate
110-43-0	Methyl n-amyl ketone
298-00-0	Methyl parathion
107-87-9	Methyl propyl ketone
75-18-3	Methyl sulfide
126-98-7	Methylacrylonitrile
METHYLENE BROMIDE	Methylene bromide
25013-15-4	Methylstyrene
51218-45-2	Metolachlor
21087-64-9	Metribuzin
7786-34-7	Mevinphos
Mineral Spirits	Mineral Spirits
2385-85-5	Mirex
2212-67-1	Molinate
7439-98-7	Molybdenum
131-70-4	Monobutyl phthalate
6923-22-4	Monocrotophos
1634-04-4	MTBE [Methyl tert-butyl ether]
300-76-5	Naled
91-20-3	Naphthalene
3018-20-0	Naphthalene, 1,2,3,4-tetrahydro-1-phenyl-
493-02-7	Naphthalene, decahydro-, trans-
71-36-3	n-Butyl alcohol
104-51-8	n-Butyl benzene
544-76-3	n-Hexadecane
7440-02-0	Nickel
7440-03-1	Niobium
14797-55-8	Nitrate
NO3-N	Nitrate [as N]
NO3/NO2	Nitrate/Nitrite
NO3/NO2-N	Nitrate/Nitrite [as N]
14797-65-0	Nitrite
NO2-N	Nitrite [as N]
98-95-3	Nitrobenzene
4165-60-0	Nitrobenzene-d5
55-18-5	N-nitrosodiethylamine
62-75-9	N-Nitrosodimethylamine
621-64-7	N-nitrosodi-n-propylamine
86-30-6	N-nitrosodiphenylamine
630-03-5	Nonacosane
629-92-5	Nonadecane
124-19-6	Nonanal
112-05-0	Nonanoic acid
103-65-1	n-Propylbenzene

cas_id	analyte_name
629-59-4	n-Tetradecane
629-50-5	n-Tridecane
6006-33-3	n-Tridecylcyclohexane
297-97-2	O,O,O-Triethyl phosphorothioate [TEPP]
126-68-1	O,O,O-Triethylphosphorothioate
100022-65-2	O,o'-diethyl s-methyl thiophos
298-06-6	O,O-Diethylphosphorodithioic acid
756-80-9	O,O-Dimethylphosphorodithioic acid
95-48-7	o-Cresol
OCDD	Octachlorodibenzodioxin
29082-74-4	Octachlorostyrene
630-02-4	Octacosane
593-45-3	Octadecane
57-11-4	Octadecanoic acid
621-61-4	Octadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester
646-13-9	Octadecanoic acid, 2-methylpropyl ester
556-67-2	Octamethylcyclotetrasiloxane
124-13-0	Octanal
111-65-9	Octane
3221-61-2	Octane, 2-methyl-
2216-33-3	Octane, 3-methyl-
2216-34-4	Octane, 4-methyl-
10544-50-0	Octasulfur
OIL/GREASE	Oil and grease
112-80-1	Oleic acid
OM	Organic Matter
ORO_C22-C32	ORO [C22-C32]
ORO_C23-C32	ORO [C23-C32]
PHCC25C40	ORO [C25-C40]
11-36-9	Orthophosphate
84-15-1	o-Terphenyl
74685-36-2	Oxacyclotetradecane-2,11-dione
OX_RED_POT	oxidation-reduction potential
100022-28-6	Oxime-, methoxy-phenyl-
131-57-7	Oxybenzone
95-47-6	o-Xylene
7440-05-3	Palladium
2051-60-7	PCB 1
33146-45-1	PCB 10
39485-83-1	PCB 100
60145-21-3	PCB 103
56558-16-8	PCB 104
32598-14-4	PCB 105
PCB-105/127	PCB 105/127
70424-69-0	PCB 106
70424-68-9	PCB 107
PCB-107/124	PCB 107/124
PCB-108/124	PCB 108/124
74472-35-8	PCB 109

cas_id	analyte_name
PCB-109/107	PCB 109/107
2050-67-1	PCB 11
38380-03-9	PCB 110
PCB-110/115	PCB 110/115
39635-32-0	PCB 111
74472-36-9	PCB 112
68194-10-5	PCB 113
74472-37-0	PCB 114
PCB-115/116	PCB 115/116
160901-73-5	PCB 118
31508-00-6	PCB 118
PCB-118/106	PCB 118/106
56558-17-9	PCB 119
PCB-12/13	PCB 12/13
68194-12-7	PCB 120
56558-18-0	PCB 121
PCB-121/88	PCB 121/88
76842-07-4	PCB 122
65510-44-3	PCB 123
70424-70-3	PCB 124
160901-75-7	PCB 126
57465-28-8	PCB 126
39635-33-1	PCB 127
38380-07-3	PCB 128
PCB-128/166	PCB 128/166
55215-18-4	PCB 129
PCB-129_CAS_CoE	PCB 129/138/160/163
PCB-129/138/163	PCB 129/138/163
52663-66-8	PCB 130
61798-70-7	PCB 131
PCB-131/142	PCB 131/142
PCB-131/142/165	PCB 131/142/165
38380-05-1	PCB 132
PCB-132/168	PCB 132/168
35694-04-3	PCB 133
52704-70-8	PCB 134
PCB-134/143	PCB 134/143
PCB-134/147/149	PCB 134/147/149
PCB-135/144	PCB 135/144
PCB-135/151	PCB 135/151
PCB-135/151/154	PCB 135/151/154
38411-22-2	PCB 136
35694-06-5	PCB 137
PCB-139/140	PCB 139/140
PCB-139/149	PCB 139/149
34883-41-5	PCB 14
59291-64-4	PCB 140
52712-04-6	PCB 141
41411-61-4	PCB 142

cas_id	analyte_name
68194-15-0	PCB 143
68194-14-9	PCB 144
74472-40-5	PCB 145
51908-16-8	PCB 146
68194-13-8	PCB 147
PCB-147/149	PCB 147/149
74472-41-6	PCB 148
2050-68-2	PCB 15
68194-08-1	PCB 150
52663-63-5	PCB 151
68194-09-2	PCB 152
PCB-152/150	PCB 152/150
35065-27-1	PCB 153
PCB-153/168	PCB 153/168
60145-22-4	PCB 154
33979-03-2	PCB 155
38380-08-4	PCB 156
PCB-156/157	PCB 156/157
69782-90-7	PCB 157
74472-42-7	PCB 158
39635-35-3	PCB 159
38444-78-9	PCB 16
41411-62-5	PCB 160
PCB-160/158	PCB 160/158
74472-43-8	PCB 161
39635-34-2	PCB 162
74472-45-0	PCB 164
PCB-164/163/138	PCB 164/163/138
74472-46-1	PCB 165
41411-63-6	PCB 166
52663-72-6	PCB 167
160901-79-1	PCB 169
32774-16-6	PCB 169
37680-66-3	PCB 17
38444-76-7	PCB 17
35065-30-6	PCB 170
52663-71-5	PCB 171
PCB-171/173	PCB 171/173
52663-74-8	PCB 172
PCB-172/192	PCB 172/192
68194-16-1	PCB 173
38411-25-5	PCB 174
40186-70-7	PCB 175
52663-65-7	PCB 176
52663-70-4	PCB 177
52663-67-9	PCB 178
52663-64-6	PCB 179
37680-65-2	PCB 18
PCB-18/30	PCB 18/30

cas_id	analyte_name
160901-82-6	PCB 180
35065-29-3	PCB 180
PCB-180/193	PCB 180/193
74472-47-2	PCB 181
60145-23-5	PCB 182
52663-69-1	PCB 183
74472-48-3	PCB 184
52712-05-7	PCB 185
74472-49-4	PCB 186
52663-68-0	PCB 187
PCB-187/182	PCB 187/182
74487-85-7	PCB 188
39635-31-9	PCB 189
38444-73-4	PCB 19
41411-64-7	PCB 190
74472-50-7	PCB 191
74472-51-8	PCB 192
69782-91-8	PCB 193
35694-08-7	PCB 194
52663-78-2	PCB 195
42740-50-1	PCB 196
PCB-196/203	PCB 196/203
33091-17-7	PCB 197
PCB-197/200	PCB 197/200
68194-17-2	PCB 198
PCB-198/199	PCB 198/199
2051-61-8	PCB 2
PCB-20/28	PCB 20/28
52663-73-7	PCB 200
40186-71-8	PCB 201
52663-75-9	PCB 201
2136-99-4	PCB 202
52663-76-0	PCB 203
74472-52-9	PCB 204
74472-53-0	PCB 205
40186-72-9	PCB 206
52663-79-3	PCB 207
52663-77-1	PCB 208
2051-24-3	PCB 209
PCB-21/20/33	PCB 21/20/33
PCB-21/33	PCB 21/33
38444-85-8	PCB 22
55720-44-0	PCB 23
55702-45-9	PCB 24
55712-37-3	PCB 25
38444-81-4	PCB 26
PCB-26/29	PCB 26/29
PCB-27/24	PCB 27/24
7012-37-5	PCB 28

cas_id	analyte_name
15862-07-4	PCB 29
2051-62-9	PCB 3
35693-92-6	PCB 30
16606-02-3	PCB 31
38444-77-8	PCB 32
PCB-32/16	PCB 32/16
37680-68-5	PCB 34
37680-69-6	PCB 35
38444-87-0	PCB 36
38444-90-5	PCB 37
53555-66-1	PCB 38
38444-88-1	PCB 39
13029-08-8	PCB 4
PCB-4/10	PCB 4/10
38444-93-8	PCB 40
PCB-41/71/40	PCB 41/71/40
36559-22-5	PCB 42
70362-46-8	PCB 43
PCB-43/49	PCB 43/49
41464-39-5	PCB 44
PCB-44/47/65	PCB 44/47/65
70362-45-7	PCB 45
PCB-45/51	PCB 45/51
41464-47-5	PCB 46
PCB-47/75/48	PCB 47/75/48
70362-47-9	PCB 48
PCB-49/69	PCB 49/69
16605-91-7	PCB 5
62796-65-0	PCB 50
PCB-50/53	PCB 50/53
68194-04-7	PCB 51
35693-99-3	PCB 52
PCB-52/43/73	PCB 52/43/73
PCB-52/73	PCB 52/73
41464-41-9	PCB 53
15968-05-5	PCB 54
74338-24-2	PCB 55
41464-43-1	PCB 56
PCB-56/60	PCB 56/60
70424-67-8	PCB 57
41464-49-7	PCB 58
PCB-58/62/75	PCB 58/62/75
74472-33-6	PCB 59
25569-80-6	PCB 6
33025-41-1	PCB 60
54230-22-7	PCB 62
74472-34-7	PCB 63
52663-58-8	PCB 64
PCB-64/41/68	PCB 64/41/68

cas_id	analyte_name
33284-54-7	PCB 65
32598-10-0	PCB 66
PCB-66/80	PCB 66/80
73575-53-8	PCB 67
73575-52-7	PCB 68
60233-24-1	PCB 69
33284-50-3	PCB 7
32598-11-1	PCB 70
PCB-70/61/74/76	PCB 70/61/74/76
41464-46-4	PCB 71
41464-42-0	PCB 72
74338-23-1	PCB 73
PCB-74/61	PCB 74/61
70362-48-0	PCB 76
160901-67-7	PCB 77
32598-13-3	PCB 77
70362-49-1	PCB 78
41464-48-6	PCB 79
34883-43-7	PCB 8
PCB-8/5	PCB 8/5
33284-52-5	PCB 80
160901-68-8	PCB 81
70362-50-4	PCB 81
52663-62-4	PCB 82
PCB-83/108	PCB 83/108
PCB-83/99	PCB 83/99
52663-60-2	PCB 84
PCB-85/116/117	PCB 85/116/117
PCB-85/120	PCB 85/120
PCB-86/87/97/109/119/125	PCB 86/87/97/109/119/125
PCB-86_CAS_CoE	PCB 86_CAS_CoE
PCB-88/91	PCB 88/91
73575-57-2	PCB 89
PCB-89/90/101	PCB 89/90/101
34883-39-1	PCB 9
PCB-9/7	PCB 9/7
PCB-90/101/113	PCB 90/101/113
68194-05-8	PCB 91
52663-61-3	PCB 92
PCB-93/98/100/102	PCB 93/98/100/102
73575-55-0	PCB 94
38379-99-6	PCB 95
PCB-95/93	PCB 95/93
PCB-95/93/100	PCB 95/93/100
73575-54-9	PCB 96
PCB-97_STL_CoE	PCB 97_STL_CoE
PCB-98/102	PCB 98/102
38380-01-7	PCB 99

cas_id	analyte_name
106-47-8	p-Chloroaniline [4-Chloroaniline]
106-54-7	p-Chlorobenzenethiol
80-07-9[1]	p-Chlorophenyl sulfone isomer 1
80-07-9[2]	p-Chlorophenyl sulfone isomer 2
106-44-5	p-Cresol
608-93-5	Pentachlorobenzene
30402-15-4	Pentachlorodibenzofuran, Total
36088-22-9	Pentachlorodibenzo-p-dioxin, Total
76-01-7	Pentachloroethane
87-86-5	Pentachlorophenol
629-99-2	Pentacosane
%GRAVEL	Percent Gravel
%MOISTURE	Percent moisture
%SAND	Percent Sand
%SOLIDS	Percent Solids
Pct UA 25C	Percent Unionized Ammonia 25C
14797-73-0	Perchlorate
pH	pH
pH CaCO3 sat60c	pH of CaCO3 saturation[25C]
pH CaCO3 sat25c	pH of CaCO3 saturation[60C]
85-01-8	Phenanthrene
108-95-2	Phenol
2772-45-4	Phenol, 2,4-bis(.alpha.,.alpha.-dimethylbenzyl)-
4165-62-2	Phenol-d5
13127-88-3	Phenol-d6
Phenolic Comp	Phenolic Compounds
882-33-7[1]	Phenyl disulfide isomer 1
882-33-7[2]	Phenyl disulfide isomer 2
298-02-2	Phorate
732-11-6	Phosmet
13171-21-6	Phosphamidon
2524-04-1	Phosphorochloridothioic acid, o,o'-diethyl ester
2953-29-9	Phosphorodithioic acid, o,o,s-trimethyl ester
3734-95-0	Phosphorothioic acid, s-[2-[(1-cyano-1-methylethyl)amino]-2-oxoethyl] o,o-diethyl ester
7723-14-0	Phosphorus
88-99-3	Phthalic acid
2306-33-4	Phthalic acid, monoethyl ester
23505-41-1	Pirimiphos ethyl
7440-06-4	Platinum
13981-52-7	Polonium-210
15389-34-1	Polonium-212
15735-67-8	Polonium-214
Q2423	Polonium-215
15756-58-8	Polonium-216
15422-74-9	Polonium-218
7440-09-7	Potassium
13966-00-2	Potassium-40
55191-51-0	Pregn-1,4,6-triene-3,20-dione,

cas_id	analyte_name
145-13-1	Pregnenolone
7287-19-6	Prometryn
1918-16-7	Propachlor
115-07-1	Propene
107-12-0	Propionitrile
57-55-6	Propylene glycol
14331-85-2	Protactinium-231
15100-28-4	Protactinium-234
92-94-4	p-Terphenyl
1718-51-0	p-Terphenyl-d14
129-00-0	Pyrene
110-86-1	Pyridine
2176-62-7	Pyridine, pentachloro-
15623-45-7	Radium-223
13233-32-4	Radium-224
Ra-226	Radium-226
13982-63-3	Radium-226
Ra-228	Radium-228
15262-20-1	Radium-228
22481-48-7	Radon-220
14859-67-7	Radon-222
Resid chlorine	Residual chlorine
141-22-0	Ricinoleic acid
299-84-3	Ronnel
7440-17-7	RUBIDIUM
135-98-8	sec-Butylbenzene
7782-49-2	Selenium
420-56-4	Silane, fluorotrimethyl-
1066-40-6	Silanol, trimethyl-
7631-86-9	Silica
7440-21-3	Silicon
SILTCLAY	SILTCLAY
7440-22-4	Silver
122-34-9	Simazine
2949-92-0	S-methyl methanethiosulphonate
7440-23-5	Sodium
7775-09-9	Sodium Chlorate
SPECIFIC_GRAVITY	Specific Gravity
7683-64-9	Squalene
22248-79-9	Stirophos [Tetrachlorovinphos]
7440-24-6	Strontium
100-42-5	Styrene
14808-79-8	Sulfate
18496-25-8	Sulfide
14265-45-3	Sulfite
3112-85-4	Sulfone, methyl phenyl
3689-24-5	Sulfotep
7704-34-9	Sulfur
7446-09-5	Sulfur dioxide

cas_id	analyte_name
Surfactants	Surfactants
13494-80-9	Tellurium
12-17-9	Temperature
TIC	Tentatively Identified Compounds [TICs]
13071-79-9	Terbufos
75-65-0	tert-Butyl alcohol
98-06-6	tert-Butyl benzene
55722-27-5	Tetrachlorodibenzofuran, Total
41903-57-5	Tetrachlorodibenzo-p-dioxin, Total
127-18-4	Tetrachloroethene
877-09-8	Tetrachloro-m-xylene
646-31-1	TETRACOSANE
638-58-4	Tetradecanamide
107-49-3	Tetraethyl pyrophosphate
21646-99-1	Tetraethyl pyrophosphite
109-99-9	Tetrahydrofuran
14167-59-0	Tetratriacontane
7440-28-0	Thallium
14133-67-6	Thallium-207
14913-50-9	Thallium-208
420-12-2	Thiirane
28249-77-6	Thiobencarbe
110-02-1	Thiophene
3172-52-9	Thiophene, 2,5-dichloro-
53907-80-5	Thiophene, cis-hexahydro-1h-cyclopenta[c]
6012-97-1	Thiophene, tetrachloro-
108-95-5	Thiophenol
7440-29-1	Thorium
15623-47-9	Thorium-227
14274-82-9	Thorium-228
14269-63-7	Thorium-230
14932-40-2	Thorium-231
TH-232	Thorium-232
15065-10-8	Thorium-234
7440-31-5	Tin
7440-32-6	Titanium
34643-46-4	Tokuthion [Protothiofos]
108-88-3	Toluene
2037-26-5	Toluene-d8
TOTAL_C10C32	Total [C10-C32]
ALKALINITY	Total Alkalinity
12172-73-5T	Total Amphibole Protocol Structure
1332-21-4T	Total Asbestos Protocol Structure
TOTAL-ASB	Total Asbestos Structures
TOTAL_CHLORIDES	Total Chlorides
12001-29-5T	Total Chrysotile Protocol Structure
Total-DeCB	Total Decachlorinated Biphenyl
Total-DiCB	Total Dichlorinated Biphenyl
Dioxin	Total Dioxins

cas_id	analyte_name
10-33-3	Total Dissolved Solids [TDS]
TTEPH	Total Extractable Petroleum Hydrocarbons [TEPH]
Total-HpCB	Total Heptachlorinated Biphenyl
Total-HxCB	Total Hexachlorinated Biphenyl
HpCDD	Total HpCDD
TOTIC	Total Inorganic Carbon
TKN	Total Kjeldahl Nitrogen [TKN]
Total-MoCB	Total Monochlorinated Biphenyl
Total-NoCB	Total Nonachlorinated Biphenyl
Total-OcCB	Total Octachlorinated Biphenyl
TOC	Total Organic Carbon
TOH	Total Organic Halogen
1336-36-3	Total PCBs
Total-PeCB	Total Pentachlorinated Biphenyl
TPHDIESEL	Total petroleum hydrocarbon-diesel
TPHGASOLINE	Total petroleum hydrocarbon-gasoline
TPH/OILH	Total petroleum hydrocarbon-motor oil
TPHCGD	Total Petroleum Hydrocarbons [TPH] gas/diesel
TPHCGDO	Total Petroleum Hydrocarbons [TPH] gas/diesel/oil
10-32-2	Total Suspended Solids [TSS]
TTEQ-a	Total TEQ - ENSR Calculated [a]
TTEQ-b	Total TEQ - ENSR Calculated [b]
Total-TeCB	Total Tetrachlorinated Biphenyl
TTHM	Total THM
Total-TriCB	Total Trichlorinated Biphenyl
8001-35-2	Toxaphene
Q908	TPH [as Motor Oil]
156-60-5	trans-1,2-Dichloroethene
10061-02-6	trans-1,3-Dichloropropene
110-57-6	trans-1,4-Dichloro-2-butene
100021-66-2	Trans-2,3-dimethylthiophane
39765-80-5	Trans-nonachlor
3319-31-1	tri(2-Ethylhexyl) trimellitate
638-68-6	Triacontane
126-73-8	Tributyl phosphate
52-68-6	Trichlorfon
75-87-6	Trichloroacetaldehyde
302-17-0	Trichloroacetaldehyde monohydrate
79-01-6	Trichloroethene
327-98-0	Trichloronate
638-67-5	Tricosane
78-30-8	Tricresyl phosphate [TOCP]
98-08-8	Trifluorotoluene
1582-09-8	Trifluralin
519-73-3	Triphenylmethane
115-86-6	Triphenylphosphate
791-28-6	Triphenylphosphine oxide
3658-80-8	Trisulfide, dimethyl
7440-33-7	Tungsten

cas_id	analyte_name
TURBIDITY	Turbidity
1120-21-4	Undecane
17301-23-4	Undecane, 2,6-dimethyl-
7440-61-1	Uranium
14158-29-3	Uranium-232
13966-29-5	Uranium-233/234
15117-96-1	Uranium-235/236
U-238	Uranium-238
7440-62-2	Vanadium
108-05-4	Vinyl acetate
593-60-2	Vinyl bromide
75-01-4	Vinyl chloride
VFH	Volatile Fuel Hydrocarbons
GROC4C12	Volatile Fuel Hydrocarbons [C4-C12]
GROC6C12	Volatile Fuel Hydrocarbons [C6-C12]
Q852	Volatile Petroleum Hydrocarbons
WASTE_OIL	WASTE OIL
1330-20-7	Xylenes [total]
Z7PDCL	Z-7-PENTADECENOL
7440-66-6	Zinc
7440-67-7	Zirconium

Attachment B

Supplemental Guidance and Response to Questions associated with the February 27, 2009 Guidance on Uniform Electronic Data Deliverables.

