

LABORATORY DATA CONSULTANTS, INC.

7750 El Camino Real, Suite 2L Carlsbad, CA 92009 Phone: 760/634-0437 Fax: 760/634-0439

Northgate Environmental Management, Inc.

January 11, 2010

1100 Quail Street Ste. 102 New Port beach, CA 92660 ATTN: Ms. Cindy Arnold

SUBJECT: Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada, Data

Validation

Dear Ms. Arnold,

Enclosed are the revised data validation reports for the fractions listed below. Please replace the previously submitted reports & associated CD with the enclosed revised reports and CD.

LDC Project # 21990:

SDG # Fraction

237785, 237885 Isotopic Uranium & Isotopic Thorium

Please feel free to contact us if you have any questions.

Sincerely,

Erlinda T. Rauto

Operations Manager/Senior Chemist



LABORATORY DATA CONSULTANTS, INC.

7750 El Camino Real, Suite 2L Carlsbad, CA 92009 Phone: 760/634-0437 Fax: 760/634-0439

Northgate Environmental Management, Inc.

December 15, 2009

1100 Quail Street Ste. 102 Newport Beach, CA 92660 ATTN: Ms. Cindy Arnold

SUBJECT: Tronox LLC Facility, 2009 Phase B Investigation, Henderson,

Nevada, Data Validation

Dear Ms. Arnold,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on November 10, 2009. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project # 21990:

<u>SDG #</u>	<u>Fraction</u>
233580, 233776, 234964 235177, 235208, 235782 235860, 236043, 237785 237795, 237885, 238405	Radium-226 & Radium-228, Isotopic Uranium & Isotopic Thorium

The data validation was performed under Stage 2B & 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Standard Operating Procedures (SOP) 40, Data Review/Validation, BRC 2009
- Quality Assurance Project Plan Tronox LLC Facility, Henderson Nevada, June 2009
- NDEP Guidance, May 2006
- Multi Agency Radiological Laboratory Analytical Protocols (MARLAP)
 Manual, July 2004
- USEPA, Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, October 2004

Please feel free to contact us if you have any questions.

Sincerely,

Erlinda T. Rauto

Operations Manager/Senior Chemist

Attachment 1

DATE DATE Ra-226 Ra-28 Th U ReC'D DUE (903.1) (904.0) (300)
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DATE DATE Ra-226 Ra-228 Th U DATE DATE 903.1) 300.0 300.
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Stage 2B/4 Stage 2B/4 Stage 2B/4 Water/Soil 233580 233776 235208 235208 235785 237785 235208 235405 238477 238477

Page: 1 of 1 Reviewer: JE 2nd Reviewer: BC

DC #: <u>21990</u> DG #: <u>233580, 233776, 234964, 235177,</u> <u>235208, 235782, 235860, 236043,</u> <u>237785, 237795, 237885, 238405, 238477</u>

Tronox Northgate Henderson Worksheet

EDD Area	Yes	No	NA	Findings/Comments
I. Completeness		i.		
Is there an EDD for the associated Tronox validation report?	X			
II. EDD Qualifier Population				
Were all qualifiers from the validation report populated into the EDD?	X			and be very little and an analysis of the control o
III. EDD Lab Anomalies.		*		
Were EDD anomalies identified?	X			
If yes, were they corrected or documented for the client?	х			See EDD_discrepancy_ form_LDC21990_121109.doc
IV. EDD.Delivery				
Was the final EDD sent to the client?	X			

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Data Validation Reports LDC #21990

Radium-226 & Radium-228



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: July 15 through July 27, 2009

LDC Report Date: December 11, 2009

Matrix: Water

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 233580

Sample Identification

M-92BDISS

M-97B

TR-6B

EB-071709-GW

M-33B

CLD-4RB

MW-6RB

M-52B

M-35B

M-11B

M-11BDISS

M-11009B

M-11009BDISS

M-92BDISSMS

M-92BDISSDUP

Introduction

This data review covers 15 water samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample EB-071709-GW was identified as an equipment blank. No radium-226 or radium-228 was found in this blank.

Sample FB080409-GW (from SDG 233776) was identified as a field blank. No radium-226 or radium-228 was found in this blank with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB080409-GW	8/4/09	Radium-228 Radium-226	2.33 pCi/L 0.396 pCi/L	M-97B

Sample concentrations were compared to concentrations detected in the equipment blanks as required by the QAPP. No sample data was qualified with the following exceptions:

Sample	Isotope	Reported Activity	Modified Final Activity	
M-97B	Radium-226	0.605 pCi/L	1.00U pCi/L	

Sample MC-3B-Filt (from SDG 230340) was identified as a filter blank. No radium-226 or radium-228 was found in this blank with the following exceptions:

Filter Blank ID	Sampling Date	Isotope	Concentration	Associated Samples		
MC-3B-Fift	5/21/09	Radium-228	3.35 pCi/L	M-92BDISS M-11BDISS M-11009BDISS		

Sample concentrations were compared to concentrations detected in the filter blanks as required by the QAPP. No sample data was qualified.

Sample PB100209-A2 (from SDG 237885) was identified as a pump blank. No radium-226 or radium-228 was found in this blank.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs.

VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 233580	All isotopes reported below the PQL.	J (all detects)	A

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples M-11B and M-11009B and samples M-11BDISS and M-11009BDISS were identified as field duplicates. No radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentra	tion (pCi/L)		D			
Analyte	M-11BDISS	M-11009BDISS	RPD (Limits)	Difference (Limits)	Flags	A or P	
Radium-228	2.46	0.283U	_	2.177 (≤3.00)	-	-	

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 233580

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
233580	M-92BDISS M-97B TR-6B EB-071709-GW M-33B CLD-4RB MW-6RB M-52B M-11B M-11BDISS M-11009B M-11009BDISS	All isotopes reported below the PQL.	J (all detects)	Α	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 233580

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Equipment Blank Data Qualification Summary - SDG 233580

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 233580

SDG	Sample	Isotope	Modified Final Activity	A or P	Code
233580	M-97B	Radium-226	1.00U pCi/L	А	bf

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Filter Blank Data Qualification Summary - SDG 233580

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Pump Blank Data Qualification Summary - SDG 233580

No Sample Data Qualified in this SDG

SDG#	:21990A29 #:233580 atory:_GEL_Laboratories		Troi LIDATIOI		_	ENE			EET	Date: 11-20-6 Page: 1_of_1 Reviewer: <u>MG</u> 2nd Reviewer:
The sa	IOD: Radium 226 and Ramples listed below were tion findings worksheets.							areas. Va	lidation fin	dings are noted in attached
	Validation	Area						С	omments	
I.	Technical holding times			Α	Samı	oling d	ates: 7	1-15-09	throug	4 7-27-09
lla.	Initial calibration			A					d	,
IIb.	Calibration verification			A				-		
III.	Blanks			Α						
IVa.	Matrix Spike/(Matrix Spike) I	Duplica	ates	A	М	S/c	900			
IVb.	Laboratory control samples	-		A	L	c s				
IVc.	Chemical recovery			Α		-				
V.	Sample result verification			N						
VI.	Minimum dectectable activit	v (MD	۹)	A						
VII.	Overall assessment of data	2		Α						
VIII.	Field duplicates			SW	D	¥ 10 +		= 11+13		
XIV	Field blanks			sw	EB	<u>. *</u>	4. FB=	FB08	10409-	GW (SDG: 233776)
Note: √alidat	A = Acceptable N = Not provided/applicable SW = See worksheet ed Samples:		¥ ≓ ND = N R = Rin FB = Fi		s dete	cted	D : TB EB	= Duplicate = Trip blant = Equipme	k nt blank	GW (SDG: 233776) 2 (SDG: 237835) - Filt (SDG: 2303
Г	all water	T	Ī			Ι	T		·	1 390.733
1	M-92BDISS	11	M-11BDISS			21			31	
2	M-97B	12	M-11009B			22			32	
3	TR-6B	13	M-11009BDIS	336 338	3	23			33	
4	EB-071709-GW	14	M-92BDISSN			24			34	
5	M-33B	15	M-92BDISSE	OUP		25			35	
6	CLD-4RB	16	PBW		·	26			36	
7	MW-6RB	17				27			37	
8	M-52B	18				28	<u> </u>		38	

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M-35B

M-11B

Notes:___

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LDC #: 31990A39 333580 SDG #:

VALIDATION FINDINGS WORKSHEET Field Blanks

of	AG	1
Page:	Reviewer:	2nd Reviewer:

sec cover METHOD: Radiochemistry (Method:_ Were field blanks identified in this SDG?

Were target isotopes detected in the field blanks? Ŷ N N/A Were Ŷ N N/A Were Blank units: P C i / ı

Sampling date:

 $\frac{7}{8}$ - 4 - 09 Field blank type: (circle one) Field Blank)/ Rinsate / Other:

Qual: 4 bf

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Associated sample units: Blank units:

Sampling date: Field blank type: (circle one) Field Blank / Rinsate / Other:

Associated Samples:

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VALIDATION FINDINGS WORKSHEET Field Blanks

0000 METHOD: Radiochemistry (Method: 50e Were field blanks identified in this SDG?

7

Qual: J+

Were target isotopes detected in the field blanks? More Were Were Work Were Were Blank units:

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	d Sample	Sample Id	יייי					
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Sample	lank / Rir		#					
60 -1	one) Field B	Blank	Action Limit	33.50				
6. 5-3	pe: (circle	Blank ID	16 -38-FiH	3.35				
Sampling date: 5-31-09	Field blank type: (circle one) Field Blank / Rinsate / Other	Analyte	ΨĊ	> RL Ra-338 3.35 33.50				
,	200			7 RL				السديون

Associated sample units:

Blank units: Sampling date:

Field blank type: (circle one) Field Blank / Rinsate / Other:

Associated Samples:

Link Caripo Campa	Analyte	Blank ID	Blank	Committee Identification
			Action	
	þ			TO.

LDC #: 21990A29

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	of\
Reviewer:_	MG
and reviewer	1- /

SDG #: 733580	Fleid Duplic	ales	2nd reviewer:
METHOD: Radiochemistry (Method: See	cover)	
	d in the field duplicate	pairs?	
	Activity (pci/L)	by difference
isotopes	ΙÌ	13	APD
Ra- 228	2.46	0.783 U	2.177 (≤3.00)
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	Activity ()	222
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Isotopes			RPD
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: July 20 through August 4, 2009

LDC Report Date: December 1, 2009

Matrix: Water

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 233776

Sample Identification

M-77B

M-77BDISS

M-50B

M-31-AB

M-31-ABDISS

M-21B

FB080409-GW

M-77BMS

M-77BDUP

Introduction

This data review covers 9 water samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample FB080409-GW was identified as a field blank. No radium-226 or radium-228 was found in this blank with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB080409-GW	8/4/09	Radium-228 Radium-226	2.33 pCi/L 0.396 pCi/L	M-21B

Sample concentrations were compared to concentrations detected in the equipment blanks as required by the QAPP. No sample data was qualified with the following exceptions:

Sample	Isotope	Reported Activity	Modified Final Activity
M-21B	Radium-226	0.716 pCi/L	1.00U pCi/L

Sample MC-3B-Filt (from SDG 230340) was identified as a filter blank. No radium-226 or radium-228 was found in this blank with the following exceptions:

Filter Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
MC-3B-Filt	5/21/09	Radium-228	3.35 pCi/L	M-77BDISS M-31-ABDISS

Sample concentrations were compared to concentrations detected in the filter blanks as required by the QAPP. No sample data was qualified.