General Issues:

Asbestos:

NDEP has recently provided technical guidance surrounding the calculation of asbestos related risk (*Asbestos-Related Risk Assessment Guidance* dated April 24, 2009). The reporting of asbestos in the Companies' supplied EDD should follow this guidance. Both the asbestos fibrous variety (chrysotile or amphibole) and the size and shape influence the asbestos-related risk (ARR). The modified elutriator method described in that document along with TEM analysis is the preferred technique for asbestos analysis associated with the BMI Complex and Common Areas. The important laboratory reporting parameters for asbestos are: Soil Concentrations (fibers or structures), Analytical Sensitivity (S/g) and Asbestos Sensitivity Units. Note that the Soil Concentration is derived from the number of fibers observed (unitless) times the analytical sensitivity (f/g). The elutriator method provides sensitivity in units of Structures/g $_{PM10}$ It is critical that the laboratory report the biologically relevant structures – meaning those structures that are within the protocol dimensions of less than **0.4** µm in diameter and are >5 µm but less than 10 µm in length or are of less than **0.4** µm in diameter and > 10 µm in length. These details are consistent with a report of both the Long and Total asbestos structures in each sample.
An example of the information that should be reported for an asbestos sample would include (subset shown here of all fields) the following. Note, we have removed the asbestos_type field from the prior EDD structure.

Field Name	Record (what is to be reported in the EDD)
sample_id_field	MC1-J07
Cas_id	12001-29-5L
Analyte_name	Long Chrysotile Protocol Structure*
Result_reported	3
Asbestos_analytical_sensitivity	2.400E+06**
Asbestos_sensitivity_units	s/gPM10

*Each sample should include results for all asbestos types: Total Chrysotile Protocol Structure, Long Chrysotile Protocol Structure, Long Amphibole Protocol Structure, Total Amphibole Protocol Structure, Long Asbestos Protocol Structure, Total Asbestos Protocol Structure.

** This should be the mean value, not the 95% UCL value.

Questions from Companies and NDEP Responses:

Basic Remediation Company (BRC):

As I indicated, we had no major issues with the NDEP EDD guidance. However, I had asked our team to review thoroughly and they have asked for clarifications on the following so as to assure compatibility between BRC's current EDD format and NDEP's EDD requirements:

1. There are several fields called out in the guidance to be populated in the "samples" table that for BRC data would more practical to be placed in the "results" table. These include "sample_id_lab", "lab_id", "sdg_id", and "batch_id." Most of the samples collected by BRC are sent to multiple laboratories for analysis. As such, BRC data typically have multiple "sample_id_lab", "lab_id", "sdg_id", and "batch_id" associated with each unique "sample_id_field." Since "sample_id_field" is a primary key for the "samples" table, having multiple records for each "sample_id_field" would be problematic. BRC requests that EDDs have the data for the "sample_id_lab", "lab_id", "sdg_id", and "batch_id" in the "results" table. If that change is not available, BRC request further guidance on how best to provide the data for the fields "sample_id_lab", "lab_id", "sdg_id", and "batch_id."

NDEP Response: These fields will be moved to the results table.

2. NDEP requests several fields be populated for data validation flags ("first_validation_qualifier", "level4_validation_qualifier", and "final_validation_qualifier"). Level 4 data validation conducted on BRC data does not produce a first validation qualifier and a subsequent Level 4 qualifier. There would not be a case where a sample for a specific method would have findings for both Level 3 and 4. As such, when a BRC sample and specific method have Level 4 validation flags, those flags would be used to populate the "level4_validation_qualifier" and "final_validation_qualifier" fields and the "first_validation_qualifier" field would not be populated. BRC wanted to make NDEP aware of this prior to submitting EDDs. If this method of populating the EDDs is not acceptable to NDEP, BRC requests NDEP provide further clarification on the proper methods to populate these fields in the EDD.

NDEP Response: These fields in the EDD Structure are being revised based on comments received on the proposed EDD format and the NDEP's *Supplemental Guidance on Data Validation* and the Stages terminology in that document. It is recognized that there is no need to have multiple validation qualifier fields other than that provided by the laboratory and that provided by the third-party/Companies. As such, the lab_qualifier field is retained along with a field for the stage (formerly level) of validation, this is called validation_stage. The previous fields entitled first_validation_qualifier and level4_validation_qualifier are removed from the EDD Structure. The final_validation_qualifer field will be retained and should contain the final non-laboratory qualifier applied to the value, if any.

3. Many of the BRC data that are qualified are qualified based on multiple reasons. BRC currently provides the all associated reason codes in the field "final_validation_reason_code." For example, a result qualified for both laboratory blank contamination (BRC reason code "3") and surrogate recoveries (BRC reason code "8") would have the field "final_validation_reason_code" populated with "3,8." BRC request that NDEP confirm that this population of the "final_validation_reason_code" field is acceptable.

NDEP Response: The use of multiple numbers in the final_validation_reason_code field is acceptable and understood.

Titanium Metals Corporation (TIMET):

The following are comments specific to Attachment A to the NDEP letter dated February 27, 2009 (EDD Requirements):

4. Attachment A states that "N/A" should be placed in fields with no data. TIMET is unable to provide this for numeric fields. We suggest providing a place holder such as "-999" instead.

   NDEP Response: In light of feedback provided by several companies, we have decided to handle issues with NULLs internally to the regional database. Therefore we will now recommend that "NULL" (rather than "N/A") be used for all fields with no data. This will be reflected in the revised version of the EDD guidance document.

5. TIMET's current Laboratory Identification Codes are as follows:

LAB CODE	LAB
CAS/E	Columbia Analytical Services
CAS/R	Columbia Analytical Services -
PARAG	Paragon Analytics
DBSA	Daniel B. Stephens and Associates

   NDEP Response: These codes are approved for use in the Lab_id field.

6. TIMET's Location ID's are unique. However, when combined with other BMI Companies' data, the possibility exists of two locations (i.e. wells named the same). As an alternative, TIMET suggests including a field with LocationID and a field for LocationName, the combination of which in the Regional database would be unique.

   NDEP Response: Location IDs submitted by the Companies will be considered Company-specific. As part of the development of the regional database, a location table will be developed which will allow locations to be uniquely identified.

7. Validation Fields (Validation_Flag....through...Final_validation_reason): For TIMET we have a lab_qual and validationqual that we merge into a new field for reporting qual_rpt. We then include the val_comments. Is the NDEP requesting

a change in current validation procedures and inclusion of the additional fields within the database?

NDEP Response: We contacted Victoria Tyson and confirmed that our plans, at outline in the response to question 2 above would work under their system. We reiterated that we plan to retain the lab_qualifier field along with a field for the stage (formerly level) of validation, this is called validation_stage. The previous fields entitled first_validation_qualifier and level4_validation_qualifier are removed from the EDD Structure. The final_validation_qualifer field will be retained and should contain the final non-laboratory qualifier applied to the value, if any.

The following are comments specific to Appendix A to the NDEP letter dated February 27, 2009 (EDD Database Tables):

8. TIMET suggests submitting two tables that include Point Information and Analysis information, otherwise data that is common will need to get repeated unnecessarily. In the TIMET database we start with a Point table which has a one-to-many relationship to a Sample table which has a one-to-many relationship to an Analysis table which has a one-to-many relationship to a ChemicalResults table.

NDEP Response: NDEP will introduce a location table which is analogous to the TIMET point table. This will be reflected in the revised version of the EDD guidance document. At this time, we do not see a need for a separate analysis table.

The following are comments specific to Appendix C to the NDEP letter dated February 27, 2009 (Sample Type Identification Code):

9. Separate the field "Prep Blank" into two fields - one for soil and one for water
10. Add FLD for field samples such as pH, Temperature, Specific Conductance
11. Add a sample type for Laboratory Duplicates

NDEP Response: Please note that this code list must be mutually exclusive. This table has been revised to accommodate comments from the Companies. The Prep Blank code will be removed and two additional codes will be added: Prep Water Blank, Prep Soil Blank. FLD has been added for field specific measurements. We have also added a Laboratory Duplicates code along with a Field Split code (separate from Field Duplicate), along with several combination codes.

12. Below is TIMET's sample type table - we include a field to indicate if it is a field sample type or a lab sample type.

SMP	SMP TYPE DESCRIPTION	SMP TYPE LAB
DL	DILUTION	LAB
ER	EQUIPMENT RINSATE	SAMP
FB	FIELD BLANK	SAMP
FD	FIELD DUPLICATE	SAMP
FLD	FIELD SAMPLES LIKE pH, Specific Conductance, Temp	SAMP
LABQC	LABORATORY QC SAMPLES	LAB
LCS	LABORATORY CONTROL SAMPLE	LAB
LCSD	LABORATORY CONTROL SAMPLE	LAB
MBLK	METHOD BLANK	LAB
MD	MATRIX DUPLICATE	LAB
MS	MATRIX SPIKE	LAB
MSD	MATRIX SPIKE DUPLICATE	LAB
NORM	NORMAL SAMPLE TAKEN IN FIELD	SAMP
ORIG	ORIGINAL SAMPLE IN LAB	LAB
PBS	PREPARATION BLANK SOIL	LAB
PBW	PREPARATION BLANK WATER	LAB
RE	RE-ANALYSIS	LAB
SB	SOURCE WATER BLANK	SAMP
TB	TRIP BLANK	SAMP
UPDAT	SAMPLE TYPES TO BE UPDATED	UNKN

NDEP Response: We have incorporated most of these into Appendix C. However, we are not adding an additional field (lab/field).

The following are comments specific to Appendix F to the NDEP letter dated February 27, 2009 (Physical and Field Parameters):

13. Suggest adding an aqueous field for pH.

NDEP Response: A code for aqueous pH has been added.

Montrose Chemical Corporation of California (Montrose):

Question Number	Section	Location	Comment/Question
13	Attachment A text, page 1	First Paragraph	NDEP is requiring each field to contain either a specified value or the string "N/A" to indicate a blank entry. What should be done in cases where the field is required to be numerical and there is a blank entry? For example, an entry in the field *Percent_Moisture* in the **Samples** table is not applicable for an aqueous sample but entering a string value in this numerical field would not be possible in Microsoft Access. In such cases, it is common to adopt a standardized "impossible" numerical value (such is -9999) to indicate blank entries in a numerical field or alternatively allow null values for such situations when a field is defined as numerical.
NDEP Response:	In light of feedback provided by the Companies, we have decided to handle issues with NULLs internally to the regional database. Therefore we will now recommend that NULL (rather than "N/A" be used for all fields with no data. This will be reflected in the revised version of the EDD guidance document.		
14	Attachment A text, page 1	Second Paragraph	Does the parenthetical phrase "(e.g. quality control (QC) data)" refer only to field quality control data like trip blank, field blanks, and equipment rinsate blanks, etc? Or, is NDEP referring to both field and laboratory quality control data. The code list in Appendix C has codes associated with both field and lab quality control analyses, so it appears that NDEP is referring to both types of QC data. Currently we include field quality control data in our database but not lab quality control data. We do not plan to start entering these data in our database unless NDEP specifically requests us to do so. Furthermore, historically we have only provided NDEP with DVSR EDDs that contained field samples and field quality control data only. Please clarify if lab quality control data are part of the required EDD submittal or are an optional part of the submittal. Obviously, we would prefer not to have to include the lab quality control data because it would require additional work to load these types of data.
NDEP Response:	QC data refers to both field and lab QC data. At this point in time we are not adding the lab or field QC data (other than replicate analyses of native samples) to the database. All QC data and information is critical to NDEPs review of the DVSR but		

Question Number	Section	Location	Comment/Question
	the database is not designed for these QC results at this time.		
15	Attachment A text, page 1	Second Paragraph	Please clarify the circumstances by which "additional fields" would be created and submitted in the DVSR. We can understand why there might be additional records but we are unsure why there might be additional fields included in the submittal.
NDEP Response:	Consider the term "fields", as used in that part of the EDD as a generic term. The only specific records we anticipate each company to include would be the quality control data, discussed above. However, each company has the option of adding additional, tables and fields o the database but these need to be separate from those that have been described here as the EDD Structure.		
16	EDD Requirements	General Question	We are unclear about what a "Required" or "Critical" field means based on the tabular list provided. Does NDEP mean that these fields must be coded with a code other than "N/A"? If so, there are several situations that we can think of for which there will be an "N/A" code entered. For example, for the field *hydro* there will be an "N/A" code provided for a sample matrix of Outdoor Air. We could provide several other examples for which this would be the case. Could NDEP further elaborate about what exactly it means by the terms "Required" and "Critical" fields?
NDEP Response:	These terms were used to describe those fields that need to be submitted with each EDD; use of "critical field" as a column header was misleading and has been changed. Each record does not necessarily need a value.		
17	EDD requirements	General Question	Please specify the effective date to comply with these EDD requirements. We are currently in the final stages of receiving DVSR reports associated with our fourth quarter 2008 Site-wide program samples and we expect that we will be sending these reports and associated EDDs to NDEP within the second quarter 2009. We will not be able to fully comply with the EDD requirements for this data set because the data were entered into our database last year prior to the required changes in reported quantitation levels and prior to this draft EDD guidance. Certain of NDEP's requirements for the EDD would require a significant level of effort in recoding the existing data, especially with respect to quantitation limits. It is recommended that we provide the fourth quarter 2008 Sitewide data EDD in the same format as previously provided and provide

Question Number	Section	Location	Comment/Question
			data in the new format for all DVSR data collected during 2009 and later.
NDEP Response:	Please comply with these requirements as soon as possible. It is hoped that all data collected after the date of this letter will comply with the requirements described herein. If this is not possible, please discuss these issues with the NDEP on a case-by-case basis.		
18	EDD Requirements	Field Names: *analyte_Name* And cas_id	Reviewing the EDD Requirements table against Appendix A indicates that the **RESULTS** table does not have a key field to identify analytes. Specifically, the field *analyte_name* appears to be intended as a key field because the EDD requirements table indicates that this field should be "unique". However, in practice this may be difficult due to differences between different EDD submitting companies with regards to analyte names. For example, some data submitters may call the compound associated with CAS number 79-01-6 "Trichloroethene" while others may call the compound "Trichloroethylene". Both submitters have "unique" names for the analytes in their respective databases but when data sets are combined, non-unique analyte names will be created in NDEP's Regional Database. Based on our conversation with Brian Ravika on March 31, 2009, it appears that NDEP already realizes this problem and is instead considering using the field *cas_id* to identify compounds. This approach will work, however, there are instances of the same compound having more than one CAS number and some analytes (such as results of the combined isomers of 2,2' and 4,4'-dichlorobenzil) that do not have a CAS number available. We recommend that NDEP develop a starter lookup table of *cas_id* for all data submitters to use based on the data already entered into its regional database. If new chemical parameters are to be added, we recommend that each DVSR submitter provide proposed new codes prior to submittal of the DVSR EDD. Finally, as with the rest of the code tables, we request that NDEP make available at request the most recent cas_id table through their consultant Neptune.
NDEP Response:	The cas_id field will be used as the key field to identify analytes. We accept the recommendation that NDEP develop a starter lookup table which will be made available to the Companies for review, and that Companies submit proposed new codes prior to submittal of the DVSR EDD.		

Question Number	Section	Location	Comment/Question
19	EDD Requirements	Field name: *Sample_Id_lab*	Providing a consistent *Sample_ID_Lab* entry for all records associated with a sample will be difficult to do. It is common to have reanalysis results in lab reports (and project databases) that have a different laboratory identifier. For example, a laboratory sample identified as "IRJ2025-01" may have reanalysis data that are identified by the laboratory as "IRJ2025-01RE1". It would put a burden on data providers to have to alter laboratory identifiers to be a single consistent string for the purpose of providing an EDD to NDEP. Additionally, if we modified laboratory identifiers in this way, a discrepancy would be created between the information presented in the hard copy laboratory report and the EDD data submittal and the DVSR Report and the EDD. Since there is enforced uniqueness for the field *Sample_ID_Field* , we are uncertain why there should also be enforced uniqueness also for the field *Sample_ID_lab* as well given that this field is not listed in the table description as a key field. We recommend that NDEP drop the requirement for *Sample_Id_Lab* consistency.
NDEP Response:	We understand this response and realize there may be times when the same sample will have different names. However, we wish to minimize this as much as possible. There is no longer a requirement for a unique sample name that is identical for all records, but the use multiple names should be minimized. In terms of database structure, the sample_id_lab field will be moved to the results table, thus allowing inconsistency within a field sample where necessary.		
20	EDD Requirements	Field name : *analyst_name*	Please confirm that an entry into the field *analyst_name* is only required for asbestos results. Consider an acceptable alternative to be analyst initials. Most laboratory's LIMS systems can provide analyst initials only.
NDEP Response:	Analyst's initials are an acceptable record for this field.		
21	EDD requirements	Field: *Detect_Flag*	Please confirm that NDEP is requiring that all data that will be included in a DVSR be quantified as detected/nondetected to the numerical value of the SQL.
NDEP Response:	This is confirmed. All data should be reported as described in the NDEP *Guidance on Detection Limits and Data Reporting*. In general, the approach is that all non-radionuclide data should be reported to the SQL.		
22	EDD requirements	Field: *Lab_ID*	We recommend the following lab identification codes:

Question Number	Section	Location	Comment/Question
			TAMI = TestAmerica Irvine TARL= TestAmerica Richland H+A = Hargis + Associates, Inc. (to be used in case of transfer of field data as described in Appendix F)
NDEP Response:	These codes are accepted for use in the lab_id field.		
23	EDD requirements	Fields: *prep_date* and *prep_time*	Could NDEP provide more detail regarding these fields? Are they intended to contain laboratory preparation date and time for samples or is this some other preparation process. See also related comment regarding including these fields in the **SAMPLES** table
NDEP Response:	These fields are intended to contain laboratory preparation date and time for samples; their inclusion in the samples table was an oversight, and they will be moved to the results table. This will be reflected in the revised version of the EDD guidance document.		
24	EDD Requirements	Multiple Fields: *hydro, litho, sub_area, easting* and *northing*	This is just a suggestion but we see potential problems with including certain fields in the **SAMPLES** table. These fields are *hydro, litho* and possibly also *sub_area* and *lou*. These are intrinsic characteristics of the sampling location that should be essentially the same from sampling event to sampling event for well locations but may change nonetheless. The investigators on the Henderson project (like any project) have historically made several refinements to the conceptual site model. Also, it is common at any investigation site to redefine the limits of investigation areas based on new interpretation of data. Hard coding these data in the **SAMPLES** table may result in NDEP having to recode many lines of data in the future if changes or refinements are made. We recommend a simpler approach – move fields that are intrinsic to the sample locations to a stand-alone new **SAMPLE_LOCATION** table along with the northing and easting coordinates. If such a table is created, we recommend adding land surface elevation to the field list. Having these fields separate from the **SAMPLES** table will make checking data integrity easier (by providing NDEP with an official list of *Location_IDs*) and will allow future refinement of areas of investigation and

Question Number	Section	Location	Comment/Question
			lithologic/hydrologic units without having to edit many lines in the **SAMPLES** table. Inclusion of *hydro* and *litho* data for vertical profile soil or groundwater samples from a borehole or from one time hydropunch groundwater sampling probably does have some value. We recommend retaining these two fields and to require entry only for cases when vertical profile samples are collected.
NDEP Response:	This recommendation has been incorporated into the EDD. A separate location will be introduced to house the fields described in the comment. This will be reflected in the revised version of the EDD guidance document.		
25	EDD requirements	Recommended additional Field	We recommend that NDEP consider adding an additional field to the **SAMPLES** table to capture information about how the sample was collected. We see this as particularly important for groundwater samples. There have been instances when groundwater samples have been collected from open boreholes using a bailer or from hydropunch equipment versus collecting the sample from a well using a submersible pump.
NDEP Response:	This recommendation has been incorporated into the EDD.		
26	Appendix A	General Question, Paragraph 1	Please specify the version(s) of Microsoft Access that NDEP will accept.
NDEP Response:	Acceptable versions are Microsoft Access 2000 or later.		
27	Appendix A	General Question, Paragraph 2	Just for clarification, when requesting "a view" is NDEP requesting creation of a query in Microsoft Access?
NDEP Response:	Yes. For clarity, this terminology will be updated in the EDD guidance document.		
28	Appendix A	**SAMPLES**	The **SAMPLES** table contains two fields that appear to be more appropriately

Question Number	Section	Location	Comment/Question
		table	attributes associated with the contents of the **RESULTS** table: *prep_date* and *prep_time*. If this is supposed to be laboratory preparation date and time (see previous question regarding these fields), the entry in the fields are method-specific and there may be different entries depending on the methods run (a SW8260B preparation time and date will probably be different those of the SW8270C analysis performed on the same sample). Additionally, a reanalysis result may have a different preparation date and time further complicating matters. In most databases, these fields are included in a **RESULTS** table.
NDEP Response:	These fields will be moved to the results table. This will be reflected in the revised version of the EDD guidance document.		
29	Appendix B – Sample Matrix Identification/Codes	Code List	Suggest adding codes for Non-Aqueous Liquids of "NAPL" and a code for blank water of "BW" to be used for trip blanks, field blanks and equipment blanks.
NDEP Response:	This recommendation has been incorporated into Appendix B.		
30	Appendix C – Sample Type Identification Code	Code List	Please provide clarification what specific types of samples would be coded with the following codes: DUPDATA and RD. Please explain the difference between a sample coded as "N" versus a sample coded as "ORIG". We recommend adding an additional code "SPT" to denote that the sample is a field split sample. Also, a reanalysis result is often performed at a different dilution factor. Normally the lab provides a *lab_qualifier* that indicates that the sample was analyzed at a different dilution factor in addition to providing the actual dilution factor for our database. In such instances in the future, we would like to code the *sample_type* as just a reanalysis result ("RE"). We see that there are codes for diluted samples of "DIL" and "DIL2". Obviously, any dilution factor greater than 1 would denote a diluted sample so coding of "DIL" or "DIL2" would not be necessary to capture dilution information.
NDEP	Appendix C has been revised based upon input from the Companies. Note, some of the codes in this table may not apply to all		

Question Number	Section	Location	Comment/Question
Response:	of the Companies. DUPDATA and DIL2 have been removed, RD is used by some of the Companies to identify samples for NDPES type regulatory requirements. A field split code (SPT) has been added. Your description of using the RE code for a diluted sample is acceptable, other Companies may prefer to use the DIL code (retained).		
31	Appendices B and C	General Question	Based on our discussion with Brian Rakvica on 3/31, we assume that NDEP will provide periodic updates of all codes upon request from NDEP's contractor Neptune in order to ensure that each new EDD submitted are prepared using the most recent code set established for the database.
NDEP Response:	We agree with this request and can provide periodic updates to the EDD structure and codes.		
32	Appendix B, C and D	General Question	Even though EDDs will be provided in Microsoft Access format it is unclear what platform NDEP will use for the regional database. Is the database program you plan to use for the regional database case sensitive to code entries? Will it matter if codes are provided in all upper case, all lower case, or upper and lower case characters?
NDEP Response:	The database that is being built from the EDDs is case sensitive.		
33	Appendix D	Fourth Bullet	Could you provide examples how formatting should be provided to include the edition number or year approved for Standard Methods for the Examination of Water and Wastewater? Additionally, does NDEP have a specific preference there a preference for edition number over date (or vice versa)?
NDEP Response:	An example format is: SM7500-Ra-B-18thEd or SM7500-Ra-E-2009, where the letter B or E refers to the Section of the method standard.		
34	Appendix E – Analytical Suite	Code List	It is unclear how to apply the codes in this list when preparing the EDD. NDEP implies in the description of the field *analytical_method* in the EDD Requirements table that it is the "identifier…used for that suite of analyses". On the other hand, the codes table in Appendix E seems to be suggesting something different with regards to

Question Number	Section	Location	Comment/Question
			an analytical suite. Is NDEP requiring that different analytical suite codes be assigned to parameters reported by the same Analytical method? For example, the Method SW-8270C includes semi-volatile organic compounds including some polycyclic aromatic compounds as target compounds and can include pesticide compounds as tentatively identified compounds. If data submitters are required to code each compound in a specific analytical method differently based on the code list provided, it would create what we believe is an unnecessary burden. If this is truly NDEP's intention to have individual compounds reported by a single method coded in this manner, we recommend that a much simpler approach would be for NDEP to maintain an analytical parameter (*cas_id*) lookup table in its own database to assign these codes to specific compounds. If the intention is to provide a single code per analytical method (example all analytes reported by SW-8270C are coded as "SVOC") then we do not have a difficulty with the coding scheme requested by NDEP.
NDEP Response:	The intent of the analytical_method and analytical_suite fields is no different from how we currently see these used in the databases provided by the Companies. Most of the Companies currently include both an analytical method as well as an analytical suite with their database. We don't expect a specific analytical_suite name based on the compound reported within a method. For example, if method SW-8270C was used and the laboratory called this an SVOC analysis, we do not expect the analytical_suite to be coded PAH when a compound such as benzo(a)pyrene is reported. The intent is to generally tie the analytical_method with the analytical_suite fields because it is much more intuitive to search a database for an analytical suite (e.g. anions) than to remember the method used. We realize that one analytical method can be applied to multiple analytical suites. Conversely, on occasion, one analytical method can be used for more than one analytical suite. In general, apply the analytical_suite code that most represents how that method was employed.		
35	Appendix F	General Question	Please provide specific guidance regarding including the following physical parameter data in the EDD structure provided: DETWA, TRANS, HYCO, STOR. We

Question Number	Section	Location	Comment/Question
			recommend that a separate data table structures be developed for these data types because groundwater level and aquifer testing data are not easily fit into the proposed chemical quality data format. We recommend that NDEP develop a separate data table structure for these data. We recommend also that parameters measured during field purging also be given a separate data table. Note that currently we do not store purging data in formats other than paper and PDF. We currently do not have plans to store field purge data in a database unless NDEP specifically requires that we do so.
NDEP Response:	We agree that TRANS, HYCO, and STOR measures belong in a separate data table. These three codes will be removed from appendix F and put in a separate appendix. However we feel that DETWA is appropriate for Appendix F because it is a measure that should be correlated with a sampling event.		

Olin Corporation

General Comments

Overall the definition does not clearly define all the fields and their purpose within the format.

36. In Attachment A, paragraph one, the statement "Each field and record should contain either a specified value or "N/A" (i.e., blanks should be populated with N/A). " This is not always good data management practice. There are fields such as the qualifier fields that should remain null to represent a detection that requires no additional qualification.

    NDEP Response: In light of feedback provided by several of the Companies, we have decided to handle issues with NULLs internally to the regional database. Therefore we will now recommend that NULL (rather than "N/A") be used for all fields with no data. This will be reflected in the revised version of the EDD guidance document.

37. It is assumed that with the request of "N/A", that all fields are required to be populated. Without a full understanding of each field, comments pertaining to specific fields below may or may not be appropriate. One example is having the lithology information related to a specific sample. This will not account for lithology layers that may be encountered at depths not sampled. Possibly consider a separate table to submit lithology information for a given location

NDEP Response: In light of feedback provided by several of the Companies, we have decided to handle issues with NULLs internally to the regional database. Therefore we will now recommend that NULL be used for all fields with no data. This will be reflected in the revised version of the EDD guidance document.

The Lithology field will be moved to a separate location table. For wells, the location identifier represents a specific screen for a given well (some wells have more than one screen). Therefore, lithography information for the depth covered by the screen can be represented as an attribute of the location. Lithology information for other depths is relevant only if there if the same well has another screen, and this scenario is handled by giving this second screen a distinct location identifier.

38. Another example is the relationship of the Asbestos fields with other analytical information. For each chemical reported, is there to be Asbestos information recorded for some type of relational analysis? Or possibly consider utilizing the Asbestos parameters as described in the Chemical Name field and add the Asbestos type to the Appendix E, Analytical Suites. Additionally, the Asbestos Sensitivity is not clear. Based on the description for the Asbestos Sensitivity Unit field, what is expected for this reading and is it in association with all analytes submitted?

NDEP Response: The asbestos discussion provided previously to the Companies should clarify how asbestos data should be reported in the EDD. We have removed the asbestos_type field from the EDD structure. An asbestos_ sensitivity and an asbestos_ sensitivity_units record should be provided with each report of asbestos results.

39. For the statement in the second paragraph of Appendix A, "All native samples, including replicates should be included in this EDD but QC results will not be incorporated into the Regional Database at this time.", based on the sample types in Appendix C then all samples are to be submitted but Nevada will only be importing certain sample types. Would like clarification on if the QC types need submitted in the separate tables?

NDEP Response: Appendix C does contain all types of QC sample type identifiers. However, at this time the database will not be populated with many of these QC samples, only with replicates.

Appendix C provides all these additional codes since many of the Companies now use these with their EDD submittal and they are included here as a structure that may be needed in the future should all QC data be included in the database.

The separate tables that a Company should include with the EDD for use during data validation review (but will not be imported to the companies wide database) should contain, at a minimum, all the laboratory QC results that are associated with the reported samples. This includes the blanks (all types), matrix spikes, laboratory control samples, laboratory replicates, and other results that were analyzed with the native samples, reported by the laboratory, and may have influenced how the samples were qualified.

40. And additionally, Olin Corporation recommends utilizing the CasRN code as a key field for all analytes and field parameters. It is not a very clean data management practice with analytes having multiple chemical names but the same CasRN and with the Field Parameters having a controlled name as described in Appendix F but all with N/A as the CasRN. Possibly consider using the analyte names of Appendix F as the CasRN and the Physical Parameters column as the chemical name field.

NDEP Response: Cas_id will be used as the key field for all analytes. For non-chemical measures, short codes (as found in the first column of Appendix F) will be used for cas_ids and longer descriptions will be used as analyte names.

Nevada Valid Values (VVLs)

Appendix B: Sample Matrix Identification/Code

35. Olin Corporation utilizes a larger list. One highly used value is a code of WT for Process and Treated Water. Will Olin be able to retain the values currently utilized or will they need to conform to the provided list?

NDEP Response: Please provide us with this list and we will incorporate it into Appendix B. Note, that we have added two additional codes (NAPL, BW) based on other responses to the EDD design.

Appendix C: Sample Type Identification/Code

36. Olin Corporation recommends the removal of some of the entries within this table. The values for DIL, DIL2, RE, and ORIG are values that would be more appropriately stated within the re-analysis field. A given sample may not in its entirety be diluted but could

possibly be reanalyzed or diluted for only a given analytical method within the sample's set of results. These types would also be considered type N as Normal Environmental Samples.

NDEP Response: Appendix C has been revised based upon input from all companies. We understand there is some redundancy between the reanalysis_flag field and the sample_type field but have left codes for dilution and reanalysis in Appendix C to accommodate approaches by different companies.

37. Additionally, the code of DUPDATA is generally utilized as a Quality Assurance step for manual data entry. Once the data has been approved, only one sample would be submitted.

NDEP Response: DUPDATA has been removed from Appendix C.

Appendix E: Analytical Suite Name/Code

38. With the Analytical Suite entries for the types of Asbestos, would this not suffice so as not to need the separate field for Asbestos type? It is recommended that the Asbestos information is conformed to reporting of the analytical and field parameters.

NDPE Response: The asbestos_type field has been removed from the EDD structure. Sufficient information will be contained in the cas_id field. However, Appendix E (Analytical Suite Name/Code) does still contain a code for asbestos as a means of easily searching the database for all asbestos types.

39. The percent moisture may be removed as there is a specific field to record this information for a sample.

NDEP Response: We agree, the PCTMST, Percentage of Moisture code has been removed since this is already captured in the percent_moisture field.

Appendix F: Physical and Field Parameters

40. Olin Corporation recommends the addition of the wet chemistry measurements that are describe in the description field for GENERAL of Appendix E. Here again a recommendation they be assigned a controlled code and maintained as a CasRN within an analyte table.

NDEP Response: Appendix F is for physical and field measurements. Other than pH, which has been added to Appendix F, no other wet chemistry measurements are generally analyzed in the field. These codes will indeed be used in the cas_id field.

The Naveda Import Fields

41. Sample depth – recommend having two fields to represent the top and bottom (or start and end) depths. Otherwise, samples taken from a screen interval or a soil core, a directive of what depth should be submitted?

NEP Response: We accept the recommendation to have separate fields for top and bottom depths. For Companies which currently only report a single depth measurement, this measurement can be used to populate both fields.

42. Sample Identification/ Location Identification Fields – are these to be unique for all of BMI Plant Sites and Common Areas Projects, or simply unique within an individual Plant?

NDEP Response: Location and sample identifiers are considered to be Company-specific; therefore such identifiers should be unique across all data deliveries from a given company. As part of the development of the regional database, a location table will be developed which will allow locations to be uniquely identified.

43. Laboratory Identification/code – it is recommended to utilize a controlled reference value table for this field. Olin Corporation has an existing table that could be supplied to Nevada.

NDEP Response: Please provide this table.

44. Asbestos Type – this field is not clear as in the Chemical name field there is a statement "For asbestos this field should contain one of the following six types: Total Chrysotile Protocol Structure, Long Chrysotile Protocol Structure, Long Amphibole Protocol Structure, Total Amphibole Protocol Structure, Long Asbestos Protocol Structure, Total Asbestos Protocol Structure." . Could this field be eliminated and utilize the Analytical Suite table?

NDEP Response: The asbestos_type field has been removed from the EDD structure. Sufficient information will be contained in the analyte_name field.

45. CAS – recommend this as a controlled table and not allow the N/A entry.

NDEP Response: NDEP will create and publish a controlled list of cas ids/analyte codes which should be used to populate the cas_id field. NULL OR N/A will not be allowed.

46. Result Type Code – recommend this as a controlled table. Olin Corporation has an existing table that could be supplied to Nevada.

NDEP Response: We accept the recommendation that an appendix be added to the EDD guidance document covering result_type_code. Olin, please provide the table you have referenced.

47. Initial or Reanalysis – recommend this be renamed to a test type and include possibly re-extraction and/or a dilution entry.

NDEP Response: We have decided to leave this field (reanalysis_flag) in the EDD structure to accommodate the different approaches of the companies. Re-extraction and dilution can be identified in the sample_type field.

48. Prep date and time fields – recommend this be moved to the results table to be associated with the prep method.

NDEP Response: These fields will be moved to the results table.

49. First Validation Qualifier and Level IV Validation Qualifier – As these fields would never be populated at the same time, recommend combining into one Validation Qualifier field. The Validation level field would be the determinate of the Validation Qualifier.

NDEP Response: This approach has been incorporated. See the response above.

50. Percent Moisture – How would Nevada like this submitted? For 95% would this be submitted as 95 or .95?

NDEP Response: Please provide percent moisture in this format: 95 for 95% (no decimal, two significant figures).

Tronox LLC:

51. Does NDEP want total propagated error or just the counting error for the rad data?

NDEP Response: NDEP prefers the two sigma error for radionuclide results be based on the total error reported but that the two sigma error may also be based on the counting error only as long as it is clarified in the DVSR. Also, the DVSR should clearly state if the error provided is not two sigma.

52. Does NDEP want the MDA in both the MDL and RDL fields?

NDEP **Response:** There is a field specifically for MDA in the EDD design, There is no RDL field, though there are SQL and PQL fields. The MDL, SQL and PQL fields should be left blank since the MDA is reported in the MDA field.

53. Does NDEP want the calculated asbestos concentrations in addition to the fiber counts and types? This seems more useful than a pile of elutriator raw data.

NDEP **Response:** Only the counts (as fibers or structures) and asbestos sensitivity is required for ARR and are therefore needed with the EDD. Asbestos_sensitivity_units are in units of S/gPM10.

54. Please specify the asbestos protocol structure definition modifications to the draft modified elutriator method and specify which structures must be reported.

NDEP Response: Only the total and long protocol structures (described in the Analyte_name field of the EDD structure) need to be reported. These names are consistent with Revision 1 (May 23, 2000) of the Modified Elutriator Method for the Determination of Asbestos in Soils and Bulk Materials.

STATE OF NEVADA
Jim Gibbons, Governor
Department of Conservation & Natural Resources
Allen Biaggi, Director
DIVISION OF ENVIRONMENTAL PROTECTION
Leo M. Drozdoff, P.E., Administrator
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

July 2, 2009

Mr. Mark Paris
Basic Remediation Company
875 West Warm Springs Road
Henderson, NV 89011

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, NV 89009

Mr. Curt Richards
Olin Corporation
3855 North Ocoee Street, Suite 200,
Cleveland, TN 37312

Mr. Joe Kelly
Montrose Chemical Corp of CA
600 Ericksen Ave NE, Suite 380
Bainbridge Island, WA 98110

Mr. Brian Spiller
Stauffer Management Co LLC
1800 Concord Pike
Wilmington, DE 19850-6438

Mr. Craig Wilkinson
Titanium Metals Corporation
PO Box 2128
Henderson, NV 89009

Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Electronic Data Deliverables (EDD) Format Update

Dear Sirs and Madam:

All of the parties listed above shall be referred to as "the Companies" for the purposes of this letter.

There have been some minor modifications to the EDD format as follows:

1. EDD Requirements Table, modified to accommodate the changes discussed below.
2. Appendix A, the following changes have been made:
    a. The field "asbestos_type" was removed.
    b. The field "asbestos_sensitivity" was changed to "asbestos_sensitivity_units"
    c. Appendix A was modified to allow multiple codes in the "final_validation_reason" field as follows:
        i. Changed "final_validation_reason" to "final_validation_reasons"
        ii. There is no longer a primary/foreign key link between the results and "validation_reason" table.
        iii. Changed "final_validation_reason" to "validation_reason" in both Appendix A and the EDD Requirements table for consistency.
3. Appendix I, this Appendix has been updated with new CAS numbers and codes based upon the recent upload of new data received from the Companies.

A revised version of the Unified EDD Format will be posted at http://ndep.nv.gov/bmi/technical.htm.

Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

Brian A Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions
Fax: (702) 486-5733

BAR:s

CC: Jim Najima, NDEP, BCA, Carson City
Marysia Skorska, NDEP, BCA, Las Vegas
Shannon Harbour, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Greg Lovato, NDEP, BCA, Carson City
Barry Conaty, Holland & Hart LLP, 975 F Street, N.W., Suite 900,Washington, D.C. 20004
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Ebrahim Juma, Clark County DAQEM, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021
Lee Erickson, Stauffer Management Company LLC, P.O. Box 18890 Golden, CO 80402
Keith Bailey, Environmental Answers, 3229 Persimmon Creek Drive, Edmond, OK 73013
Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr., Henderson, NV 89014
Mike Skromyda, Tronox LLC, PO Box 55, Henderson, Nevada 89009
Jeff Gibson, AMPAC, 3883 Howard Hughes Parkway, Suite 70, Las Vegas, Nevada 89109
Cindi Byrns, Olin Chlor Alkali, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 10733 Wave Crest Court Stockton, CA 95209
Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612
Robert Infelise, Cox Castle Nicholson, 555 California Street, 10th Floor, San Francisco, CA 94104-1513
Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004

Unified EDD Format

The objective of this guidance is to specify the design of the format for the submission of electronic data from the Companies to NDEP. The goal is to streamline the uploading of the Companies' electronic data into the regional database maintained by the NDEP. This task requires defining each element of the EDD(s) so that they are provided in a consistent format. Provided below are the required elements of the EDD format and descriptions of the elements. Requested formats and codes are provided in appendices, which should be followed to the extent possible. Additions to the fields should be provided as comments to this guidance or in formal communications if they are developed later in the project. Due to the resources required to modify the EDD for each Company it is the desire of the NDEP to modify this EDD as infrequently as possible.

The EDD should be delivered as a Microsoft Access database (file format Access 2000 or later) with the data organized into several tables. The fields to be included in each table are described in Appendix A.

It is understood that the database developed for the data validation summary report (DVSR) will include additional fields and records (e.g. quality control (QC) data). However, these additional fields and records should be provided in a separate table from the format described here. All native samples, including replicates should be included in this EDD but QC results (other than replicates) will not be incorporated into the regional database at this time.

It is understood that not all fields will contain a value. Empty fields will be represented as "NULLs" in the Microsoft Access database.

Non-Analytical Data

There are some data which will be stored in the regional database but which do not fit into the same format as the analytical data. Examples of these data are hydraulic parameters and soil material properties as described in Appendices G and H. Separate data tables will be developed to hold these data, which are not part of the standard EDD deliveries.

EDD Requirements

Required Fields:

Short Description	Field Name	Detailed Description
DVSR Identification	dvsr_id	A unique ID for each DVSR, from each company. The ID should contain elements that make it clear which company supplied the DVSR, the year of submittal, and a unique number designation. Format: ZZZZZ-YYYY-XXXX where ZZZZZ = company, or background (BKG), YYYY = number of the DVSR, XXXX = year.

Short Description	Field Name	Detailed Description
Sub-area or parcel designation	sub_area	A unique designation for each sub-area or parcel.
LOU designation	lou	A designation for LOU associated with the sample. If no LOU is associated with the sample this field should be labeled as "NULL".
Sample top depth	sample_top_depth	Sample top depth in feet. For Companies which only record a single sample depth, this value should go in both the sample_top_depth and sample_bottom_depth fields.
Sample bottom depth	sample_bottom_depth	Sample bottom depth in feet. For Companies which only record a single sample depth, this value should go in both the sample_top_depth and sample_bottom_depth fields.
Northing Coordinate	northing	Northing coordinate of the sample in NAD 1983 State Plane Nevada East feet
Easting Coordinate	easting	Easting coordinate of the sample in NAD 1983 State Plane Nevada East feet
Sample Identification - Field	sample_id_field	The ID used on the Chain of Custody, or similar field record. This ID should be unique to the sample and also consistent (identical) for all records associated with that sample. For example, where multiple analytes are reported the sample ID should be identical for all.
Sample Identification - Laboratory	sample_id_lab	The ID of the sample used at the laboratory. This ID should generally be unique to the sample and also consistent for all records associated with that sample. For example, where multiple analytes are reported the sample ID should be identical for all. There are instances where a different name may be required (e.g. reanalysis) but the use of multiple names should be minimized as much as possible.
Sample Collection Information	sample_collection_comment	Field for capturing information about how the sample was collected, for example, when groundwater samples have been collected from open boreholes using a bailer or from direct push equipment versus collecting the sample from a well using a submersible pump. This field should be populated only in cases where the sample was collected in a "non-standard" manner.