Sample PB100209-A2 (from SDG 237885) was identified as a pump blank. No radium-226 or radium-228 was found in this blank.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs.

VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 233776	All isotopes reported below the PQL.	J (all detects)	Α

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 233776

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
233776	M-77B M-77BDISS M-50B M-31-AB M-31-ABDISS M-21B FB080409-GW	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 233776

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 233776

SDG	Sample	Isotope	Modified Final Activity	A or P	Code
233776	M-21B Radium-226		1.00U pCi/L	А	bf

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Filter Blank Data Qualification Summary - SDG 233776

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Pump Blank Data Qualification Summary - SDG 233776

No Sample Data Qualified in this SDG

					Date: 11- 20- 09
	LLC	3	lage 2D	2nd	Page:l of Reviewer: Reviewer:
IOD: Radium 226 and R	adium 228 (EP	A Method 90	03.1 & 904)		
	·		·	Callada Ataua Marakana	
		each of the f	ollowing validation areas. v	alidation findings ar	e noted in attached
-	<u> </u>				
Validation	Area			Comments	
Technical holding times		A	Sampling dates: 7-20-0	9 through 8	-4-09
Initial calibration		Α		0	
Calibration verification		Α			
Blanks	gn d	ASW			
		A	MS/DUP		
Laboratory control samples		Α	LCS		
Chemical recovery		A			
Sample result verification		N			
		Α			
		A			
Field duplicates		N			
Field blanks		SW	FB= 7		
A = Acceptable N = Not provided/applicable SW = See worksheet	e R = F	Rinsate	s detected D = Duplicate TB = Trip bla	e ink	06: 237885)
ed Samples: all water		1017	Filter Blank =	MC-3B-Fil+	(SDG: 230340
M-77B	11		21	31	
M-77BDISS	12		22	32	
M-50B	13		23	33	
M-31-AB	14		24	34	
M-31-ABDISS	15		25	35	
M-21B	16		26	36	
FB080409-GW	17		27	37	
M-77BMS	18		28	38	
M-77BDUP 228	19		29	39	
PBW	20		30	40	
	Validation Technical holding times Initial calibration Calibration verification Blanks Matrix Spike/(Matrix Spike) Laboratory control samples Chemical recovery Sample result verification Minimum dectectable activi Overall assessment of data Field duplicates Field blanks A = Acceptable N = Not provided/applicable SW = See worksheet ad Samples: A [WATEV M-77B M-77BDISS M-50B M-31-ABDISS M-21B FB080409-GW M-77BMS 236 238 M-77BDUP	#: 233776 atory: GEL Laboratories LLC ### Addition Area Technical holding times	# 233776 Satory: GEL Laboratories LLC ## 10D: Radium 226 and Radium 228 (EPA Method 90 amples listed below were reviewed for each of the folion findings worksheets. Validation Area	Stage 2B	Stage 2B

LDC #: 21990 B39 SDG #: 233776

VALIDATION FINDINGS WORKSHEET

Field Blanks

2nd Reviewer: Reviewer:_

> Sec cover METHOD: Radiochemistry (Method:_

Qual: U bf ૭ Sample Identification Associated Samples: Were field blanks identified in this court.

Were target isotopes detected in the field blanks?

Blank units: PCi/L Associated sample units: PCi/L Sampling date: 8 - 4 - 09

Sampling date: 8 - 4 - 09 Field blank type: (circle one) Field Blank) Rinsate / Other: 0.716/1.00 <u></u> Blank Action Limit 0.396 Blank ID 2.33 ~ Ra-338 Ra-226 Analyte

Assoclated sample units: Blank units:

Sampling date:

Field blank type: (circle one) Field Blank / Rinsate / Other:

Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected Sample Identification Associated Samples: Blank Action Limit Blank ID Analyte

21990B29 233776

VALIDATION FINDINGS WORKSHEET Field Blanks

C3VC1 METHOD: Radiochemistry (Method: 50e Were, target isotopes detected in the field blanks?

7

Qual:

6 Were field blanks luchimistry N/A Were target isotopes detected in the field blank units: PC: /L Associated sample units: PC: /L Associated sample units: PC: /Sampling date: 5-21-09

(all diss.) (N.D.) quali 2000 Sample identification ampler ž 33.50 Blank Action Limit 138-Filt Blank ID 3.35 Ra-338 Analyte , RL

Associated sample units: Blank units:

Sampling date:

Field blank type: (circle one) Field Blank / Rinsate / Other:

Associated Samples:

Action Limit		Sample Identification
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: August 7 through August 10, 2009

LDC Report Date: December 1, 2009

Matrix: Soil/Water

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 234964

Sample Identification

RSAM8-10B SA92-10BMS
RSAM8-20B SA92-10BDUP
RSAM8009-20B EB081009-SO2MS
RSAM8-31B EB081009-SO2DUP

RSAM8-31B SA62-10B SA62-24B SA144-10B SA144-09-10B SA144-28B SA92-10B SA92-20B SA92-31B

SA119-0.5B SA119-10B

SA119-30B SA119-48B

SA158-10B

SA158-20B

SA158-31B

EB081009-SO2

Introduction

This data review covers 21 soil samples and 3 water samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample EB081009-SO2 was identified as an equipment blank. No radium-226 or radium-228 was found in this blank.