Short Description	Field Name	Detailed Description
Laboratory Identification/ code	lab_id	A unique identification of each laboratory, down to the laboratory location. For example, TestAmerica-Richland, Washington should have a designation that differs from other TestAmerica locations. Companies should provide a recommended ID for each laboratory currently used or expected. A designation for field analysis should be included.
SDG- Sample Delivery Group	sdg_id	The Sample Delivery Group identification supplied by the laboratory.
Analytical Batch Identification	batch_id	The analytical batch identification supplied by the laboratory.
Location Identification	location_id	An identification of the well or location where the sample was taken. The ID should be unique to that well or location and should be used in all future reports and EDDs. This identifier will be considered to be Company-specific; as part of the development of the regional database, a location table will be developed which will allow locations to be uniquely identified across companies.
hydrogeologic	hydro	The designation of the water-bearing zone associated with the sample: Shallow Zone, Middle Zone, or Deep Zone. This hydrogeologic nomenclature is described in the January 6, 2009 letter (*Hydrogeologic and Lithologic Nomenclature Unification)* from NDEP to the Companies.
lithologic	litho	The designation of the lithologic nomenclature tags: Qal (Quaternary Alluvium), xMCf (transitional Muddy Creek formation), or UMCf (Upper Muddy Creek formation). This lithologic nomenclature is described in the January 6, 2009 letter (*Hydrogeologic and Lithologic Nomenclature Unification)* from NDEP to the Companies.
Sample Matrix Identification/ code	matrix	A short code that designates the matrix of the sample. A recommended set is provided in Appendix B.
Sample Type Identification/ code	sample_type	A short code that designates the sample type (e.g. Field Duplicate as FD). A recommended set is provided in Appendix C.
Analytical Method Name/code	analytical_method	An identifier for the analytical method used for that suite of analyses. The identifier should include the version of the method. For example, many of the SW-846 methods have a letter at the end to indicate the version (e.g. 8330B). A recommended format is provided in Appendix D.
Preparation Method Name/code	preparation_method	An identifier for the preparation method used for that suite of analyses. Use the same guidelines as found in Appendix D.

Short Description	Field Name	Detailed Description
Analytical Suite	analytical_suite	A short code that designates the analytical suite, such as SVOC. A recommended list is provided in Appendix E.
Analyst Name	analyst_name	The name, or initials, of the analyst that performed the analysis. This field is required for asbestos results.
Total or Dissolved	filtered_flag	A flag T (true) or F (false) indicating whether the sample was filtered. T indicates the aqueous sample was filtered and is dissolved.
Sample Date	sample_date	The Year, Month, and Day of sample collection. Requested format: XXXXYYZZ, where XXXX=year, YY= month, and ZZ = day of month. This same format shall be used for all dates.
Sample Time	sample_time	The Hour:Minute:Seconds sample was collected. A 24 hour format is requested: 12:15:00 indicates 15 minutes after Noon. One hour later would be 13:15:00.
Preparation Date	prep_date	The Year, Month, and Day of laboratory sample preparation. Requested format: XXXXYYZZ, where XXXX=year, YY= month, and ZZ = day of month. This same format shall be used for all dates.
Preparation Time	prep_time	The Hour:Minute:Seconds the sample was prepared. A 24 hour format is requested: 12:15:00 indicates 15 minutes after Noon. One hour later would be 13:15:00.
Analysis Date	analysis_date	The Year, Month, and Day of sample analysis. Requested format: XXXXYYZZ, where XXXX=year, YY= month, and ZZ = day of month. This same format shall be used for all dates.
Analysis Time	analysis_time	The Hour:Minute: Seconds the sample was analyzed. A 24 hour format is requested: 12:15:00 indicates 15 minutes after Noon. One hour later would be 13:15:00.
CAS id or short code	cas_id	The Chemical Abstracts Society designation for the analyte, or a suitable code if no CAS designation for the analyte in question. Approved codes are listed in Appendix I. Asbestos types are treated as chemicals, in that each asbestos type (Total Chrysotile Protocol Structure, Long Chrysotile Protocol Structure, Long Amphibole Protocol Structure, Total Amphibole Protocol Structure, Long Asbestos Protocol Structure, Total Asbestos Protocol Structure) has its own code This field is also used to capture physical parameters. Appropriate physical parameters are provided in Appendix F.

Short Description	Field Name	Detailed Description
Chemical Name	analyte_name	A unique name for the analyte which corresponds to the code in the cas_id field. Approved names are listed in Appendix I.
Result Type Code	result_type	A short code to indicate the type of result for this record. Acceptable values include: TG (Target), SURR (Surrogate), IS (Internal Standard), SC (Spike Compound), TIC (tentatively Identified Compound). Others should be recommended by the Companies during review of this EDD guidance.
Initial or Reanalysis	reanalysis_flag	The field should contain either "Initial" or "Reanalysis" or similar designations to indicate whether the result is from the initial analysis or reanalysis. A sample that requires dilution and subsequent reanalysis would be so designated as would a sample that required re-extraction.
Lab Reported Result	result_reported	The analytical value for that analyte (or physical parameter) as reported by the laboratory. For asbestos, this is the number of structures.
Result Units	result_units	Units associated with the reported value.
Reported Results Uncertainty	result_uncertainty	The uncertainty value associated with the laboratory reported results. This will apply to radionuclides and possibly other analytes (e.g. XRF analysis results). This field is not applicable to asbestos. The DVSR (or laboratory report within the DVSR) should define the uncertainty (e.g. one sigma).
Asbestos Sensitivity	asbestos_analytical_sensitivity	The analytical sensitivity associated with the asbestos results. This should be the Mean value, not a 95% UCL value.
Asbestos Sensitivity Units	asbestos_sensitivity_units	The units associated with the asbestos sensitivity value (structures/gram usually as S/g PM10).
Detect Flag	detect_flag	A flag, T (true) or F (false), to indicate whether the value is considered a detection or not. Values less than the Sample Quantitation Limit (SQL) are generally considered Not Detected. Radionuclides and other reported values that are not censored at the laboratory will be reported as T. For all radionuclide results, the flag will always equal T (true) indicating a value (positive or negative) was reported, regardless of the value relative to the MDA.
Method Detection Limit	method_detection_limit	The Method Detection Limit for the analyte. This definition should follow the December 3, 2008 NDEP guidance entitled *Detection Limits and Data Reporting*
Sample Quantitation Limit	sample_quantitation_limit	The SQL for the analytes. This definition should follow the December 3, 2008 NDEP guidance entitled *Detection Limits and Data Reporting*

Short Description	Field Name	Detailed Description
Practical Quantitation Limit	practical_quantitation_limit	The Practical Quantitation Limit (PQL) for the analyte. This definition should follow the December 3, 2008 NDEP guidance entitled *Detection Limits and Data Reporting*
Minimum Detectable Activity	minimum_detectable_activity	The Minimum Detectable Activity, also known as Minimum Detectable Concentration. This is used for radionuclide results.
Percent Moisture	percent_moisture	The percentage of moisture of a solid sample. Please provide this record as a whole number, such as 95 for 95% moisture (no decimal).
Dilution Factor	dilution_factor	Any dilution factor used to arrive at the final reported value.
Laboratory Qualifier	lab_qualifier	The qualifier that may have been assigned to a reported value by the laboratory that performed the analysis.
Was result validated	validation_flag	A flag, T (true) or F (false). T indicates the value was validated after the laboratory reported the value.
Validation Stage	validation_stage	The stage to which the data has been validated. This stage designation should be consistent with the NDEP Guidance dated April 19, 2009. Stage 2B or 4 are the anticipated values. The terms used need to be defined in the DVSR.
Final Validation Qualifier	final_validation_qualifier	The final non-laboratory qualifier applied to the value.
Final Validation Reason Codes	final_validation_reason_codes	The reason code(s) that corresponds to the final Validation Qualifier (if more than one code, should be represented as a comma-separated list of codes). At this point there is no specified set of values. The companies may use their codes (and combination of codes) as long as all values are defined in the DVSR. All validation values should be consistent with the December 3, 2008 NDEP guidance entitled *Detection Limits and Data Reporting* document. For example, any reference to a sensitivity indicator (SQL, PQL etc) should be consistent with that guidance and only those sensitivity indicators should be used.
Validation Reason Code	validation_reason_code	Individual validation reason code used in lookup table.
Final Validation Reason Description	validation_reason	The description of the reason code. For example, Holding Time Exceeded. The description should be consistent with the DVSR.
Comment Field (Sample)	sample_comment	A field to include comments associated with a specific sample.

Short Description	Field Name	Detailed Description
Comment Field (Result)	result_comment	A field to include comments associated with a specific result.

Appendix A: EDD Database Tables

The EDD should be a Microsoft Access database containing at least four tables: a samples table, a results table, a locations table, and a validation_reason table. The samples table will contain sample metadata and will have field_sample_id as its primary key. The results table will link to the samples table using field_sample_id as a foreign key. The validation reason will have rows consisting of the dvsr_id, the company-specific validation_reason_code, and the corresponding reason description.

For convenience, the EDD database should also contain a query that links the samples, location, and result tables, allowing a "flat-file" view of the data.

Details of the fields included in each table are shown in the table below. The data type of all fields should be text, except where indicated below.

Field Name	Table(s)
dvsr_id	**samples** **validation_reason**
validation_reason_code validation_reason	**validation_reason**
sub_area lou northing (number) easting (number) hydro litho	**locations**
location_id	**locations(primary key)** **samples(foreign key, references locations table)**
sample_top_depth (number) sample_bottom_depth (number) matrix sample_type filtered_flag sample_date (date) sample_time (time) percent_moisture (number) sample_collection_comment sample_comment	**samples**
sample_id_field	**samples**(primary key) **results**(foreign key, references sample_id field in samples table)

Field Name	Table(s)
analytical_method	
preparation_method	
analytical_suite	
analyst_name	
analysis_date (date)	
analysis_time (time)	
prep_date (date)	
prep_time (time)	
analyte_name	
cas_id	
result_type	
reanalysis_flag	
result_reported (number)	
result_units	
result_uncertainty (number)	
asbestos_analytical_sensitivity (number)	
asbestos_sensitivity_units	
detect_flag	
method_detection_limit (number)	
sample_quantitation_limit (number)	
practical_quantitation_limit (number)	
minimum_detectable_activity (number)	
dilution_factor (number)	
sample_id_lab	
lab_id	
sdg_id	
batch_id	
lab_qualifier	
validation_flag	
validation_stage	
final_validation_qualifier	
final_validation_reason_codes	
result_comment	**results**

Appendix B: Sample Matrix Identification/Code

matrix	Sample Matrix Identification
AO	Outdoor Air
AI	Indoor Air
AG	Soil Gas
AF	Flux Chamber Air
SD	Sediment
SO	Soil
SW	Swab or Wipe
TA	Animal Tissue
TP	Plant Tissue
WS	Surface Water
WG	Ground Water
NAPL	Non-aqueous phase liquid
BW	Blank Water

Appendix C: Sample Type Identification/Code

Sample Type Code	Description
AB	Ambient Conditions Blank
BD	Blank Spike Duplicate
BS	Blank Spike
DIL	Diluted Sample
EB	Equipment Blank
ER	Equipment Rinse
FB	Field Blank
FD	Field Duplicate Sample
FR	Field Replicate
FS	Field Spike
FLD	Field analyses such as pH, temperature, specific conductance
KD	Known (External Reference Material) Duplicate
LB	Lab Blank
LD	Lab Duplicate
LCS	Lab Control Spike
LCSD	Lab Control Spike Duplicate
LR	Lab Replicate
MB	Material/Method Blank
MBD	Material/Method Blank Duplicate
MS	Matrix Spike Lab
MSD	Lab Matrix Spike and Spike Duplicate pair considered as one sample
NORM	Normal Environmental Sample taken in field
ORIG	Original sample in laboratory
SPB	Soil Prep Blank
WPB	Water Prep Blank
RD	Regulatory Duplicate
RE	Re-analysis
RM	Known (External Reference Material) Rinsate
RN	Rinsate
SD	Lab Matrix Spike Duplicate considered as separate from spike
SPT	A field split sample
TB	Trip Blank
TBD	Trip Blank Duplicate
WT	Waste
FDMS	A combination field duplicate matrix spike

Appendix D: Analytical Method Name/Code Guidance

Recommended format and guidance for analytical names:

- If the method is based on the United Stated Environmental Protection Agency (EPA) SW-846, start the name with "SW-" followed by the number and any applicable letter: XXXXc such as 8260b (SW-8260b).
- If the method is based on an EPA method that includes a digit after the period (e.g. Clean Water Act methods), be sure to include that, even if the digit is zero. Start the name with EPA: EPA 300.0
- If the method is based on an EPA document and citing that document is sufficient to understand the method used, include the document number: EPA-540-R97-028.
- If the method is based on an ASTM method, include ASTM- prior to the letter and number designation: ASTM D5755-03. Be sure to include the Based Designation (D5755) and Edition-Version (-03).
- If the method is based on Standard Methods for the Examination of Water and Wastewater, include "SM" prior to the number along with the Base Designation (7500) and the method version (-Ra). The results would be "SM7500-Ra." The DVSR should include the edition (e.g. 18th edition) or year the method was approved.
- Proprietary methods specific to a laboratory should have a designation that can be traced to the DVSR and method standard operating procedure (SOP). The version of the method needs be included in the DVSR and may also be incorporated into the EDD.

Preparation methods are not absolutely required in the EDD but a field (preparation_method) is included in the EDD structure to provide this information. However, all preparation methods that are distinct from the determination method must be included in the DVSR report. If preparation methods are included in the EDD they need to be in a separate column.

A designation indicating that method is a modified version (e.g. mod) is recommended but not required. However, the DVSR should indicate if the method is a modified version of a published method.

Appendix E: Analytical Suite Name/Code

Analytical Method Code	Description
ALDH	Aldehyde analysis
ASB	Asbestos
CRVL	Hexavalent chromium
CYAN	Cyanide
DIO_FUR	Dioxin and Furan
FIELD	Field measurements
GENERAL	Wet chemistry type measurements anions, hardness, bicarbonate, alkalinity, perchlorate, ammonia, bromide, TKN, etc
HERB	Herbicides
METALS	Metals and elements using ICP, AA, ICP-MS
ORG_ACID	Organic Acids analysis
PCB	PCB analysis, aroclors or congeners.
WPH	pH of aqueous sample
OCPEST	Organo-chlorine pesticide
OPPEST	Organo-phosphate pesticide
SOLIDS	TDS, TSS
SVOC	Semi-Volatile Organic Compounds, exclusive of Pesticides, PCBs, and PAHs.
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons, all molecular weights
VOC	Volatile Organic Compounds
XRFMetals	Metals and elements using XRF.
RADS	Radionuclides
PAH	Polyaromatic Hydrocarbon
TEM	Transmission Electron Microscopy (asbestos)
PLM	Polarized Light Microscopy (asbestos)
XRD	X-ray Diffraction (asbestos and metals)

Appendix F: Field Measurements

cas_id	Physical Parameter (analyte_name)
DETWA	Depth to Water
DO	Dissolved Oxygen
TEMP	Groundwater Temperature (°C)
EC	Electrical Conductivity
ORP	Oxidation Reduction Potential - Redox
WPH	Aqueous pH

Appendix G: Hydraulic Parameters

ID	Description
HYCO	Hydraulic Conductivity
STOR	Storativitity
TRANS	Transmissivity

Appendix H: Soil Material Properties

ID	Description
CEC	Cation Exchange Capacity
DBD	Dry Bulk Density
GSD	Grain Size Distribution
USCS	Unified Soil Classification System Description
FOC	Fraction Organic Carbon
MSC	Munsell Soil Color
SGR	Specific Gravity
SPH	Soil pH
TOP	Total Porosity
VMC	Volumetric Moisture Content
VWC	Volumetric Water Content

Appendix I: CAS IDS/ANALYTE CODES

cas_id	analyte_name
SIEVE_100	#100 SIEVE
SIEVE_016	#16 SIEVE
SIEVE_200	#200 SIEVE
SIEVE_030	#30 SIEVE
SIEVE_004	#4 SIEVE
SIEVE_050	#50 SIEVE
SIEVE_008	#8 SIEVE
Z7HEX	[Z]-7-Hexadecene
630-20-6	1,1,1,2-Tetrachloroethane
71-55-6	1,1,1-Trichloroethane
79-34-5	1,1,2,2-Tetrachloroethane
79-00-5	1,1,2-Trichloroethane
782-08-1	1,1-Bis[4-chlorophenyl]chloromethane
513-88-2	1,1-Dichloroacetone
75-34-3	1,1-Dichloroethane
75-35-4	1,1-Dichloroethene
563-58-6	1,1-Dichloropropene
75-37-6	1,1-Difluoroethane
608-73-1	1,2,3,4,5,6-Hexachlorocyclohexane
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin
634-66-2	1,2,3,4-Tetrachlorobenzene
634-90-2	1,2,3,5-Tetrachlorobenzene
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin
87-61-6	1,2,3-Trichlorobenzene
96-18-4	1,2,3-Trichloropropane
95-94-3	1,2,4,5-Tetrachlorobenzene
95-94-3i	1,2,4,5-Tetrachlorobenzene Isomer
291-22-5	1,2,4,5-Tetrathiane
120-82-1	1,2,4-Trichlorobenzene
95-63-6	1,2,4-Trimethylbenzene
289-16-7	1,2,4-Trithiolane
6576-93-8	1,2,5-Trithiepane
84-69-5	1,2-Benzenedicarboxylic acid, bis[2-methylpropyl] ester
100014-25-3	1,2-Bis[bis[2-chloroethyl]phos
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane
430-58-0	1,2-Dichloro-1-fluoroethylene

cas_id	analyte_name
95-50-1	1,2-Dichlorobenzene
107-06-2	1,2-Dichloroethane
17060-07-0	1,2-Dichloroethane-d4
540-59-0	1,2-Dichloroethene
78-87-5	1,2-Dichloropropane
624-73-7	1,2-Diiodoethane
122-66-7	1,2-Diphenylhydrazine
540-63-6	1,2-Ethanedithiol
163	1,3 & 1,4 Dichlorobenzenes
108-70-3	1,3,5-Trichlorobenzene
108-67-8	1,3,5-Trimethylbenzene
106-99-0	1,3-Butadiene
55880-77-8	1,3-Butadiene, pentachloro-
534-07-6	1,3-Dichloroacetone
541-73-1	1,3-Dichlorobenzene
142-28-9	1,3-Dichloropropane
542-75-6	1,3-Dichloropropene
81-20-9	1,3-Dimethyl-2-nitrobenzene
1193-11-9	1,3-Dioxolane, 2,2,4-trimethyl
144-19-4	1,3-Pentanediol
100012-68-9	1,4,7-Androstatrien-3,17-dione
14D22CEBZ	1,4-dichloro-2-[2-chloroethenyl]-benzene
106-46-7	1,4-Dichlorobenzene
3855-82-1	1,4-Dichlorobenzene-d4
123-91-1	1,4-Dioxane
17647-74-4	1,4-Dioxane-d8
3650-28-0	1,4-Methanoindan, hexahydro-7-isopropyl-4-methyl-8-methylene
SIEVE_1/2-IN	1/2-IN SIEVE
6285-05-8	1-[4-chlorophenyl]-1-Propanone
SIEVE_1-1/2-IN	1-1/2-IN SIEVE
109719-83-7	13C-1,2,3,4,6,7,8-HpCDD
109719-84-8	13C-1,2,3,4,6,7,8-HpCDF
114423-98-2	13C-1,2,3,4,7,8-HXCDF
109719-81-5	13C-1,2,3,6,7,8-HxCDD
109719-79-1	13C-1,2,3,7,8-PeCDD
109719-77-9	13C-1,2,3,7,8-PeCDF
234432-85-0	13C12-PCB 1
234432-89-4	13C12-PCB 104
208263-62-1	13C12-PCB 105
235416-29-2	13C12-PCB 111
208263-63-2	13C12-PCB 114
104130-40-7	13C12-PCB 118
160901-73-5	13C12-PCB 118
208263-64-3	13C12-PCB 123
160901-75-7	13C12-PCB 126
208263-65-4	13C12-PCB 126
208263-67-6	13C12-PCB 15
234432-90-7	13C12-PCB 155
208263-68-7	13C12-PCB 156

cas_id	analyte_name
13C12-PCB-156/157	13C12-PCB 156/157
208263-69-8	13C12-PCB 167
160901-79-1	13C12-PCB 169
208263-70-1	13C12-PCB 169
160901-80-4	13C12-PCB 170
232919-67-4	13C12-PCB 178
160901-82-6	13C12-PCB 180
234432-91-8	13C12-PCB 188
208263-73-4	13C12-PCB 189
234432-87-2	13C12-PCB 19
105600-26-8	13C12-PCB 202
234446-64-1	13C12-PCB 205
208263-75-6	13C12-PCB 206
234432-92-9	13C12-PCB 208
105600-27-9	13C12-PCB 209
208263-76-7	13C12-PCB 28
208263-77-8	13C12-PCB 3
208263-79-0	13C12-PCB 37
234432-86-1	13C12-PCB 4
234432-88-3	13C12-PCB 54
105600-23-5	13C12-PCB 77
160901-67-7	13C12-PCB 77
160901-68-8	13C12-PCB 81
208461-24-9	13C12-PCB 81
76523-40-5	13C-2,3,7,8-TCDD
89059-46-1	13C-2,3,7,8-TCDF
114423-97-1	13C-Octachlorodibenzodioxin
127062-51-5	13-Hexyloxacyclotridec-10-EN-2
17351-34-7	14-Pentadecenoic acid
4764-72-1	15-Octadecenoic acid, methyl e
6971-40-0	17-Pentatriacontene
2642-80-0	1-Chloro-2,2-bis[p-chlorophenyl]ethane
628-34-2	1-Chloro-2-ethoxyethane
544-10-5	1-Chlorohexane
6624-79-9	1-Dotriacontanol
629-96-9	1-Eicosanol
95-14-7	1H-Benzotriazole
1H1PP2	1-hydroxy,1-phenyl,propanon-2
SIEVE_1-IN	1-IN SIEVE
590-67-0	1-Methylcyclohexanol
108-03-2	1-Nitropropane
6570-87-2	1-Pentanol, 3,4-dimethyl-
763-29-1	1-Pentene, 2-methyl-
5155-70-4	1-Phenanthrenecarboxylic acid
78-83-1	1-Propanol, 2-methyl-
69102-77-8	1-Propene, pentachloro-
464-06-2	2,2,3-Trimethylbutane
540-84-1	2,2,4-Trimethylpentane
DCBZL	2,2'-/4,4'-Dichlorobenzil

cas_id	analyte_name
594-20-7	2,2-Dichloropropane
100014-71-4	2,2'-Dichlorostilbene
590-35-2	2,2-Dimethylpentane
1003-17-4	2,2-Dimethyltetrahydrofuran
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran
2346TCP	2,3,4,6-Tetrachloropyridine
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran
921-47-1	2,3,4-trimethylhexane
2402-79-1	2,3,5,6-Tetrachloropyridine
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran
TCDD2378CL37	2,3,7,8-tetrachlorodibenzo-p-dioxin-CL37
1746-01-6	2,3,7,8-Tetrachlororodibenzo-p-dioxin
31566-10-6	2,3-Dicarbaheptaborane[7], 2,3-dimethyl-
565-59-3	2,3-Dimethylpentane
4808-48-4	2,3-Diphenylmaleic anhydride
93-76-5	2,4,5-T
93-72-1	2,4,5-TP [Silvex]
95-95-4	2,4,5-Trichlorophenol
118-79-6	2,4,6-Tribromophenol
88-06-2	2,4,6-Trichlorophenol
94-75-7	2,4-D
94-82-6	2,4-DB
53-19-0	2,4-DDD
3424-82-6	2,4-DDE
789-02-6	2,4'-DDT
789-05-6i	2,4'-DDT isomer
120-83-2	2,4-Dichlorophenol
19719-28-9	2,4-Dichlorophenylacetic acid
108-08-7	2,4-Dimethylpentane
105-67-9	2,4-Dimethylphenol
51-28-5	2,4-Dinitrophenol
121-14-2	2,4-Dinitrotoluene
1618-26-4	2,4-Dithiapentane
1618-26-4[1]	2,4-Dithiapentane isomer 1
1921-70-6	2,6,10,14-Tetramethylpentadecane
28469-92-3	2,6-Dichlorostyrene
1072-05-5	2,6-Dimethylheptane
606-20-2	2,6-Dinitrotoluene
128-37-0	2,6-Di-tert-Butyl-p-Cresol
112-34-5	2-[2-Butoxyethoxy]ethanol
706-14-9	2[3H]-Furanone, 5-hexyldihydro-
112-07-2	2-Butoxyethyl acetate
126-99-8	2-Chloro-1,3-butadiene
118-91-2	2-Chlorobenzoic acid
609-65-4	2-Chlorobenzoyl chloride
611-19-8	2-Chlorobenzylchloride
110-75-8	2-Chloroethyl vinyl ether
91-58-7	2-Chloronaphthalene
95-57-8	2-Chlorophenol

cas_id	analyte_name
95-49-8	2-Chlorotoluene
1121-05-7	2-Cyclopenten-1-one, 2,3-dimethyl-
3913-81-3	2-Decenal, [e]-
110-80-5	2-Ethoxyethanol
111-15-9	2-Ethoxyethyl acetate
104-76-7	2-Ethyl-1-hexanol
149-57-5	2-Ethylhexanoic acid
103-09-3	2-Ethylhexyl acetate
24468-13-1	2-ethylhexyl chloroformate
403-19-0	2-Fluoro-4-nitrophenol
1526-17-6	2-Fluoro-6-nitrophenol
321-60-8	2-Fluorobiphenyl
367-12-4	2-Fluorophenol
591-78-6	2-Hexanone
149-30-4	2-Mercaptobenzothiazole
994-05-8	2-Methoxy-2-methyl-butane
55045-07-3	2-Methyl-6-propyldodecane
591-76-4	2-Methylhexane
91-57-6	2-Methylnaphthalene
88-74-4	2-Nitroaniline
88-75-5	2-Nitrophenol
79-46-9	2-Nitropropane
3760-11-0	2-Nonenoic acid
111-13-7	2-Octanone
75207-54-4	2-Pentacosanone
502-69-2	2-Pentadecanone, 6,10,14-trime
58175-57-8	2-Propyl-1-pentanol
2463-77-6	2-Undecenal
91-94-1	3,3-Dichlorobenzidine
562-49-2	3,3-Dimethylpentane
3,4-Methylphenol	3,4-Methylphenol
926-82-9	3,5-Dimethylheptane
591-22-0	3,5-dimethyl-pyridine
100014-71-3	3,6-Dichloro-benzene-1,2-diol
SIEVE_3/4-IN	3/4-IN SIEVE
SIEVE_3/8-IN	3/8-IN SIEVE
2037-31-2	3-chlorobenzenethiol
535-80-8	3-Chlorobenzoic acid
620-20-2	3-Chlorobenzylchloride
4867-37-2	3-Chlorothioanisole
617-78-7	3-Ethylpentane
3HEX25D	3-Hexene-2,5-dione
6418-41-3	3-Methyl tridecane
72218-58-7	3-Methylheptyl acetate
589-34-4	3-Methylhexane
99-09-2	3-Nitroaniline
565-80-0	3-Pentanone, 2,4-dimethyl-
465-80-0	3-pentanone, 2,4-dimetyl-
625-33-2	3-Penten-2-one

cas_id	analyte_name
72-54-8	4,4-DDD
72-55-9	4,4-DDE
50-29-3	4,4-DDT
44DCBZL	4,4-Dichlorobenzil
90-98-2	4,4'-Dichlorobenzophenone
5181-10-2	4,4'-Dichlorodiphenylsulphide
534-52-1	4,6-Dinitro-2-methylphenol
481216-TMH	4,8,12,16-Tetramethylheptadecan-4-olide
1918-02-1	4-Amino-3,5,6-trichloropicolinic acid
460-00-4	4-Bromofluorobenzene
101-55-3	4-Bromophenyl phenyl ether
59-50-7	4-Chloro-3-methylphenol
98-66-8	4-Chlorobenzene sulfonic acid
74-11-3	4-Chlorobenzoic acid
104-83-6	4-Chlorobenzylchloride
22711-23-5	4-Chlorodibenzoyl
106-48-9	4-Chlorophenol
98-57-7	4-Chlorophenyl methyl sulfone
7005-72-3	4-Chlorophenyl phenyl ether
123-09-1	4-Chlorothioanisole
106-54-7	4-Chlorothiophenol
106-43-4	4-Chlorotoluene
622-96-8	4-Ethyltoluene
108-10-1	4-Methyl-2-pentanone [MIBK]
100-01-6	4-Nitroaniline
100-02-7	4-Nitrophenol
3744-02-3	4-Penten-2-One, 4-Methyl-
5166-53-01	5-methyl-3-hexen-2-one
100014-00-7	6S-2,3,8,8-tetramethyltricyclo
82-05-3	7H-Benz[de]anthracen-7-one
7225-66-3	7-Hexyl Tridecane
7225-66-3[1]	7-Hexyl Tridecane Isomer
7225-66-3[2]	7-Hexyl Tridecane Isomer 1
605-48-1	9,10-Dichloroanthracene
60-33-3	9,12-Octadecadienoic acid [Z,Z]-
301-02-0	9-Octadecenamide, [z]-
3906-30-7	9-Octadecenamide, n,n-dimethyl
112-79-8	9-Octadecenoic acid, [e]-
83-32-9	Acenaphthene
208-96-8	Acenaphthylene
75-07-0	Acetaldehyde
822-23-1	Acetic acid, Octadecyl ester
1878-66-6	Acetic acid, p-chlorophenyl-
67-64-1	Acetone
75-05-8	Acetonitrile
98-86-2	Acetophenone
532-27-4	Acetophenone, 2-chloro-
107-02-8	Acrolein
107-13-1	Acrylonitrile

cas_id	analyte_name
14952-40-0	Actinium-227
14331-83-0	Actinium-228
15972-60-8	Alachlor
309-00-2	Aldrin
ALKB	Alkalinity, Bicarbonate [As CaCO3]
ALKC	Alkalinity, Carbonate [As CaCO3]
107-05-1	Allyl chloride
12587-46-1	ALPHA activity
319-84-6[1]	Alpha Lindane Isomer 1
319-84-6[2]	Alpha Lindane Isomer 2
A2PPBZMETH	alpha-2-propenylbenzenemethanol
319-84-6	alpha-BHC
6753-98-6	alpha-Caryophyllene
5103-71-9	alpha-Chlordane
98-83-9	alpha-Methylstyrene
7429-90-5	Aluminum
14596-10-2	Americium-241
7664-41-7	Ammonia
NH3NH3	Ammonia [as Ammonium]
NH3_N	Ammonia [as N]
14798-03-9	Ammonium
62-53-3	Aniline
120-12-7	Anthracene
7440-36-0	Antimony
Apparent Color	Apparent Color
12674-11-2	Aroclor 1016
11104-28-2	Aroclor 1221
11141-16-5	Aroclor 1232
53469-21-9	Aroclor 1242
12672-29-6	Aroclor 1248
11097-69-1	Aroclor 1254
11096-82-5	Aroclor 1260
37324-23-5	Aroclor 1262
11100-14-4	Aroclor 1268
7440-38-2	Arsenic
22541-54-4	Arsenic III
17428-41-0	Arsenic V
1332-21-4	Asbestos
3244-90-4	Aspon
1912-24-9	Atrazine
2642-71-9	Azinphos-ethyl
86-50-0	Azinphos-methyl
103-33-3	Azobenzene
7440-39-3	Barium
100-52-7	Benzaldehyde
134-96-3	Benzaldehyde, 4-hydroxy-3,5-dimethoxy-
55-21-0	Benzamide
39193-06-1	Benzamide, 4-chloro-n-[4-chlor
71-43-2	Benzene

cas_id	analyte_name
53172-84-2	Benzene, [1-methyl-1-butenyl]-
622-38-8	Benzene, [ethylthio]-
1193-82-4	Benzene, [methylsulfinyl]-
1520-42-9	Benzene, 1,1',1''-[1-ethanyl-2-ylidene]tris-
3085-42-5	Benzene, 1,1'-sulfinylbis[4-chloro-
54935-00-1	Benzene, 1,4-dichloro-2-[2-chloroethenyl]
1123-84-8	Benzene, 1,4-dichloro-2-ethenyl-
611-14-3	Benzene, 1-ethyl-2-methyl-
45892-47-5	Benzene, 2,4-dichloro-1-[2-chl
1078-71-3	Benzene, heptyl-
101-41-7	Benzeneacetic acid, methyl ester
5597-50-2	Benzenepropanoic acid, 4-hydro
103-25-3	Benzenepropanoic acid, methyl
98-64-6	Benzenesulfonamide, 4-chloro-
98-11-3	Benzenesulfonic acid
1212-08-4	Benzenesulfonothioic Acid, S-p
108-98-5	Benzenethiol
92-87-5	Benzidine
56-55-3	Benzo[a]anthracene
50-32-8	Benzo[a]pyrene
B[b&k]F	Benzo[b,k]fluoranthene
205-99-2	Benzo[b]fluoranthene
191-24-2	Benzo[g,h,i]perylene
207-08-9	Benzo[k]fluoranthene
65-85-0	Benzoic acid
1421-49-4	Benzoic acid, 3,5-bis[1,1-dimethylethyl]-4-hydroxy-
2905-65-9	Benzoic acid, m-chloro-
119-61-9	Benzophenone
33093-42-4	Benzophenone, 3,4,4'-trichloro
100-51-6	Benzyl alcohol
100-44-7	Benzyl chloride
7440-41-7	Beryllium
12587-47-2	BETA activity
319-85-7	beta-BHC
71-52-3	Bicarbonate alkalinity
141-66-2	Bidrin
BOD	Biochemical Oxygen Demand
92-52-4	Biphenyl
111-91-1	bis[2-Chloroethoxy]methane
111-44-4	bis[2-Chloroethyl] ether
108-60-1	bis[2-Chloroisopropyl] ether
117-81-7	bis[2-Ethylhexyl] phthalate
103-23-1	bis[2-ethylhexyl]adipate
1142-19-4i	Bis[4-chlorophenyl] disulfide isomer
2393-97-7	Bis[4-chlorophenylthio]methane
80-07-9	bis[p-Chlorophenyl] sulfone
1142-19-4	bis[p-Chlorophenyl]disulfide
3561-67-9	Bis[phenylthio]methane
7440-69-9	Bismuth

cas_id	analyte_name
14331-79-4	Bismuth-210
15229-37-5	Bismuth-211
14913-49-6	Bismuth-212
14733-03-0	Bismuth-214
80-05-7	Bisphenol A
35400-43-2	Bolstar [Sulprofos]
7440-42-8	Boron
314-40-9	Bromacil
24959-67-9	Bromide
7726-95-6	Bromine
108-86-1	Bromobenzene
75-27-4	Bromodichloromethane
75-25-2	Bromoform
74-83-9	Bromomethane
23184-66-9	Butachlor
78-78-4	Butane, 2-methyl-
85-68-7	Butylbenzyl phthalate
7440-43-9	Cadmium
58-08-2	Caffeine
7440-70-2	Calcium
CTIC	Calculated Inorganic Carbon
334-48-5	Capric acid
124-07-2	Caprylic acid
86-74-8	Carbazole
7440-44-0	Carbon
124-38-9	Carbon dioxide
75-15-0	Carbon disulfide
56-23-5	Carbon tetrachloride
3812-32-6	Carbonate alkalinity
786-19-6	Carbophenothion
786-19-6[1]	Carbophenothion Isomer 1
100015-81-8	Caryophyllene
CEC	Cation Exchange Capacity
7440-46-2	Cesium
13967-70-9	Cesium-134
10045-97-3	Cesium-137
COD	Chemical Oxygen Demand
7790-93-4	Chlorate
57-74-9	Chlordane
470-90-6	Chlorfenvinfos
16887-00-6	Chloride
7782-50-5	Chlorine
13898-47-0	Chlorite
24934-91-6	Chlormephos
C2CEB	chloro[2-chloroethyl]-benzene
107-20-0	Chloroacetaldehyde
108-90-7	Chlorobenzene
74-97-5	Chlorobromomethane
75-00-3	Chloroethane

cas_id	analyte_name
67-66-3	Chloroform
593-71-5	Chloroiodomethane
74-87-3	Chloromethane
5598-13-0	Chloropyrifos-methyl
2921-88-2	Chlorpyrifos
ChlorpyrophosME	Chlorpyrophos methyl ester
7440-47-3	Chromium
18540-29-9	Chromium [VI]
218-01-9	Chrysene
156-59-2	cis-1,2-Dichloroethene
10061-01-5	cis-1,3-Dichloropropene
7440-48-4	Cobalt
13981-50-5	Cobalt-57
13981-38-9	Cobalt-58
10198-40-0	Cobalt-60
COBBLES	COBBLES
7440-50-8	Copper
56-72-4	Coumaphos
7700-17-6	Crotoxyphos
57-12-5	Cyanide, Total
2597-49-1	Cyclobutane, ethenyl-
293-96-9	Cyclodecane
1501-82-2	Cyclododecene
110-82-7	Cyclohexane
10498-35-8	Cyclohexane, 1,2-dichloro-, cis-
822-86-6	Cyclohexane, 1,2-dichloro-, trans-
1122-82-3	Cyclohexane, isothiocyanato-
108-87-2	Cyclohexane, Methyl-
80-53-5	Cyclohexanemethanol, 4-hydroxy
108-94-1	Cyclohexanone
55255-41-9	Cyclopentane, [trichloroethenyl]
2453-00-1	Cyclopentane, 1,3-dimethyl-
2532-58-3	Cyclopentane, 1,3-dimethyl-, cis-
1640-89-7	Cyclopentane, ethyl-
96-37-7	Cyclopentane, methyl-
541-02-6	Cyclopentasiloxane, decamethyl
99-87-6	Cymene [Isopropyltoluene]
D15_COEFF	D15 COEFF
D30_COEFF	D30 COEFF
D50_COEFF	D50 COEFF
D60_COEFF	D60 COEFF
D85_COEFF	D85 COEFF
75-99-0	Dalapon
8017-34-3	DDT, Technical
DTN	decahydro-trans-Napthalene
6975-98-0	Decane, 2-methyl-
13151-34-3	Decane, 3-methyl-
119-07-3	Decyl octyl phthalate
319-86-8i	Delta Lindane Isomer

cas_id	analyte_name
319-86-8	delta-BHC
11B-delta	DELTA-BORON 11
8065-48-3	Demeton
298-03-3	Demeton-O
126-75-0	Demeton-S
DTW	Depth to Water
123-42-2	Diacetone alcohol
333-41-5	Diazinon
53-70-3	Dibenzo[a,h]anthracene
132-64-9	Dibenzofuran
132-65-0	Dibenzothiophene
73506-94-2	Dibromochloroethane
124-48-1	Dibromochloromethane
96-12-8	Dibromochloropropane
1868-53-7	Dibromofluoromethane
74-95-3	Dibromomethane
1918-00-9	Dicamba
DICBTOT	DiCB-[12]+[13]
97-17-6	Dichlorfenthion
79-02-7	Dichloroacetaldehyde
594-04-7	Dichloroiodomethane
75-09-2	Dichloromethane [Methylene chloride]
120-36-5	Dichloroprop
62-73-7	Dichlorvos
60-57-1	Dieldrin
110-81-6	Diethyl disulfide
84-66-2	Diethyl phthalate
352-93-2	Diethyl sulfide
108-20-3	Diisopropyl ether
60-51-5	Dimethoate
131-11-3	Dimethyl phthalate
67-68-5	Dimethyl sulfoxide
624-92-0	Dimethyldisulfide
84-74-2	Di-n-butyl phthalate
117-84-0	Di-n-octyl phthalate
88-85-7	Dinoseb
TEQ_DF	Dioxins/Furans TEQ
78-34-2	Dioxothion
882-33-7	Diphenyl disulfide
139-66-2	Diphenyl sulfide
127-63-9	Diphenyl sulfone
501-65-5	Diphenylethyne
101-81-5	Diphenylmethane
DPPT	diphenyl-propanetrione
7782-44-7	dissolved oxygen
298-04-4	Disulfoton
5989-27-5	D-Limonene
127-19-5	DMAC
629-97-0	Docosane

cas_id	analyte_name
629-97-0 [1]	Docosane isomer
3891-98-3	Dodecane, 2,6,10-trimethyl-
143-07-7	Dodecanoic acid
544-85-4	Dotriacontane
DRO_C10C22	DRO [C10-C22]
PHCC8C24	DRO [C8-C24]
EFH_C13C40	EFH [C13 - C40]
PHCC8C40	EFH [C8 - C40]
112-95-8	Eicosane
EC	Electrical Conductivity
959-98-8	Endosulfan I
33213-65-9	Endosulfan II
1031-07-8	Endosulfan sulfate
72-20-8	Endrin
7421-93-4	Endrin aldehyde
53494-70-5	Endrin ketone
2104-64-5	EPN
112-84-5	Erucylamide
74-84-0	Ethane
624-89-5	Ethane, [methylthio]-
619-33-0	Ethane, 1,1-dichloro-2,2-diethoxy-
6628-18-8	Ethane, 1,2-bis[methylthio]-
106-93-4	Ethane, 1,2-dibromo-
27-72-1	Ethane, hexachloro-
134-81-6	Ethanedione, diphenyl-
75-08-1	Ethanethiol
64-17-5	Ethanol
115-20-8	Ethanol, 2,2,2-trichloro-
111-46-6	Ethanol, 2,2'-oxybis-
111-90-0	Ethanol, 2-[2-ethoxyethoxy]-
563-12-2	Ethion
13194-48-4	Ethoprop
100022-54-1	Ethyl 2-chloro-2-[3-chlorobenzene]
141-78-6	Ethyl acetate
60-29-7	Ethyl ether
97-63-2	Ethyl methacrylate
56-38-2	Ethyl parathion
637-92-3	Ethyl tert-butyl ether
100-41-4	Ethylbenzene
74-85-1	Ethylene
107-21-1	Ethylene glycol
111-76-2	Ethylene glycol monobutyl ether
25550-14-5	Ethyltoluene
470-82-6	Eucalyptol
7440-53-1	Europium
52-85-7	Fampphur
115-90-2	Fensulfothion
55-38-9	Fenthion
7439-89-6 [2+]	Ferrous Iron