Samples FB072909-SO (from SDG 234267) and FB080309-SO (from SDG 234414) were identified as field blanks. No radium-226 or radium-228 was found in these blanks.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
SA92-10BDUP (RSAM8-10B RSAM8-20B RSAM8-31B SA62-10B SA62-24B SA144-10B SA144-10B SA144-28B SA92-10B SA92-10B SA92-31B SA92-31B SA158-10B SA158-31B)	Radium-226	-	0.826 pCi/g (≤0.50)	J (all detects) UJ (all non-detects)	A

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL pCi/g	QAPP PQL pCi/g	Flag	A or P
RSAM8-20B	Radium-228	0.618	0.5	None	Р
SA62-10B	Radium-228	0.600	0.5	None	Р
SA144-10B	Radium-228	0.731	0.5	None	Р
SA144009-10B	Radium-228	0.719	0.5	None	Р
SA119-30B	Radium-228	0.570	0.5	None	Р

The MDA was greater than the PQL as listed above.

V. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 234964 All isotopes reported below the PQL.		J (all detects)	Α

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples RSAM8-20B and RSAM8009-20B and samples SA144-10B and SA144009-10B were identified as field duplicates. No radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentra	tion (pCi/g)		Diff		
Analyte	RSAM8-20B	RSAM8009-20B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	0.671	1.06	-	0.389 (≤0.50)	-	-
Radium-226	1.61	1.04	-	0.57 (≤0.50)	J (all detects)	Α

	Concentra	ation (pCi/g)				
Analyte	SA144-10B	SA144009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	1.01	0.991	-	0.019 (≤0.50)	-	-
Radium-226	1.24	0.788	-	0.452 (≤0.50)	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 234964

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
234964	RSAM8-10B RSAM8-20B RSAM8-20B RSAM8-31B SA62-10B SA62-24B SA144-10B SA144-09-10B SA144-28B SA92-10B SA92-20B SA92-31B SA158-10B SA158-10B SA158-31B	Radium-226	J (all detects) UJ (all non-detects)	A	Duplicate sample analysis (Difference) (Id)
234964	RSAM8-20B SA62-10B SA144-10B SA144009-10B SA119-30B	Radium-228	None	Р	Minimum detectable activity (PQL)
234964	RSAM8-10B RSAM8-20B RSAM8-20B RSAM8-31B SA62-10B SA62-24B SA144-10B SA144-10B SA144-28B SA92-10B SA92-20B SA92-31B SA119-0.5B SA119-10B SA119-30B SA119-48B SA158-10B SA158-20B SA158-31B EB081009-SO2	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)
234964	RSAM8-20B RSAM8009-20B	Radium-226	J (all detects)	A	Field duplicates (Difference) (fd)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 234964

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Equipment Blank Data Qualification Summary - SDG 234964

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 234964

No Sample Data Qualified in this SDG

Tronox Northgate Henderson

VALIDATION COMPLETENESS WORKSHEET Date: 11-20-09 LDC #: 21990C29 Stage 2B Page: __lof__l_ SDG #: 233964 234964 m4 Reviewer: MG Laboratory: GEL Laboratories LLC 2nd Reviewer:

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Technical holding times	A	Sampling dates: 8-7-09 through 8-10-09
IIa.	Initial calibration	A	d
IIb.	Calibration verification	A	
111.	Blanks	A	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS/DUP
IVb.	Laboratory control samples	A	LCS
IVc.	Chemical recovery	A	
V.	Sample result verification	N	
VI.	Minimum dectectable activity (MDA)	SW	
VII.	Overall assessment of data	Α	
VIII.	Field duplicates	SW	D= 2+3 D= 7+8
XIV	Field blanks	ND	EB = 20, FB = FB072909-50 (SDG: 234267)

FB = FB 080309-50 (SDG: 234414)

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

EB = Equipment blank

Validated Samples:

1	RSAM8-10B	3 11	SA92-20B	5	21	SA92-10BMS 378 5	31
2	RSAM8-20B	12	SA92-31B		22	SA92-10BDUP	32
3	RSAM8009-20B	13	SA119-0.5B		23 2	776 728 EB081009-SO2MS W	33
4	RSAM8-31B	14	SA119-10B		24 2	EB081009-SO2DUP	34
5	SA62-10B	15	SA119-30B		₂₅ l	PBS	35
6	SA62-24B	16	SA119-48B		₂₆)	PBW	36
7	SA144-10B	17	SA158-10B		27		37
8	SA144009-10B	18	SA158-20B		28		38
9	SA144-28B	19	SA158-31B	J	29		39
10	SA92-10B	20	7 EB081009-SO2	W	30		40

Notes:		 	

LDC #: 31990 c 39 234964 SDG #:

VALIDATION FINDINGS WORKSHEET

Duplicate Analysis

Page: Lof Reviewer:__ 2nd Reviewer:__

METHOD: Radiochemistry (Method: See Cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a duplicate sample analyzed the required frequency of 5% in this SDG? Were all duplicate sample duplicate error ratio (DER) ≤ 1.42 ? DER = $\frac{|Act_{12}Act_{2}|}{2+\delta_{2}^{2}|^{1/2}}$ Act = sample activity $\delta = 1$ sigma error $2|\delta_{1}^{2}+\delta_{2}^{2}|^{1/2}$ Y N N/A

LEVEL IV ONLY:

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

Y N N/A

# Duplicate ID Matrix Isotope DER (Limits) Associated Samples Qualifications			
by difference DER (Limits)		Qualifications	「
67 of		Associated Samples	01771 017
# Duplicate ID Matrix Isotope	by difference	DER (Limits)	3
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# Duplicate ID		Matrix	,
#		Duplicate ID	70
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	:			by difference	Accordated Camples	Onslifications
T	Duplicate ID	Matrix	Isotope	DER (Limits)	Associated Samples	Cuamications
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Comments:_

16 #: 31990C39

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

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See

Cover

e following sample MDAs are above the RDL:

ETHOD: Radiochemistry (Method:

*	Sample ID	Isotope	ROL (units)	Ta ball	Flading	Ottofffications
-	۲	Ra-338	0.5 (pc:/4)	0,618 (PC:/4)	Lab D	None / P
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7	J.			0.600		
,						
^	7			0.731		
1						
7	æ			0.719		
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LDC #:	21990629
SDG #:	00.0.

VALIDATION FINDINGS WORKSHEET Field Duplicates

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ntified in this SDG?	pairs?	
		1.1.1.00.00.00
	3	By difference Qual parent only
	1.06	0.389 (±0.50)
1.61	1.04	0.57 (b) Jaers /A
		<u> </u>
Activity (P	ci/g)	by difference
7	8	RPD
1.01	0.991	0.019 (±0.50)
1.24	0.788	0.452 (1)
Activity (
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: August 11, 2009

LDC Report Date: December 4, 2009

Matrix: Soil/Water

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 235177

Sample Identification

SA107-0.5B EB081109-SO SA107-10B RSAU6-0.5BMS SA107009-10B RSAU6-0.5BDUP

SA107009-10 SA107-29B SA61-10B SA61-30B SA155-0.5B

SA155009-0.5B

SA155-10B

SA155-30B

SA115-0.5B SA115-10B

SA115-10D

SA115009-10B

SA115-25B

SA115-40B

SA115-51B

RSAU6-0.5B

RSAU6-10B RSAU6-25B

RSAU6-40B

Introduction

This data review covers 22 soil samples and one water sample listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample EB081109-SO1 was identified as an equipment blank. No radium-226 or radium-228 was found in this blank.

Samples FB072909-SO (from SDG 234267) and FB080309-SO (from SDG 234414) were identified as field blanks. No radium-226 or radium-228 was found in these blanks.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
RSAU6-0.5BDUP (SA115-0.5B SA115-10B SA115009-10B SA115-25B SA115-40B SA115-51B RSAU6-0.5B RSAU6-10B RSAU6-25B RSAU6-40B)	Radium-226	-	0.558 pCi/g (≤0.50)	J (all detects) UJ (all non-detects)	А

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs.

V. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 235177	All isotopes reported below the PQL.	J (all detects)	А

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA107-10B and SA107009-10B, samples SA155-0.5B and SA155009-0.5B, and samples SA115-10B and SA115009-10B were identified as field duplicates. No radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentra	tion (pCi/g)	200	D.W.		
Analyte	SA107-10B	SA107009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	0.618	0.837	-	0.219 (≤0.50)	-	-
Radium-226	1.51	1.84	-	0.33 (≤0.50)	-	-

	Concentra	ition (pCi/g)	DDD.	D:##		
Analyte	SA155-0.5B	SA155009-0.5B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	1,21	0.768	-	0.442 (≤0.50)	-	-
Radium-226	1.09	0.789	-	0.301 (≤0.50)	-	-

	Concentrat	ion (pCi/g)	222	5.4		
Analyte	SA115-10B	SA115009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	0.701	0.955	-	0.254 (≤0.50)	-	_
Radium-226	1.28	1.72	-	0.44 (≤0.50)	-	_

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 235177

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
235177	SA115-0.5B SA115-10B SA115009-10B SA115-25B SA115-40B SA115-51B RSAU6-0.5B RSAU6-10B RSAU6-25B RSAU6-40B	Radium-226	J (all detects) UJ (all non-detects)	A	Duplicate sample analysis (Difference) (ld)
235177	SA107-0.5B SA107-10B SA107009-10B SA107-29B SA61-10B SA61-30B SA155-0.5B SA155-0.5B SA155-10B SA155-30B SA115-0.5B SA115-0.5B SA115-0.5B SA115-09-10B SA115-25B SA115-40B SA115-51B RSAU6-0.5B RSAU6-10B RSAU6-25B RSAU6-40B EB081109-SO	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 235177

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Equipment Blank Data Qualification Summary - SDG 235177

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 235177

No Sample Data Qualified in this SDG

Tronox Northgate Henderson

LDC #: 21990D29	VALIDATION COMPLETENESS WORKSHEET
SDG #: 235177	Stage 2B
Laboratory: GEL Laboratories I	LC_

	Date:	12-1-09
	Page:_	
F	Reviewer:	MG
2nd F	Reviewer:	

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Technical holding times	A	Sampling dates: 8-11-09
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
111.	Blanks	A	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS/DUP LCS/LCSD
IVb.	Laboratory control samples	A	LCS/LCSD
IVc.	Chemical recovery	A	
V.	Sample result verification	N	
VI.	Minimum dectectable activity (MDA)	A	
VII.	Overall assessment of data	Α	
VIII.	Field duplicates	SW	D=2+3, D=7+8, D=12+13
	Field blanks	ND	EB=21 FB= FB072909-50 (SDG: 234267)