cas_id	analyte_name
Q376	Flashpoint
206-44-0	Fluoranthene
86-73-7	Fluorene
16984-48-8	Fluoride
944-22-9	Fonofos
50-00-0	Formaldehyde
75-69-4	Freon-11 [Trichlorofluoromethane]
76-13-1	Freon-113 [1,1,2-Trifluoro-1,2,2-trichloroethane]
75-71-8	Freon-12 [Dichlorodifluoromethane]
28903-24-4	gamma-2,3,4,5,6-Pentachlorocyclohexene
58-89-9	gamma-BHC [Lindane]
5103-74-2	gamma-Chlordane
8006-61-9	Gasoline
GW_ELEVATION	GW_ELEVATION
HARD	Hardness, Total
Q2240	HEM Oil/Grease
629-94-7	Heneicosane
76-44-8	Heptachlor
1024-57-3	Heptachlor epoxide
38998-75-3	Heptachlorodibenzofuran, Total
37871-00-4	Heptachlorodibenzo-p-dioxin, Total
593-49-7	Heptacosane
62016-79-9	Heptacosane, 1-chloro-
629-78-7	Heptadecane
13287-23-5	Heptadecane, 8-methyl-
7225-64-1	Heptadecane, 9-octyl
111-71-7	Heptanal
142-82-5	Heptane
3074-71-3	Heptane, 2,3-dimethyl-
2213-23-2	Heptane, 2,4-dimethyl
2216-30-0	Heptane, 2,5-dimethyl
592-27-8	Heptane, 2-methyl-
111-14-8	Heptanoic Acid
118-74-1	Hexachlorobenzene
87-68-3	Hexachlorobutadiene
77-47-4	Hexachlorocyclopentadiene
55684-94-1	Hexachlorodibenzofuran, Total
34465-46-8	Hexachlorodibenzo-p-dioxin
67-72-1	Hexachloroethane
HCH	Hexachlorohexane
630-01-3	Hexacosane
629-54-9	Hexadecanamide
638-36-8	Hexadecane, 2,6,10,14-tetramethyl-
57-10-3	Hexadecanoic acid
23470-00-0	Hexadecanoic acid, 2-hydroxy-1-[hydroxymethyl]ethyl ester
111-06-8	Hexadecanoic acid, Butyl ester
541-05-9	Hexamethylcyclotrisiloxane
680-31-9	Hexamethylphosphoramide
66-25-1	Hexanal

cas_id	analyte_name
123-05-7	Hexanal, 2-ethyl-
110-54-3	Hexane
4337-65-9	hexanedioic acid, mono[2-ethylhexyl]ester
630-06-8	Hexatriacontane
630-06-8 [1]	Hexatriacontane isomer
107-41-5	Hexylene glycol
7647-01-0	Hydrochloric acid
14280-30-9	Hydroxide
OH-ALK	Hydroxide alkalinity
118-29-6	Hydroxymethyl phthalimide
Ignitability	Ignitability
193-39-5	Indeno[1,2,3-cd]pyrene
20461-54-5	Iodide
7553-56-2	Iodine
Q901	Ion Balance Difference
7439-89-6	Iron
75-28-5	ISOBUTANE
115-11-7	Isobutylene
78-59-1	Isophorone
67-63-0	Isopropyl alcohol
98-82-8	Isopropylbenzene
872-56-0	Isopropylcyclobutane
25155-15-1	Isopropyltoluene
143-50-0	Kepone
Lab Cond	Laboratory conductivity
Lab pH	Laboratory pH
LI 25deg	Langelier Index - 25 degree
7439-91-0	Lanthanum
7439-92-1	Lead
14255-04-0	Lead-210
15816-77-0	Lead-211
15092-94-1	Lead-212
15067-28-4	Lead-214
21609-90-5	Leptophos
7439-93-2	Lithium
12172-73-5L	Long Amphibole Protocol Structure
1332-21-4L	Long Asbestos Protocol Structure
12001-29-5L	Long Chrysotile Protocol Structure
19890-84-7	Longifolenaldehyde
65794-96-9	m,p-Cresols
136777-61-2	m,p-Xylene
7439-95-4	Magnesium
121-75-5	Malathion
7439-96-5	Manganese
MBAS	MBAS
94-74-6	MCPA
93-65-2	MCPP
7085-19-0	Mecoprop
7439-97-6	Mercury

cas_id	analyte_name
150-50-5	Merphos
141-79-7	Mesityl oxide
122-14-5	Metathione
74-82-8	Methane
74-93-1	Methanethiol
67-56-1	Methanol
33146-57-5	Methanone, [4-chlorophenyl][2,4-dichlorophenyl]
134-85-0	Methanone, [4-chlorophenyl]phenyl-
72-43-5	Methoxychlor
79-20-9	Methyl Acetate
953-17-3	Methyl carbophenothion
20333-39-5	Methyl ethyl disulphide
78-93-3	Methyl ethyl ketone [2-Butanone]
74-88-4	Methyl iodide
110-12-3	Methyl isoamyl ketone
22967-92-6	Methyl mercury
80-62-6	Methyl methacrylate
110-43-0	Methyl n-amyl ketone
298-00-0	Methyl parathion
107-87-9	Methyl propyl ketone
75-18-3	Methyl sulfide
126-98-7	Methylacrylonitrile
METHYLENE BROMIDE	Methylene bromide
25013-15-4	Methylstyrene
51218-45-2	Metolachlor
21087-64-9	Metribuzin
7786-34-7	Mevinphos
Mineral Spirits	Mineral Spirits
2385-85-5	Mirex
2212-67-1	Molinate
7439-98-7	Molybdenum
131-70-4	Monobutyl phthalate
6923-22-4	Monocrotophos
1634-04-4	MTBE [Methyl tert-butyl ether]
300-76-5	Naled
91-20-3	Naphthalene
3018-20-0	Naphthalene, 1,2,3,4-tetrahydro-1-phenyl-
493-02-7	Naphthalene, decahydro-, trans-
71-36-3	n-Butyl alcohol
104-51-8	n-Butyl benzene
544-76-3	n-Hexadecane
7440-02-0	Nickel
7440-03-1	Niobium
14797-55-8	Nitrate
NO3-N	Nitrate [as N]
NO3/NO2	Nitrate/Nitrite
NO3/NO2-N	Nitrate/Nitrite [as N]
14797-65-0	Nitrite
NO2-N	Nitrite [as N]

cas_id	analyte_name
98-95-3	Nitrobenzene
4165-60-0	Nitrobenzene-d5
55-18-5	N-nitrosodiethylamine
62-75-9	N-Nitrosodimethylamine
621-64-7	N-nitrosodi-n-propylamine
86-30-6	N-nitrosodiphenylamine
630-03-5	Nonacosane
629-92-5	Nonadecane
124-19-6	Nonanal
111-84-2	Nonane
112-05-0	Nonanoic acid
103-65-1	n-Propylbenzene
629-59-4	n-Tetradecane
629-50-5	n-Tridecane
6006-33-3	n-Tridecylcyclohexane
297-97-2	O,O,O-Triethyl phosphorothioate [TEPP]
126-68-1	O,O,O-Triethylphosphorothioate
100022-65-2	O,o'-diethyl s-methyl thiophos
298-06-6	O,O-Diethylphosphorodithioic acid
756-80-9	O,O-Dimethylphosphorodithioic acid
95-48-7	o-Cresol
OCDD	Octachlorodibenzodioxin
29082-74-4	Octachlorostyrene
630-02-4	Octacosane
593-45-3	Octadecane
57-11-4	Octadecanoic acid
621-61-4	Octadecanoic acid, 2-hydroxy-1-[hydroxymethyl]ethyl ester
646-13-9	Octadecanoic acid, 2-methylpropyl ester
556-67-2	Octamethylcyclotetrasiloxane
124-13-0	Octanal
111-65-9	Octane
3221-61-2	Octane, 2-methyl-
2216-33-3	Octane, 3-methyl-
2216-34-4	Octane, 4-methyl-
10544-50-0	Octasulfur
OIL/GREASE	Oil and grease
112-80-1	Oleic acid
OM	Organic Matter
ORO_C22-C32	ORO [C22-C32]
ORO_C23-C32	ORO [C23-C32]
PHCC25C40	ORO [C25-C40]
11-36-9	Orthophosphate
84-15-1	o-Terphenyl
74685-36-2	Oxacyclotetradecane-2,11-dione
OX_RED_POT	oxidation-reduction potential
100022-28-6	Oxime-, methoxy-phenyl-
131-57-7	Oxybenzone
95-47-6	o-Xylene
7440-05-3	Palladium

cas_id	analyte_name
2051-60-7	PCB 1
33146-45-1	PCB 10
39485-83-1	PCB 100
60145-21-3	PCB 103
56558-16-8	PCB 104
32598-14-4	PCB 105
PCB-105/127	PCB 105/127
70424-69-0	PCB 106
70424-68-9	PCB 107
PCB-107/124	PCB 107/124
PCB-108/124	PCB 108/124
74472-35-8	PCB 109
PCB-109/107	PCB 109/107
2050-67-1	PCB 11
38380-03-9	PCB 110
PCB-110/115	PCB 110/115
39635-32-0	PCB 111
74472-36-9	PCB 112
68194-10-5	PCB 113
74472-37-0	PCB 114
PCB-115/116	PCB 115/116
31508-00-6	PCB 118
PCB-118/106	PCB 118/106
56558-17-9	PCB 119
PCB-12/13	PCB 12/13
68194-12-7	PCB 120
56558-18-0	PCB 121
PCB-121/88	PCB 121/88
76842-07-4	PCB 122
65510-44-3	PCB 123
70424-70-3	PCB 124
57465-28-8	PCB 126
39635-33-1	PCB 127
38380-07-3	PCB 128
PCB-128/166	PCB 128/166
55215-18-4	PCB 129
PCB-129_CAS_CoE	PCB 129/138/160/163
PCB-129/138/163	PCB 129/138/163
52663-66-8	PCB 130
61798-70-7	PCB 131
PCB-131/142	PCB 131/142
PCB-131/142/165	PCB 131/142/165
38380-05-1	PCB 132
PCB-132/168	PCB 132/168
35694-04-3	PCB 133
52704-70-8	PCB 134
PCB-134/143	PCB 134/143
PCB-134/147/149	PCB 134/147/149
PCB-135/144	PCB 135/144

cas_id	analyte_name
PCB-135/151	PCB 135/151
PCB-135/151/154	PCB 135/151/154
38411-22-2	PCB 136
35694-06-5	PCB 137
PCB-139/140	PCB 139/140
PCB-139/149	PCB 139/149
34883-41-5	PCB 14
59291-64-4	PCB 140
52712-04-6	PCB 141
41411-61-4	PCB 142
68194-15-0	PCB 143
68194-14-9	PCB 144
74472-40-5	PCB 145
51908-16-8	PCB 146
68194-13-8	PCB 147
PCB-147/149	PCB 147/149
74472-41-6	PCB 148
2050-68-2	PCB 15
68194-08-1	PCB 150
52663-63-5	PCB 151
68194-09-2	PCB 152
PCB-152/150	PCB 152/150
35065-27-1	PCB 153
PCB-153/168	PCB 153/168
60145-22-4	PCB 154
33979-03-2	PCB 155
38380-08-4	PCB 156
PCB-156/157	PCB 156/157
69782-90-7	PCB 157
74472-42-7	PCB 158
39635-35-3	PCB 159
38444-78-9	PCB 16
41411-62-5	PCB 160
PCB-160/158	PCB 160/158
74472-43-8	PCB 161
39635-34-2	PCB 162
74472-45-0	PCB 164
PCB-164/163/138	PCB 164/163/138
74472-46-1	PCB 165
41411-63-6	PCB 166
52663-72-6	PCB 167
32774-16-6	PCB 169
37680-66-3	PCB 17
35065-30-6	PCB 170
52663-71-5	PCB 171
PCB-171/173	PCB 171/173
52663-74-8	PCB 172
PCB-172/192	PCB 172/192
68194-16-1	PCB 173

cas_id	analyte_name
38411-25-5	PCB 174
40186-70-7	PCB 175
52663-65-7	PCB 176
52663-70-4	PCB 177
52663-67-9	PCB 178
52663-64-6	PCB 179
37680-65-2	PCB 18
PCB-18/30	PCB 18/30
35065-29-3	PCB 180
PCB-180/193	PCB 180/193
74472-47-2	PCB 181
60145-23-5	PCB 182
52663-69-1	PCB 183
74472-48-3	PCB 184
52712-05-7	PCB 185
74472-49-4	PCB 186
52663-68-0	PCB 187
PCB-187/182	PCB 187/182
74487-85-7	PCB 188
39635-31-9	PCB 189
38444-73-4	PCB 19
41411-64-7	PCB 190
74472-50-7	PCB 191
74472-51-8	PCB 192
69782-91-8	PCB 193
35694-08-7	PCB 194
52663-78-2	PCB 195
42740-50-1	PCB 196
PCB-196/203	PCB 196/203
33091-17-7	PCB 197
PCB-197/200	PCB 197/200
68194-17-2	PCB 198
PCB-198/199	PCB 198/199
52663-75-9	PCB 199
2051-61-8	PCB 2
PCB-20/28	PCB 20/28
52663-73-7	PCB 200
40186-71-8	PCB 201
2136-99-4	PCB 202
52663-76-0	PCB 203
74472-52-9	PCB 204
74472-53-0	PCB 205
40186-72-9	PCB 206
52663-79-3	PCB 207
52663-77-1	PCB 208
2051-24-3	PCB 209
PCB-21/20/33	PCB 21/20/33
PCB-21/33	PCB 21/33
38444-85-8	PCB 22

cas_id	analyte_name
55720-44-0	PCB 23
55702-45-9	PCB 24
55712-37-3	PCB 25
38444-81-4	PCB 26
PCB-26/29	PCB 26/29
38444-76-7	PCB 27
PCB-27/24	PCB 27/24
7012-37-5	PCB 28
15862-07-4	PCB 29
2051-62-9	PCB 3
35693-92-6	PCB 30
16606-02-3	PCB 31
38444-77-8	PCB 32
PCB-32/16	PCB 32/16
37680-68-5	PCB 34
37680-69-6	PCB 35
38444-87-0	PCB 36
38444-90-5	PCB 37
53555-66-1	PCB 38
38444-88-1	PCB 39
13029-08-8	PCB 4
PCB-4/10	PCB 4/10
38444-93-8	PCB 40
PCB-41/71/40	PCB 41/71/40
36559-22-5	PCB 42
70362-46-8	PCB 43
PCB-43/49	PCB 43/49
41464-39-5	PCB 44
PCB-44/47/65	PCB 44/47/65
70362-45-7	PCB 45
PCB-45/51	PCB 45/51
41464-47-5	PCB 46
PCB-47/75/48	PCB 47/75/48
70362-47-9	PCB 48
PCB-49/69	PCB 49/69
16605-91-7	PCB 5
62796-65-0	PCB 50
PCB-50/53	PCB 50/53
68194-04-7	PCB 51
35693-99-3	PCB 52
PCB-52/43/73	PCB 52/43/73
PCB-52/73	PCB 52/73
41464-41-9	PCB 53
15968-05-5	PCB 54
74338-24-2	PCB 55
41464-43-1	PCB 56
PCB-56/60	PCB 56/60
70424-67-8	PCB 57
41464-49-7	PCB 58

cas_id	analyte_name
PCB-58/62/75	PCB 58/62/75
74472-33-6	PCB 59
PCB-59/62/75	PCB 59/62/75
25569-80-6	PCB 6
33025-41-1	PCB 60
54230-22-7	PCB 62
74472-34-7	PCB 63
52663-58-8	PCB 64
PCB-64/41/68	PCB 64/41/68
33284-54-7	PCB 65
32598-10-0	PCB 66
PCB-66/80	PCB 66/80
73575-53-8	PCB 67
73575-52-7	PCB 68
60233-24-1	PCB 69
33284-50-3	PCB 7
32598-11-1	PCB 70
PCB-70/61/74/76	PCB 70/61/74/76
41464-46-4	PCB 71
41464-42-0	PCB 72
74338-23-1	PCB 73
PCB-74/61	PCB 74/61
70362-48-0	PCB 76
32598-13-3	PCB 77
70362-49-1	PCB 78
41464-48-6	PCB 79
34883-43-7	PCB 8
PCB-8/5	PCB 8/5
33284-52-5	PCB 80
70362-50-4	PCB 81
52663-62-4	PCB 82
PCB-83/108	PCB 83/108
PCB-83/99	PCB 83/99
52663-60-2	PCB 84
PCB-85/116/117	PCB 85/116/117
PCB-85/120	PCB 85/120
PCB-86/87/97/109/119/125	PCB 86/87/97/109/119/125
PCB-86_CAS_CoE	PCB 86_CAS_CoE
PCB-88/91	PCB 88/91
73575-57-2	PCB 89
PCB-89/90/101	PCB 89/90/101
34883-39-1	PCB 9
PCB-9/7	PCB 9/7
PCB-90/101/113	PCB 90/101/113
68194-05-8	PCB 91
52663-61-3	PCB 92
PCB-93/98/100/102	PCB 93/98/100/102
73575-55-0	PCB 94
38379-99-6	PCB 95

cas_id	analyte_name
PCB-95/93	PCB 95/93
PCB-95/93/100	PCB 95/93/100
73575-54-9	PCB 96
PCB-97_STL_CoE	PCB 97_STL_CoE
PCB-98/102	PCB 98/102
38380-01-7	PCB 99
106-47-8	p-Chloroaniline [4-Chloroaniline]
80-07-9[1]	p-Chlorophenyl sulfone isomer 1
80-07-9[2]	p-Chlorophenyl sulfone isomer 2
106-44-5	p-Cresol
608-93-5	Pentachlorobenzene
30402-15-4	Pentachlorodibenzofuran, Total
36088-22-9	Pentachlorodibenzo-p-dioxin, Total
76-01-7	Pentachloroethane
87-86-5	Pentachlorophenol
629-99-2	Pentacosane
%GRAVEL	Percent Gravel
%MOISTURE	Percent moisture
%SAND	Percent Sand
%SOLIDS	Percent Solids
Pct UA 25C	Percent Unionized Ammonia 25C
14797-73-0	Perchlorate
1520-96-3	Perylene-d12
pH	pH
pH CaCO3 sat60c	pH of CaCO3 saturation[25C]
pH CaCO3 sat25c	pH of CaCO3 saturation[60C]
85-01-8	Phenanthrene
108-95-2	Phenol
2772-45-4	Phenol, 2,4-bis[.alpha.,.alpha.-dimethylbenzyl]-
3864-99-1	Phenol, 2-[5-chloro-2h-benzotr
4165-62-2	Phenol-d5
13127-88-3	Phenol-d6
Phenolic Comp	Phenolic Compounds
882-33-7[1]	Phenyl disulfide isomer 1
882-33-7[2]	Phenyl disulfide isomer 2
298-02-2	Phorate
732-11-6	Phosmet
13171-21-6	Phosphamidon
2524-04-1	Phosphorochloridothioic acid, o,o'-diethyl ester
2953-29-9	Phosphorodithioic acid, o,o,s-trimethyl ester
3734-95-0	Phosphorothioic acid, s-[2-[[1-cyano-1-methylethyl]amino]-2-oxoethyl] o,o-diethyl ester
7723-14-0	Phosphorus
88-99-3	Phthalic acid
2306-33-4	Phthalic acid, monoethyl ester
23505-41-1	Pirimiphos ethyl
7440-06-4	Platinum
7440-08-6	Polonium-209
13981-52-7	Polonium-210
15389-34-1	Polonium-212

cas_id	analyte_name
15735-67-8	Polonium-214
15706-52-2	Polonium-215
15756-58-8	Polonium-216
15422-74-9	Polonium-218
7440-09-7	Potassium
13966-00-2	Potassium-40
55191-51-0	Pregn-1,4,6-triene-3,20-dione,
145-13-1	Pregnenolone
7287-19-6	Prometryn
1918-16-7	Propachlor
115-07-1	Propene
107-12-0	Propionitrile
57-55-6	Propylene glycol
14331-85-2	Protactinium-231
15100-28-4	Protactinium-234
92-94-4	p-Terphenyl
1718-51-0	p-Terphenyl-d14
129-00-0	Pyrene
110-86-1	Pyridine
2176-62-7	Pyridine, pentachloro-
15623-45-7	Radium-223
13233-32-4	Radium-224
13982-63-3	Radium-226
15262-20-1	Radium-228
22481-48-7	Radon-220
14859-67-7	Radon-222
Resid chlorine	Residual chlorine
141-22-0	Ricinoleic acid
299-84-3	Ronnel
7440-17-7	RUBIDIUM
135-98-8	sec-Butylbenzene
7782-49-2	Selenium
420-56-4	Silane, fluorotrimethyl-
1066-40-6	Silanol, trimethyl-
7631-86-9	Silica
7440-21-3	Silicon
SILTCLAY	SILTCLAY
7440-22-4	Silver
122-34-9	Simazine
2949-92-0	S-methyl methanethiosulphonate
7440-23-5	Sodium
7775-09-9	Sodium Chlorate
SPECIFIC_GRAVITY	Specific Gravity
7683-64-9	Squalene
22248-79-9	Stirophos [Tetrachlorovinphos]
7440-24-6	Strontium
100-42-5	Styrene
14808-79-8	Sulfate
18496-25-8	Sulfide

cas_id	analyte_name
14265-45-3	Sulfite
3112-85-4	Sulfone, methyl phenyl
3689-24-5	Sulfotep
7704-34-9	Sulfur
7446-09-5	Sulfur dioxide
Surfactants	Surfactants
13494-80-9	Tellurium
12-17-9	Temperature
TIC	Tentatively Identified Compounds [TICs]
13071-79-9	Terbufos
75-65-0	tert-Butyl alcohol
98-06-6	tert-Butyl benzene
55722-27-5	Tetrachlorodibenzofuran, Total
41903-57-5	Tetrachlorodibenzo-p-dioxin, Total
127-18-4	Tetrachloroethene
877-09-8	Tetrachloro-m-xylene
646-31-1	TETRACOSANE
638-58-4	Tetradecanamide
107-49-3	Tetraethyl pyrophosphate
21646-99-1	Tetraethyl pyrophosphite
109-99-9	Tetrahydrofuran
119-64-2	Tetralin
14167-59-0	Tetratriacontane
7440-28-0	Thallium
14133-67-6	Thallium-207
14913-50-9	Thallium-208
420-12-2	Thiirane
28249-77-6	Thiobencarbe
110-02-1	Thiophene
3172-52-9	Thiophene, 2,5-dichloro-
53907-80-5	Thiophene, cis-hexahydro-1h-cyclopenta[c]
6012-97-1	Thiophene, tetrachloro-
108-95-5	Thiophenol
7440-29-1	Thorium
15623-47-9	Thorium-227
14274-82-9	Thorium-228
15594-54-4	Thorium-229
14269-63-7	Thorium-230
14932-40-2	Thorium-231
TH-232	Thorium-232
15065-10-8	Thorium-234
7440-31-5	Tin
7440-32-6	Titanium
34643-46-4	Tokuthion [Protothiofos]
108-88-3	Toluene
2037-26-5	Toluene-d8
TOTAL_C10C32	Total [C10-C32]
ALKALINITY	Total Alkalinity
12172-73-5T	Total Amphibole Protocol Structure

cas_id	analyte_name
1332-21-4T	Total Asbestos Protocol Structure
TOTAL-ASB	Total Asbestos Structures
TOTAL_CHLORIDES	Total Chlorides
12001-29-5T	Total Chrysotile Protocol Structure
Total-DeCB	Total Decachlorinated Biphenyl
Total-DiCB	Total Dichlorinated Biphenyl
Dioxin	Total Dioxins
10-33-3	Total Dissolved Solids [TDS]
TTEPH	Total Extractable Petroleum Hydrocarbons [TEPH]
Total-HpCB	Total Heptachlorinated Biphenyl
Total-HxCB	Total Hexachlorinated Biphenyl
HpCDD	Total HpCDD
TOTIC	Total Inorganic Carbon
TKN	Total Kjeldahl Nitrogen [TKN]
Total-MoCB	Total Monochlorinated Biphenyl
Total-NoCB	Total Nonachlorinated Biphenyl
Total-OcCB	Total Octachlorinated Biphenyl
TOC	Total Organic Carbon
TOH	Total Organic Halogen
1336-36-3	Total PCBs
Total-PeCB	Total Pentachlorinated Biphenyl
TPHDIESEL	Total petroleum hydrocarbon-diesel
TPHGASOLINE	Total petroleum hydrocarbon-gasoline
TPH/OILH	Total petroleum hydrocarbon-motor oil
TPHCGD	Total Petroleum Hydrocarbons [TPH] gas/diesel
TPHCGDO	Total Petroleum Hydrocarbons [TPH] gas/diesel/oil
10-32-2	Total Suspended Solids [TSS]
TTEQ-a	Total TEQ - ENSR Calculated [a]
TTEQ-b	Total TEQ - ENSR Calculated [b]
Total-TeCB	Total Tetrachlorinated Biphenyl
TTHM	Total THM
Total-TriCB	Total Trichlorinated Biphenyl
8001-35-2	Toxaphene
156-60-5	trans-1,2-Dichloroethene
10061-02-6	trans-1,3-Dichloropropene
110-57-6	trans-1,4-Dichloro-2-butene
100021-66-2	Trans-2,3-dimethylthiophane
39765-80-5	Trans-nonachlor
3319-31-1	tri[2-Ethylhexyl] trimellitate
638-68-6	Triacontane
126-73-8	Tributyl phosphate
52-68-6	Trichlorfon
75-87-6	Trichloroacetaldehyde
302-17-0	Trichloroacetaldehyde monohydrate
79-01-6	Trichloroethene
327-98-0	Trichloronate
638-67-5	Tricosane
78-30-8	Tricresyl phosphate [TOCP]
98-08-8	Trifluorotoluene

cas_id	analyte_name
1582-09-8	Trifluralin
519-73-3	Triphenylmethane
115-86-6	Triphenylphosphate
791-28-6	Triphenylphosphine oxide
3658-80-8	Trisulfide, dimethyl
7440-33-7	Tungsten
TURBIDITY	Turbidity
1120-21-4	Undecane
17301-23-4	Undecane, 2,6-dimethyl-
7440-61-1	Uranium
14158-29-3	Uranium-232
13966-29-5	Uranium-233/234
15117-96-1	Uranium-235/236
U-238	Uranium-238
7440-62-2	Vanadium
108-05-4	Vinyl acetate
593-60-2	Vinyl bromide
75-01-4	Vinyl chloride
VFH	Volatile Fuel Hydrocarbons
GROC4C12	Volatile Fuel Hydrocarbons [C4-C12]
GROC6C12	Volatile Fuel Hydrocarbons [C6-C12]
Q852	Volatile Petroleum Hydrocarbons
WASTE_OIL	WASTE OIL
1330-20-7	Xylenes [total]
Z7PDCL	Z-7-PENTADECENOL
7440-66-6	Zinc
7440-67-7	Zirconium

Attachment B

Supplemental Guidance and Response to Questions associated with the February 27, 2009 Guidance on Uniform Electronic Data Deliverables.

General Issues:

Asbestos:

NDEP has recently provided technical guidance surrounding the calculation of asbestos related risk (*Asbestos-Related Risk Assessment Guidance* dated April 24, 2009). The reporting of asbestos in the Companies' supplied EDD should follow this guidance. Both the asbestos fibrous variety (chrysotile or amphibole) and the size and shape influence the asbestos-related risk (ARR). The modified elutriator method described in that document along with TEM analysis is the preferred technique for asbestos analysis associated with the BMI Complex and Common Areas. The important laboratory reporting parameters for asbestos are: Soil Concentrations (fibers or structures), Analytical Sensitivity (S/g) and Asbestos Sensitivity Units. Note that the Soil Concentration is derived from the number of fibers observed (unitless) times the analytical sensitivity (f/g). The elutriator method provides sensitivity in units of Structures/g $_{PM10}$ It is critical that the laboratory report the biologically relevant structures – meaning those structures that are within the protocol dimensions of less than **0.4** µm in diameter and are >5 µm but less than 10 µm in length or are of less than **0.4** µm in diameter and > 10 µm in length. These details are consistent with a report of both the Long and Total asbestos structures in each sample.
An example of the information that should be reported for an asbestos sample would include (subset shown here of all fields) the following. Note, we have removed the asbestos_type field from the prior EDD structure.

Field Name	Record (what is to be reported in the EDD)
sample_id_field	MC1-J07
Cas_id	12001-29-5L
Analyte_name	Long Chrysotile Protocol Structure*
Result_reported	3
Asbestos_analytical_sensitivity	2.400E+06**
Asbestos_sensitivity_units	s/gPM10

*Each sample should include results for all asbestos types: Total Chrysotile Protocol Structure, Long Chrysotile Protocol Structure, Long Amphibole Protocol Structure, Total Amphibole Protocol Structure, Long Asbestos Protocol Structure, Total Asbestos Protocol Structure.

** This should be the mean value, not the 95% UCL value.

Questions from Companies and NDEP Responses:

Basic Remediation Company (BRC):

As I indicated, we had no major issues with the NDEP EDD guidance. However, I had asked our team to review thoroughly and they have asked for clarifications on the following so as to assure compatibility between BRC's current EDD format and NDEP's EDD requirements:

1. There are several fields called out in the guidance to be populated in the "samples" table that for BRC data would more practical to be placed in the "results" table. These include "sample_id_lab", "lab_id", "sdg_id", and "batch_id." Most of the samples collected by BRC are sent to multiple laboratories for analysis. As such, BRC data typically have multiple "sample_id_lab", "lab_id", "sdg_id", and "batch_id" associated with each unique "sample_id_field." Since "sample_id_field" is a primary key for the "samples" table, having multiple records for each "sample_id_field" would be problematic. BRC requests that EDDs have the data for the "sample_id_lab", "lab_id", "sdg_id", and "batch_id" in the "results" table. If that change is not available, BRC request further guidance on how best to provide the data for the fields "sample_id_lab", "lab_id", "sdg_id", and "batch_id."

NDEP Response: These fields will be moved to the results table.

2. NDEP requests several fields be populated for data validation flags ("first_validation_qualifier", "level4_validation_qualifier", and "final_validation_qualifier"). Level 4 data validation conducted on BRC data does not produce a first validation qualifier and a subsequent Level 4 qualifier. There would not be a case where a sample for a specific method would have findings for both Level 3 and 4. As such, when a BRC sample and specific method have Level 4 validation flags, those flags would be used to populate the "level4_validation_qualifier" and "final_validation_qualifier" fields and the "first_validation_qualifier" field would not be populated. BRC wanted to make NDEP aware of this prior to submitting EDDs. If this method of populating the EDDs is not acceptable to NDEP, BRC requests NDEP provide further clarification on the proper methods to populate these fields in the EDD.

NDEP Response: These fields in the EDD Structure are being revised based on comments received on the proposed EDD format and the NDEP's *Supplemental Guidance on Data Validation* and the Stages terminology in that document. It is recognized that there is no need to have multiple validation qualifier fields other than that provided by the laboratory and that provided by the third-party/Companies. As such, the lab_qualifier field is retained along with a field for the stage (formerly level) of validation, this is called validation_stage. The previous fields entitled first_validation_qualifier and level4_validation_qualifier are removed from the EDD Structure. The final_validation_qualifer field will be retained and should contain the final non-laboratory qualifier applied to the value, if any.

3. Many of the BRC data that are qualified are qualified based on multiple reasons. BRC currently provides the all associated reason codes in the field "final_validation_reason_code." For example, a result qualified for both laboratory blank contamination (BRC reason code "3") and surrogate recoveries (BRC reason code "8") would have the field "final_validation_reason_code" populated with "3,8." BRC request that NDEP confirm that this population of the "final_validation_reason_code" field is acceptable.

NDEP Response: The use of multiple numbers in the final_validation_reason_code field is acceptable and understood.

Titanium Metals Corporation (TIMET):

The following are comments specific to Attachment A to the NDEP letter dated February 27, 2009 (EDD Requirements):

4. Attachment A states that "N/A" should be placed in fields with no data. TIMET is unable to provide this for numeric fields. We suggest providing a place holder such as "-999" instead.

   NDEP Response: In light of feedback provided by several companies, we have decided to handle issues with NULLs internally to the regional database. Therefore we will now recommend that "NULL" (rather than "N/A") be used for all fields with no data. This will be reflected in the revised version of the EDD guidance document.

5. TIMET's current Laboratory Identification Codes are as follows:

LAB CODE	LAB
CAS/E	Columbia Analytical Services
CAS/R	Columbia Analytical Services -
PARAG	Paragon Analytics
DBSA	Daniel B. Stephens and Associates

   NDEP Response: These codes are approved for use in the Lab_id field.

6. TIMET's Location ID's are unique. However, when combined with other BMI Companies' data, the possibility exists of two locations (i.e. wells named the same). As an alternative, TIMET suggests including a field with LocationID and a field for LocationName, the combination of which in the Regional database would be unique.

   NDEP Response: Location IDs submitted by the Companies will be considered Company-specific. As part of the development of the regional database, a location table will be developed which will allow locations to be uniquely identified.

7. Validation Fields (Validation_Flag....through...Final_validation_reason): For TIMET we have a lab_qual and validationqual that we merge into a new field for reporting qual_rpt. We then include the val_comments. Is the NDEP requesting

a change in current validation procedures and inclusion of the additional fields within the database?

NDEP Response: We contacted Victoria Tyson and confirmed that our plans, at outline in the response to question 2 above would work under their system. We reiterated that we plan to retain the lab_qualifier field along with a field for the stage (formerly level) of validation, this is called validation_stage. The previous fields entitled first_validation_qualifier and level4_validation_qualifier are removed from the EDD Structure. The final_validation_qualifer field will be retained and should contain the final non-laboratory qualifier applied to the value, if any.

The following are comments specific to Appendix A to the NDEP letter dated February 27, 2009 (EDD Database Tables):

8. TIMET suggests submitting two tables that include Point Information and Analysis information, otherwise data that is common will need to get repeated unnecessarily. In the TIMET database we start with a Point table which has a one-to-many relationship to a Sample table which has a one-to-many relationship to an Analysis table which has a one-to-many relationship to a ChemicalResults table.

NDEP Response: NDEP will introduce a location table which is analogous to the TIMET point table. This will be reflected in the revised version of the EDD guidance document. At this time, we do not see a need for a separate analysis table.

The following are comments specific to Appendix C to the NDEP letter dated February 27, 2009 (Sample Type Identification Code):

9. Separate the field "Prep Blank" into two fields - one for soil and one for water
10. Add FLD for field samples such as pH, Temperature, Specific Conductance
11. Add a sample type for Laboratory Duplicates

NDEP Response: Please note that this code list must be mutually exclusive. This table has been revised to accommodate comments from the Companies. The Prep Blank code will be removed and two additional codes will be added: Prep Water Blank, Prep Soil Blank. FLD has been added for field specific measurements. We have also added a Laboratory Duplicates code along with a Field Split code (separate from Field Duplicate), along with several combination codes.

12. Below is TIMET's sample type table - we include a field to indicate if it is a field sample type or a lab sample type.

SMP	SMP TYPE DESCRIPTION	SMP TYPE LAB
DL	DILUTION	LAB
ER	EQUIPMENT RINSATE	SAMP
FB	FIELD BLANK	SAMP
FD	FIELD DUPLICATE	SAMP
FLD	FIELD SAMPLES LIKE pH, Specific Conductance, Temp	SAMP
LABQC	LABORATORY QC SAMPLES	LAB
LCS	LABORATORY CONTROL SAMPLE	LAB
LCSD	LABORATORY CONTROL SAMPLE	LAB
MBLK	METHOD BLANK	LAB
MD	MATRIX DUPLICATE	LAB
MS	MATRIX SPIKE	LAB
MSD	MATRIX SPIKE DUPLICATE	LAB
NORM	NORMAL SAMPLE TAKEN IN FIELD	SAMP
ORIG	ORIGINAL SAMPLE IN LAB	LAB
PBS	PREPARATION BLANK SOIL	LAB
PBW	PREPARATION BLANK WATER	LAB
RE	RE-ANALYSIS	LAB
SB	SOURCE WATER BLANK	SAMP
TB	TRIP BLANK	SAMP
UPDAT	SAMPLE TYPES TO BE UPDATED	UNKN

NDEP Response: We have incorporated most of these into Appendix C. However, we are not adding an additional field (lab/field).

The following are comments specific to Appendix F to the NDEP letter dated February 27, 2009 (Physical and Field Parameters):

13. Suggest adding an aqueous field for pH.

NDEP Response: A code for aqueous pH has been added.

Montrose Chemical Corporation of California (Montrose):

Question Number	Section	Location	Comment/Question
13	Attachment A text, page 1	First Paragraph	NDEP is requiring each field to contain either a specified value or the string "N/A" to indicate a blank entry. What should be done in cases where the field is required to be numerical and there is a blank entry? For example, an entry in the field *Percent_Moisture* in the **Samples** table is not applicable for an aqueous sample but entering a string value in this numerical field would not be possible in Microsoft Access. In such cases, it is common to adopt a standardized "impossible" numerical value (such is -9999) to indicate blank entries in a numerical field or alternatively allow null values for such situations when a field is defined as numerical.
NDEP Response:	In light of feedback provided by the Companies, we have decided to handle issues with NULLs internally to the regional database. Therefore we will now recommend that NULL (rather than "N/A" be used for all fields with no data. This will be reflected in the revised version of the EDD guidance document.		
14	Attachment A text, page 1	Second Paragraph	Does the parenthetical phrase "(e.g. quality control (QC) data)" refer only to field quality control data like trip blank, field blanks, and equipment rinsate blanks, etc? Or, is NDEP referring to both field and laboratory quality control data. The code list in Appendix C has codes associated with both field and lab quality control analyses, so it appears that NDEP is referring to both types of QC data. Currently we include field quality control data in our database but not lab quality control data. We do not plan to start entering these data in our database unless NDEP specifically requests us to do so. Furthermore, historically we have only provided NDEP with DVSR EDDs that contained field samples and field quality control data only. Please clarify if lab quality control data are part of the required EDD submittal or are an optional part of the submittal. Obviously, we would prefer not to have to include the lab quality control data because it would require additional work to load these types of data.
NDEP Response:	QC data refers to both field and lab QC data. At this point in time we are not adding the lab or field QC data (other than replicate analyses of native samples) to the database. All QC data and information is critical to NDEPs review of the DVSR but		

Question Number	Section	Location	Comment/Question
	the database is not designed for these QC results at this time.		
15	Attachment A text, page 1	Second Paragraph	Please clarify the circumstances by which "additional fields" would be created and submitted in the DVSR. We can understand why there might be additional records but we are unsure why there might be additional fields included in the submittal.
NDEP Response:	Consider the term "fields", as used in that part of the EDD as a generic term. The only specific records we anticipate each company to include would be the quality control data, discussed above. However, each company has the option of adding additional, tables and fields o the database but these need to be separate from those that have been described here as the EDD Structure.		
16	EDD Requirements	General Question	We are unclear about what a "Required" or "Critical" field means based on the tabular list provided. Does NDEP mean that these fields must be coded with a code other than "N/A"? If so, there are several situations that we can think of for which there will be an "N/A" code entered. For example, for the field *hydro* there will be an "N/A" code provided for a sample matrix of Outdoor Air. We could provide several other examples for which this would be the case. Could NDEP further elaborate about what exactly it means by the terms "Required" and "Critical" fields?
NDEP Response:	These terms were used to describe those fields that need to be submitted with each EDD; use of "critical field" as a column header was misleading and has been changed. Each record does not necessarily need a value.		
17	EDD requirements	General Question	Please specify the effective date to comply with these EDD requirements. We are currently in the final stages of receiving DVSR reports associated with our fourth quarter 2008 Site-wide program samples and we expect that we will be sending these reports and associated EDDs to NDEP within the second quarter 2009. We will not be able to fully comply with the EDD requirements for this data set because the data were entered into our database last year prior to the required changes in reported quantitation levels and prior to this draft EDD guidance. Certain of NDEP's requirements for the EDD would require a significant level of effort in recoding the existing data, especially with respect to quantitation limits. It is recommended that we provide the fourth quarter 2008 Sitewide data EDD in the same format as previously provided and provide

Question Number	Section	Location	Comment/Question
			data in the new format for all DVSR data collected during 2009 and later.
NDEP Response:	Please comply with these requirements as soon as possible. It is hoped that all data collected after the date of this letter will comply with the requirements described herein. If this is not possible, please discuss these issues with the NDEP on a case-by-case basis.		
18	EDD Requirements	Field Names: *analyte_Name* And cas_id	Reviewing the EDD Requirements table against Appendix A indicates that the **RESULTS** table does not have a key field to identify analytes. Specifically, the field *analyte_name* appears to be intended as a key field because the EDD requirements table indicates that this field should be "unique". However, in practice this may be difficult due to differences between different EDD submitting companies with regards to analyte names. For example, some data submitters may call the compound associated with CAS number 79-01-6 "Trichloroethene" while others may call the compound "Trichloroethylene". Both submitters have "unique" names for the analytes in their respective databases but when data sets are combined, non-unique analyte names will be created in NDEP's Regional Database. Based on our conversation with Brian Ravika on March 31, 2009, it appears that NDEP already realizes this problem and is instead considering using the field *cas_id* to identify compounds. This approach will work, however, there are instances of the same compound having more than one CAS number and some analytes (such as results of the combined isomers of 2,2' and 4,4'-dichlorobenzil) that do not have a CAS number available. We recommend that NDEP develop a starter lookup table of *cas_id* for all data submitters to use based on the data already entered into its regional database. If new chemical parameters are to be added, we recommend that each DVSR submitter provide proposed new codes prior to submittal of the DVSR EDD. Finally, as with the rest of the code tables, we request that NDEP make available at request the most recent cas_id table through their consultant Neptune.
NDEP Response:	The cas_id field will be used as the key field to identify analytes. We accept the recommendation that NDEP develop a starter lookup table which will be made available to the Companies for review, and that Companies submit proposed new codes prior to submittal of the DVSR EDD.		