FB = FB080309-50 (SDG: 234414)

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank EB = Equipment blank

Validated Samples:

1	SA107-0.5B S	11	SA115-0.5B S	212	12001100 00	V 3	:1
2	SA107-10B	12	SA115-10B	22	726 728 RSAU6-0.5BMS	3	32
3	SA107009-10B	13	SA115009-10B	23	RSAU6-0.5BDUP	3	33
4	SA107-29B	14	SA115-25B	24	PBS	3	34
5	SA61-10B	15	SA115-40B	₂₅ 2	PBW	3	35
6	SA61-30B	16	SA115-51B	26		3	36
7	SA155-0.5B	17	RSAU6-0.5B	27		3	37
8	SA155009-0.5B	18	RSAU6-10B	28		3	38
9	SA155-10B	19	RSAU6-25B	29		3	39
10	SA155-30B	20	RSAU6-40B	30		4	10

Notes:		 	

91990 Dag 235177 ":# DGT SDG #:

VALIDATION FINDINGS WORKSHEET **Duplicate Analysis**

Reviewer:_ Page:__

2nd Reviewer:

METHOD: Radiochemistry (Method: Sec cover

Act = sample activity $\delta = 1$ sigma error Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A". Was a duplicate sample analyzed the required frequency of 5% in this SDG? Were all duplicate sample duplicate error ratio (DER) \leq 1.42? DER= $\frac{|Act_1-Act_2|}{2}$ 1.72 YN N/A

LEVEL IV ONLY:

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. Y N N/A

<u> </u>				by difference		
**	# Duplicate ID	D Matrix	Isotope	DER (Limits)	Associated Samples	Qualifications
	73	1,05	Ra-236	0.558 pc:/ (=0.50)	md all soil -	J/UJ/A 19
<u> </u>				О	=	
<u> </u>				-		
<u></u>						
<u>L</u>						
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) (
ັ້	Comments:					
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LDC #: 21990D 29 SDG #: 235177

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: I of I
Reviewer: MG
2nd reviewer: \(\)

METHOD: Radiochemistry (Method: See cover

YN N/A

Were field duplicate pairs identified in this SDG?

Were target isotopes detected in the field duplicate pairs?

	Activity (PC	i/g)	by difference
isotopes	2	3	APD
Ra-228	0.618	0.837	0.219 (< 0.50)
Ra-226	1.51	1.84	0.33 ()
			ŀ

	Activity (pci/q)	by difference
!sotopes	7	8	RPD
. Ra-278	1.21	0.768	0.442 (= 0.50)
Ra-226	1.09	0.789	0.301 ()
		·	,

	Activity (pci/g)	by difference
isotopes	12	13	RPD
Ra- 228	0.701	0.955	0.254 (= 0.50)
Ra-226	1.28	1.72	0.44 ()

	Activity ()	
Isotopes	·		RPD
		•	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: August 11 through August 20, 2009

LDC Report Date: December 4, 2009

Matrix: Soil/Water

Parameters: Radium-226 & Radium-228

Validation Level: Stage 4

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 235208

Sample Identification

RSAU6-53B SA70-10BMS SA86-10B SA70-10BDUP

SA86009-10B

SA86-28B

RSAM6-10B

RSAM6-28B

RSAM6009-28B

SA70-10B

SA70-30B

SA167-0.5B

SA167-10B

SA167009-10B

SA167-28B

EB081909-SO1

SA197-10B

SA197009-10B

SA197-21B

SA104-10B

SA104009-10B

SA104-30B

Introduction

This data review covers 21 soil samples and one water sample listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample EB081909-SO1 was identified as an equipment blank. No radium-226 or radium-228 was found in these blanks.

Samples FB072909-SO (from SDG 234267) and FB080309-SO (from SDG 234414) were identified as field blanks. No radium-226 or radium-228 was found in these blanks.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Although the LCS/LCSD relative percent difference (RPD) was not within QC limits for one isotope, the LCS/LCSD percent recoveries (%R) were within QC limits and no data were qualified.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
RSAM6-28B	Radium-228	0.635	0.50	None	Р
SA167-0.5B	Radium-228	0.567	0.50	None	Р
SA167-10B	Radium-228	0.533	0.50	None	Р
SA167-28B	Radium-228	0.624	0.50	None	Р
SA197-21B	Radium-228	0.538	0.50	None	Р
SA104-10B	Radium-228	0.681	0.50	None	Р
SA104009-10B	Radium-228	0.667	0.50	None	Р

The MDA was greater than the PQL as listed above.

VI. Sample Result Verification and Project Quantitation Limit

All sample result verifications were acceptable.

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 235208	All isotopes reported below the PQL.	J (all detects)	А

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA86-10B and SA86009-10B, samples RSAM6-28B and RSAM6009-28B, samples SA167-10B and SA167009-10B, samples SA197-10B and SA197009-10B, and samples SA104-10B and SA104009-10B were identified as field duplicates. No radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentration (pCi/g)		555			
Analyte	SA86-10B	SA86009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	0.912	1.03	-	0.118 (≤0.50)	-	-
Radium-226	1.04	1.59	-	0.55 (≤0.50)	J (all detects)	А

	Concentration (pCi/g)		222	D.'''		
Analyte	RSAM6-28B	RSAM6009-28B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	0.980	0,965	-	0.015 (≤0.50)	-	-
Radium-226	1.95	1.56	-	0.39 (≤0.50)	-	-

	Concentrat	ion (pCi/g)	·· ·· · · · · · · · · · · · · · · · ·			
Analyte	SA167-10B	SA167009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	1.20	1.10	-	0.10 (≤0.50)	-	-
Radium-226	2.09	1.59	-	0.50 (≤0.50)	-	-

	Concentration (pCi/g)		DDD Difference		·	
Analyte	SA197-10B	SA197009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	1.35	1.65	-	0.30 (≤0.50)	-	-
Radium-226	1.88	1.58	-	0.30 (≤0.50)	-	-

	Concentra	tion (pCi/g)	200	D.''			
Analyte	SA104-10B	SA104009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P	
Radium-228	1.17	1.19	-	0.02 (≤0.50)	-	-	

	Concentra	Concentration (pCi/g)		5.4			
Analyte	SA104-10B	SA104009-10B	RPD (Limits)	Difference (Limits)	·		
Radium-226	0.931	0.793	-	0.138 (≤0.50)	-	-	

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 235208

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
235208	RSAM6-28B SA167-0.5B SA167-10B SA167-28B SA197-21B SA104-10B SA104-09-10B	Radium-228	None	Р	Minimum detectable activity (PQL)
235208	RSAU6-53B SA86-10B SA86009-10B SA86-28B RSAM6-10B RSAM6-28B RSAM6009-28B SA70-10B SA70-30B SA167-0.5B SA167-0.5B SA167-09-10B SA167-28B EB081909-SO1 SA197-10B SA197-10B SA197-21B SA104-10B SA104-10B SA104-30B	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)
235208	SA86-10B SA86009-10B	Radium-226	J (all detects)	А	Field duplicates (Difference) (fd)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 235208

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Equipment Blank Data Qualification Summary - SDG 235208

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 235208

No Sample Data Qualified in this SDG

Tronox Northgate Henderson

LDC #: 21990E29	VALIDATION COMPLETENESS WORKSHEET
SDG #: 235208	Stage 4
Laboratory: <u>GEL Laboratories I</u>	<u>LC</u>

	Date:	12-1-0
	Page:_	<u> </u>
	Reviewer:	MG
2nd	Reviewer:	

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

Validation Area			Comments				
l.	Technical holding times	A	Sampling dates: 8-11-09 through 8-20-09				
IIa.	Initial calibration	A	0				
Ilb.	Calibration verification	Α					
111.	Blanks	A					
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/DUP				
IVb.	Laboratory control samples	SW	LCS/LCSD				
IVc.	Chemical recovery	A					
V.	Sample result verification	Α					
VI.	Minimum dectectable activity (MDA)	sw					
VII.	Overall assessment of data	A					
VIII.	Field duplicates	SW	D=2+3 D=6+7 D=11+12 D=15+16 D=18+19				
ΧIV	Field blanks	ND	D=2+3 D=6+7 D=11+12 D=15+16 D=18+19 EB= 14 FB= FB072909-50 (SDG: 234267)				

FB = FB080309-SO (SDG: 234414)

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

EB = Equipment blank

Validated Samples:

1	RSAU6-53B	S	11	SA167-10B	S	21	776 278 S	31
2	SA86-10B		12	SA167009-10B	1	22	SA70-10BDUP 1	32
3	SA86009-10B		13	SA167-28B	Ţ	23	PBS	33
4	SA86-28B		142	EB081909-SO1	W	24 2	PBW	34
5	RSAM6-10B		15	SA197-10B	S	25		35
6	RSAM6-28B		16	SA197009-10B		26		36
7	RSAM6009-28B		17	SA197-21B		27		37
8	SA70-10B		18	SA104-10B		28		38
9	SA70-30B		19	SA104009-10B		29	·	39
10	SA167-0.5B	,	20	SA104-30B	\downarrow	30		40

Notes:	
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LDC #: 31990E 29 SDG #: 335208

	Page:_	of.
	Reviewer:	MG
2nd	Reviewer:	1~

Method: Radiochemistry (EPA Method See cover)

		T		
Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	1/			
II. Calibration				
Were all instruments and detectors calibration as required?	/			
Were NIST traceable standards used for all calibrations?	1./			
Was the check source identified by activity and radionuclide?	/			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?				
III. Blanks				
Were blank analyses performed as required?	/			
Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see the Blanks validation completeness worksheet.		/		
IV. Matrix spikes and Duplicates				
Were a matrix spike (MS) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil /Water		/		
Were the MS percent recoveries (%R) within the QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	1			·
Was a duplicate sample anaylzed at the required frequency of 5% in this SDG?	1			
Were all duplicate sample duplicate error rations (DER) ≤1.42?.	1			
/. Laboratory control samples				
Vas an LCS analyzed per analytical batch?	1			
Vere the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%		/		
1: Sample Chemical/Carrier Recovery				
Vas a tracer/carrier added to each sample?				
Vere tracer/carrier recoveries within the QC limits?	/			
It. Regional Quality Assurance and Quality Control				
/ere performance evaluation (PE) samples performed?		/	Τ	
ere the performance evaluation (PE) samples within the acceptance limits?			1	
II. Sample Result Verification				
ere activities adjusted to reflect all sample dilutions and dry weight factors oplicable to level IV validation?	/			
ere the Minimum Detectable Activities (MDA) < RL?		/		

LDC #: 21990 E29 SDG #: 235208

VALIDATION FINDINGS CHECKLIST

Page: 2_of, Reviewer: <u>#G</u> 2nd Reviewer: ____

Validation Area	Yes	No	NA	Findings/Comments
D. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			
X. Field duplicates				
Field duplicate pairs were identified in this SDG.	/			-
Target analytes were detected in the field duplicates.	/			
XI. Field blanks				
Field blanks were identified in this SDG.	/			
Target analytes were detected in the field blanks.		/		

6€30661€ 235,308 SDG #: LDC #:_

VALIDATION FINDINGS WORKSHEET Laboratory Control Sample (LCS)

Page: Reviewer: 2nd Reviewer:

> See cover METHOD: Radiochemistry (Method:_

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A". ON NA NA NA

Was a laboratory control sample (LCS) analyzed at the required frequency in this SDG? Were all LCS percent recoveries (%R) within the control limits of 75-125%?