Question Number	Section	Location	Comment/Question
19	EDD Requirements	Field name: *Sample_Id_lab*	Providing a consistent *Sample_ID_Lab* entry for all records associated with a sample will be difficult to do. It is common to have reanalysis results in lab reports (and project databases) that have a different laboratory identifier. For example, a laboratory sample identified as "IRJ2025-01" may have reanalysis data that are identified by the laboratory as "IRJ2025-01RE1". It would put a burden on data providers to have to alter laboratory identifiers to be a single consistent string for the purpose of providing an EDD to NDEP. Additionally, if we modified laboratory identifiers in this way, a discrepancy would be created between the information presented in the hard copy laboratory report and the EDD data submittal and the DVSR Report and the EDD. Since there is enforced uniqueness for the field *Sample_ID_Field* , we are uncertain why there should also be enforced uniqueness also for the field *Sample_ID_lab* as well given that this field is not listed in the table description as a key field. We recommend that NDEP drop the requirement for *Sample_Id_Lab* consistency.
NDEP Response:	We understand this response and realize there may be times when the same sample will have different names. However, we wish to minimize this as much as possible. There is no longer a requirement for a unique sample name that is identical for all records, but the use multiple names should be minimized. In terms of database structure, the sample_id_lab field will be moved to the results table, thus allowing inconsistency within a field sample where necessary.		
20	EDD Requirements	Field name : *analyst_name*	Please confirm that an entry into the field *analyst_name* is only required for asbestos results. Consider an acceptable alternative to be analyst initials. Most laboratory's LIMS systems can provide analyst initials only.
NDEP Response:	Analyst's initials are an acceptable record for this field.		
21	EDD requirements	Field: *Detect_Flag*	Please confirm that NDEP is requiring that all data that will be included in a DVSR be quantified as detected/nondetected to the numerical value of the SQL.
NDEP Response:	This is confirmed. All data should be reported as described in the NDEP *Guidance on Detection Limits and Data Reporting*. In general, the approach is that all non-radionuclide data should be reported to the SQL.		
22	EDD requirements	Field: *Lab_ID*	We recommend the following lab identification codes:

Question Number	Section	Location	Comment/Question
			TAMI = TestAmerica Irvine TARL= TestAmerica Richland H+A = Hargis + Associates, Inc. (to be used in case of transfer of field data as described in Appendix F)
NDEP Response:	These codes are accepted for use in the lab_id field.		
23	EDD requirements	Fields: *prep_date* and *prep_time*	Could NDEP provide more detail regarding these fields? Are they intended to contain laboratory preparation date and time for samples or is this some other preparation process. See also related comment regarding including these fields in the **SAMPLES** table
NDEP Response:	These fields are intended to contain laboratory preparation date and time for samples; their inclusion in the samples table was an oversight, and they will be moved to the results table. This will be reflected in the revised version of the EDD guidance document.		
24	EDD Requirements	Multiple Fields: *hydro, litho, sub_area, easting* and *northing*	This is just a suggestion but we see potential problems with including certain fields in the **SAMPLES** table. These fields are *hydro, litho* and possibly also *sub_area* and *lou*. These are intrinsic characteristics of the sampling location that should be essentially the same from sampling event to sampling event for well locations but may change nonetheless. The investigators on the Henderson project (like any project) have historically made several refinements to the conceptual site model. Also, it is common at any investigation site to redefine the limits of investigation areas based on new interpretation of data. Hard coding these data in the **SAMPLES** table may result in NDEP having to recode many lines of data in the future if changes or refinements are made. We recommend a simpler approach – move fields that are intrinsic to the sample locations to a stand-alone new **SAMPLE_LOCATION** table along with the northing and easting coordinates. If such a table is created, we recommend adding land surface elevation to the field list. Having these fields separate from the **SAMPLES** table will make checking data integrity easier (by providing NDEP with an official list of *Location_IDs*) and will allow future refinement of areas of investigation and

Question Number	Section	Location	Comment/Question
			lithologic/hydrologic units without having to edit many lines in the **SAMPLES** table. Inclusion of *hydro* and *litho* data for vertical profile soil or groundwater samples from a borehole or from one time hydropunch groundwater sampling probably does have some value. We recommend retaining these two fields and to require entry only for cases when vertical profile samples are collected.
NDEP Response:	This recommendation has been incorporated into the EDD. A separate location will be introduced to house the fields described in the comment. This will be reflected in the revised version of the EDD guidance document.		
25	EDD requirements	Recommended additional Field	We recommend that NDEP consider adding an additional field to the **SAMPLES** table to capture information about how the sample was collected. We see this as particularly important for groundwater samples. There have been instances when groundwater samples have been collected from open boreholes using a bailer or from hydropunch equipment versus collecting the sample from a well using a submersible pump.
NDEP Response:	This recommendation has been incorporated into the EDD.		
26	Appendix A	General Question, Paragraph 1	Please specify the version(s) of Microsoft Access that NDEP will accept.
NDEP Response:	Acceptable versions are Microsoft Access 2000 or later.		
27	Appendix A	General Question, Paragraph 2	Just for clarification, when requesting "a view" is NDEP requesting creation of a query in Microsoft Access?
NDEP Response:	Yes. For clarity, this terminology will be updated in the EDD guidance document.		
28	Appendix A	**SAMPLES**	The **SAMPLES** table contains two fields that appear to be more appropriately

Question Number	Section	Location	Comment/Question
		table	attributes associated with the contents of the **RESULTS** table: *prep_date* and *prep_time*. If this is supposed to be laboratory preparation date and time (see previous question regarding these fields), the entry in the fields are method-specific and there may be different entries depending on the methods run (a SW8260B preparation time and date will probably be different those of the SW8270C analysis performed on the same sample). Additionally, a reanalysis result may have a different preparation date and time further complicating matters. In most databases, these fields are included in a **RESULTS** table.
NDEP Response:	These fields will be moved to the results table. This will be reflected in the revised version of the EDD guidance document.		
29	Appendix B – Sample Matrix Identification/Codes	Code List	Suggest adding codes for Non-Aqueous Liquids of "NAPL" and a code for blank water of "BW" to be used for trip blanks, field blanks and equipment blanks.
NDEP Response:	This recommendation has been incorporated into Appendix B.		
30	Appendix C – Sample Type Identification Code	Code List	Please provide clarification what specific types of samples would be coded with the following codes: DUPDATA and RD. Please explain the difference between a sample coded as "N" versus a sample coded as "ORIG". We recommend adding an additional code "SPT" to denote that the sample is a field split sample. Also, a reanalysis result is often performed at a different dilution factor. Normally the lab provides a *lab_qualifier* that indicates that the sample was analyzed at a different dilution factor in addition to providing the actual dilution factor for our database. In such instances in the future, we would like to code the *sample_type* as just a reanalysis result ("RE"). We see that there are codes for diluted samples of "DIL" and "DIL2". Obviously, any dilution factor greater than 1 would denote a diluted sample so coding of "DIL" or "DIL2" would not be necessary to capture dilution information.
NDEP	Appendix C has been revised based upon input from the Companies. Note, some of the codes in this table may not apply to all		

Question Number	Section	Location	Comment/Question
Response:	of the Companies. DUPDATA and DIL2 have been removed, RD is used by some of the Companies to identify samples for NDPES type regulatory requirements. A field split code (SPT) has been added. Your description of using the RE code for a diluted sample is acceptable, other Companies may prefer to use the DIL code (retained).		
31	Appendices B and C	General Question	Based on our discussion with Brian Rakvica on 3/31, we assume that NDEP will provide periodic updates of all codes upon request from NDEP's contractor Neptune in order to ensure that each new EDD submitted are prepared using the most recent code set established for the database.
NDEP Response:	We agree with this request and can provide periodic updates to the EDD structure and codes.		
32	Appendix B, C and D	General Question	Even though EDDs will be provided in Microsoft Access format it is unclear what platform NDEP will use for the regional database. Is the database program you plan to use for the regional database case sensitive to code entries? Will it matter if codes are provided in all upper case, all lower case, or upper and lower case characters?
NDEP Response:	The database that is being built from the EDDs is case sensitive.		
33	Appendix D	Fourth Bullet	Could you provide examples how formatting should be provided to include the edition number or year approved for Standard Methods for the Examination of Water and Wastewater? Additionally, does NDEP have a specific preference there a preference for edition number over date (or vice versa)?
NDEP Response:	An example format is: SM7500-Ra-B-18thEd or SM7500-Ra-E-2009, where the letter B or E refers to the Section of the method standard.		
34	Appendix E – Analytical Suite	Code List	It is unclear how to apply the codes in this list when preparing the EDD. NDEP implies in the description of the field *analytical_method* in the EDD Requirements table that it is the "identifier…used for that suite of analyses". On the other hand, the codes table in Appendix E seems to be suggesting something different with regards to

Question Number	Section	Location	Comment/Question
			an analytical suite. Is NDEP requiring that different analytical suite codes be assigned to parameters reported by the same Analytical method? For example, the Method SW-8270C includes semi-volatile organic compounds including some polycyclic aromatic compounds as target compounds and can include pesticide compounds as tentatively identified compounds. If data submitters are required to code each compound in a specific analytical method differently based on the code list provided, it would create what we believe is an unnecessary burden. If this is truly NDEP's intention to have individual compounds reported by a single method coded in this manner, we recommend that a much simpler approach would be for NDEP to maintain an analytical parameter (*cas_id*) lookup table in its own database to assign these codes to specific compounds. If the intention is to provide a single code per analytical method (example all analytes reported by SW-8270C are coded as "SVOC") then we do not have a difficulty with the coding scheme requested by NDEP.
NDEP Response:	The intent of the analytical_method and analytical_suite fields is no different from how we currently see these used in the databases provided by the Companies. Most of the Companies currently include both an analytical method as well as an analytical suite with their database. We don't expect a specific analytical_suite name based on the compound reported within a method. For example, if method SW-8270C was used and the laboratory called this an SVOC analysis, we do not expect the analytical_suite to be coded PAH when a compound such as benzo(a)pyrene is reported. The intent is to generally tie the analytical_method with the analytical_suite fields because it is much more intuitive to search a database for an analytical suite (e.g. anions) than to remember the method used. We realize that one analytical method can be applied to multiple analytical suites. Conversely, on occasion, one analytical method can be used for more than one analytical suite. In general, apply the analytical_suite code that most represents how that method was employed.		
35	Appendix F	General Question	Please provide specific guidance regarding including the following physical parameter data in the EDD structure provided: DETWA, TRANS, HYCO, STOR. We

Question Number	Section	Location	Comment/Question
			recommend that a separate data table structures be developed for these data types because groundwater level and aquifer testing data are not easily fit into the proposed chemical quality data format. We recommend that NDEP develop a separate data table structure for these data. We recommend also that parameters measured during field purging also be given a separate data table. Note that currently we do not store purging data in formats other than paper and PDF. We currently do not have plans to store field purge data in a database unless NDEP specifically requires that we do so.
NDEP Response:	We agree that TRANS, HYCO, and STOR measures belong in a separate data table. These three codes will be removed from appendix F and put in a separate appendix. However we feel that DETWA is appropriate for Appendix F because it is a measure that should be correlated with a sampling event.		

Olin Corporation

General Comments

Overall the definition does not clearly define all the fields and their purpose within the format.

36. In Attachment A, paragraph one, the statement "Each field and record should contain either a specified value or "N/A" (i.e., blanks should be populated with N/A). " This is not always good data management practice. There are fields such as the qualifier fields that should remain null to represent a detection that requires no additional qualification.

    NDEP Response: In light of feedback provided by several of the Companies, we have decided to handle issues with NULLs internally to the regional database. Therefore we will now recommend that NULL (rather than "N/A") be used for all fields with no data. This will be reflected in the revised version of the EDD guidance document.

37. It is assumed that with the request of "N/A", that all fields are required to be populated. Without a full understanding of each field, comments pertaining to specific fields below may or may not be appropriate. One example is having the lithology information related to a specific sample. This will not account for lithology layers that may be encountered at depths not sampled. Possibly consider a separate table to submit lithology information for a given location

NDEP Response: In light of feedback provided by several of the Companies, we have decided to handle issues with NULLs internally to the regional database. Therefore we will now recommend that NULL be used for all fields with no data. This will be reflected in the revised version of the EDD guidance document.

The Lithology field will be moved to a separate location table. For wells, the location identifier represents a specific screen for a given well (some wells have more than one screen). Therefore, lithography information for the depth covered by the screen can be represented as an attribute of the location. Lithology information for other depths is relevant only if there if the same well has another screen, and this scenario is handled by giving this second screen a distinct location identifier.

38. Another example is the relationship of the Asbestos fields with other analytical information. For each chemical reported, is there to be Asbestos information recorded for some type of relational analysis? Or possibly consider utilizing the Asbestos parameters as described in the Chemical Name field and add the Asbestos type to the Appendix E, Analytical Suites. Additionally, the Asbestos Sensitivity is not clear. Based on the description for the Asbestos Sensitivity Unit field, what is expected for this reading and is it in association with all analytes submitted?

NDEP Response: The asbestos discussion provided previously to the Companies should clarify how asbestos data should be reported in the EDD. We have removed the asbestos_type field from the EDD structure. An asbestos_ sensitivity and an asbestos_ sensitivity_units record should be provided with each report of asbestos results.

39. For the statement in the second paragraph of Appendix A, "All native samples, including replicates should be included in this EDD but QC results will not be incorporated into the Regional Database at this time.", based on the sample types in Appendix C then all samples are to be submitted but Nevada will only be importing certain sample types. Would like clarification on if the QC types need submitted in the separate tables?

NDEP Response: Appendix C does contain all types of QC sample type identifiers. However, at this time the database will not be populated with many of these QC samples, only with replicates.

Appendix C provides all these additional codes since many of the Companies now use these with their EDD submittal and they are included here as a structure that may be needed in the future should all QC data be included in the database.

The separate tables that a Company should include with the EDD for use during data validation review (but will not be imported to the companies wide database) should contain, at a minimum, all the laboratory QC results that are associated with the reported samples. This includes the blanks (all types), matrix spikes, laboratory control samples, laboratory replicates, and other results that were analyzed with the native samples, reported by the laboratory, and may have influenced how the samples were qualified.

40. And additionally, Olin Corporation recommends utilizing the CasRN code as a key field for all analytes and field parameters. It is not a very clean data management practice with analytes having multiple chemical names but the same CasRN and with the Field Parameters having a controlled name as described in Appendix F but all with N/A as the CasRN. Possibly consider using the analyte names of Appendix F as the CasRN and the Physical Parameters column as the chemical name field.

NDEP Response: Cas_id will be used as the key field for all analytes. For non-chemical measures, short codes (as found in the first column of Appendix F) will be used for cas_ids and longer descriptions will be used as analyte names.

Nevada Valid Values (VVLs)

Appendix B: Sample Matrix Identification/Code

35. Olin Corporation utilizes a larger list. One highly used value is a code of WT for Process and Treated Water. Will Olin be able to retain the values currently utilized or will they need to conform to the provided list?

NDEP Response: Please provide us with this list and we will incorporate it into Appendix B. Note, that we have added two additional codes (NAPL, BW) based on other responses to the EDD design.

Appendix C: Sample Type Identification/Code

36. Olin Corporation recommends the removal of some of the entries within this table. The values for DIL, DIL2, RE, and ORIG are values that would be more appropriately stated within the re-analysis field. A given sample may not in its entirety be diluted but could

possibly be reanalyzed or diluted for only a given analytical method within the sample's set of results. These types would also be considered type N as Normal Environmental Samples.

NDEP Response: Appendix C has been revised based upon input from all companies. We understand there is some redundancy between the reanalysis_flag field and the sample_type field but have left codes for dilution and reanalysis in Appendix C to accommodate approaches by different companies.

37. Additionally, the code of DUPDATA is generally utilized as a Quality Assurance step for manual data entry. Once the data has been approved, only one sample would be submitted.

NDEP Response: DUPDATA has been removed from Appendix C.

Appendix E: Analytical Suite Name/Code

38. With the Analytical Suite entries for the types of Asbestos, would this not suffice so as not to need the separate field for Asbestos type? It is recommended that the Asbestos information is conformed to reporting of the analytical and field parameters.

NDPE Response: The asbestos_type field has been removed from the EDD structure. Sufficient information will be contained in the cas_id field. However, Appendix E (Analytical Suite Name/Code) does still contain a code for asbestos as a means of easily searching the database for all asbestos types.

39. The percent moisture may be removed as there is a specific field to record this information for a sample.

NDEP Response: We agree, the PCTMST, Percentage of Moisture code has been removed since this is already captured in the percent_moisture field.

Appendix F: Physical and Field Parameters

40. Olin Corporation recommends the addition of the wet chemistry measurements that are describe in the description field for GENERAL of Appendix E. Here again a recommendation they be assigned a controlled code and maintained as a CasRN within an analyte table.

NDEP Response: Appendix F is for physical and field measurements. Other than pH, which has been added to Appendix F, no other wet chemistry measurements are generally analyzed in the field. These codes will indeed be used in the cas_id field.

The Naveda Import Fields

41. Sample depth – recommend having two fields to represent the top and bottom (or start and end) depths. Otherwise, samples taken from a screen interval or a soil core, a directive of what depth should be submitted?

NEP Response: We accept the recommendation to have separate fields for top and bottom depths. For Companies which currently only report a single depth measurement, this measurement can be used to populate both fields.

42. Sample Identification/ Location Identification Fields – are these to be unique for all of BMI Plant Sites and Common Areas Projects, or simply unique within an individual Plant?

NDEP Response: Location and sample identifiers are considered to be Company-specific; therefore such identifiers should be unique across all data deliveries from a given company. As part of the development of the regional database, a location table will be developed which will allow locations to be uniquely identified.

43. Laboratory Identification/code – it is recommended to utilize a controlled reference value table for this field. Olin Corporation has an existing table that could be supplied to Nevada.

NDEP Response: Please provide this table.

44. Asbestos Type – this field is not clear as in the Chemical name field there is a statement "For asbestos this field should contain one of the following six types: Total Chrysotile Protocol Structure, Long Chrysotile Protocol Structure, Long Amphibole Protocol Structure, Total Amphibole Protocol Structure, Long Asbestos Protocol Structure, Total Asbestos Protocol Structure." . Could this field be eliminated and utilize the Analytical Suite table?

NDEP Response: The asbestos_type field has been removed from the EDD structure. Sufficient information will be contained in the analyte_name field.

45. CAS – recommend this as a controlled table and not allow the N/A entry.

NDEP Response: NDEP will create and publish a controlled list of cas ids/analyte codes which should be used to populate the cas_id field. NULL OR N/A will not be allowed.

46. Result Type Code – recommend this as a controlled table. Olin Corporation has an existing table that could be supplied to Nevada.

NDEP Response: We accept the recommendation that an appendix be added to the EDD guidance document covering result_type_code. Olin, please provide the table you have referenced.

47. Initial or Reanalysis – recommend this be renamed to a test type and include possibly re-extraction and/or a dilution entry.

NDEP Response: We have decided to leave this field (reanalysis_flag) in the EDD structure to accommodate the different approaches of the companies. Re-extraction and dilution can be identified in the sample_type field.

48. Prep date and time fields – recommend this be moved to the results table to be associated with the prep method.

NDEP Response: These fields will be moved to the results table.

49. First Validation Qualifier and Level IV Validation Qualifier – As these fields would never be populated at the same time, recommend combining into one Validation Qualifier field. The Validation level field would be the determinate of the Validation Qualifier.

NDEP Response: This approach has been incorporated. See the response above.

50. Percent Moisture – How would Nevada like this submitted? For 95% would this be submitted as 95 or .95?

NDEP Response: Please provide percent moisture in this format: 95 for 95% (no decimal, two significant figures).

Tronox LLC:

51. Does NDEP want total propagated error or just the counting error for the rad data?

NDEP Response: NDEP prefers the two sigma error for radionuclide results be based on the total error reported but that the two sigma error may also be based on the counting error only as long as it is clarified in the DVSR. Also, the DVSR should clearly state if the error provided is not two sigma.

52. Does NDEP want the MDA in both the MDL and RDL fields?

NDEP **Response:** There is a field specifically for MDA in the EDD design, There is no RDL field, though there are SQL and PQL fields. The MDL, SQL and PQL fields should be left blank since the MDA is reported in the MDA field.

53. Does NDEP want the calculated asbestos concentrations in addition to the fiber counts and types? This seems more useful than a pile of elutriator raw data.

NDEP **Response:** Only the counts (as fibers or structures) and asbestos sensitivity is required for ARR and are therefore needed with the EDD. Asbestos_sensitivity_units are in units of S/gPM10.

54. Please specify the asbestos protocol structure definition modifications to the draft modified elutriator method and specify which structures must be reported.

NDEP Response: Only the total and long protocol structures (described in the Analyte_name field of the EDD structure) need to be reported. These names are consistent with Revision 1 (May 23, 2000) of the Modified Elutriator Method for the Determination of Asbestos in Soils and Bulk Materials.