LEVEL IV ONLY:

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. ON N/A

	Qualifications	* No Qual																					
Associated Commission	Associated Samples	all water																					
 1655/2555 % RPD	120 7/ 0/10	(OP =) Q:10																				it for LCS/LCSD	
Isotope	~	- 1																				vec in lim	
Matrix	Water																					Ka-338 % rec in limit	
LCS ID	752/527																					*	
*	_			1	\dagger	\dagger	+			+	\dagger	\dagger	\dashv	 -	-	\parallel	+	+				omments:	

DC #: 31990 E 29

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: | of | Reviewer: MG

2nd Reviewer:

AETHOD: Radiochemistry (Method: SCE Cover

he following sample MDAs are above the RDL;

Ra-238 0.50 (pc/d) 0.635 (pc/d) Lab DL > OAPP Pat None 0.537 0.634 0.681 0.681 0.687 0.667	# Sample ID	edotosj	AAPP POL RDL (units)	Lab DL		
10 0.637 (Puly) Lab DL > 0.407 None 10 0.634 11 0.694 19 0.667 V 19 0.667 V	9	Ra. 228	11:00/ 02/0	Still Value	Finding	Qualifications
13 13 13 14 15 16 16 19 19 19 19		5 -	0.30 (12.0)	0.655 (Pc/q)	Lab DL > GAPP	1
13 13 14 19 19 19 19 19 19 19 19	07		,			
13 13 17 19 19 19)			0.567		
13 17 18 19 19 19						
13 17 18 19 19 19				0.533		
17 18 19 19 19 19 19	1.2					
19 0.538 19 0.681 19 0.667 V				0.634		
18 0.681 19 0.667 ψ	<u></u>					
19 0.681				0.538		
19 0 0 68 1	01					
\$\frac{1}{2} \frac{1}{2} \frac{1}{2} \frac{1}{2} \frac{1}{2} \frac	0			0.681		
ψ						
	5	7			 	
						•

LDC #: <u>11990 E 29</u> SDG #: <u>235208</u>

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 2
Reviewer: MG

2nd reviewer: V

METHOD: Radiochemistry (Method: See cover)

(Y) N N/A (Y) N N/A Were field duplicate pairs identified in this SDG?

Were target isotopes detected in the field duplicate pairs?

	Activity (pci/a)	by difference Qual parent only
Isotopes	2	0 3	RPD RPD
Ra-228	0.912	1.03	0.118 (< 0.50)
Ra-226	1.04	1.59	0.55 () Johns/A fd
			-

	Activity (c:/5)	by difference
Isotopes	6	7	RPD
. Ra-228	0.980	0.965	0.015 (4 0.50)
Ra-226	1.95	1.56	0.39 ()

	Activity (pci/q,	by difference
Isotopes	(1	12	RPD
Ra-228	1.20	1.10	0.10 (±0.50)
Ra-226	2.09	1.59	0.50 ()

	Activity (pci/s)	by difference
isotopes	15	16	-RPD
Ra-228	1.35	1.65	0.30 (= 0.50)
Ra-226	1.88	1.58	0.30 ()

LDC #: <u>31990 E39</u> SDG #: <u>335308</u>

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 2 of 2

Reviewer: MG

2nd reviewer:

METHOD: Radiochemistry (Method: Sec	cover		
YN N/A Were field duplicate pairs ide N N/A Were target isotopes detecte	ntified in this SDG? d in the field duplicate p	airs?	
	Activity (PC		by difference
isotopes	18	19	-RPD
Ra- 228	1.17	1.19	0.02 (±0.50)
Ru-226	0.931	0.793	0.138 ()
			·
	Activity ()	
!sotopes			RPD
	Activity ()	
isotopes			RPD
	Activity ()	
!sotopes			RPD
		•	
			`

LDC #: 31990 E39 SDG #: 335308

VALIDATION FINDINGS WORKSHEET Level IV Recalculation Worksheet

2nd Reviewer: Page: Reviewer:

METHOD: Radiochemistry (Method: See cover

Percent recoveries (%R) for a laboratory control sample, a matrix spike and a matrix spike duplicate sample were recaluculated using the following formula:

 $%R = \frac{Found}{True} \times 100$

Where, Found = activity of each analyte measured in the analysis of the sample.

True = activity of each analyte in the source.

A matrix spike and matrix spike duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = 1S-D; x 100

S = Original sample activity Where,

יייניי כן כויפויים מחוולום מרוועול	D = Duplicate sample activity	
	(S+D)/2	

					Recalculated	Reported		
Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	%R or RPD	%R or RPD	Acceptable	
	Laboratory control sample						(a.c.)	7
7.05		Ra-236	10.64 (PCi/4)	10.64 (PCi/4) 11.1 (PCi/4)	95.9	95.5	>	
	Matrix spike sample						-	
10		Ra-338	78.97 (PCi/4)	8.97 (PCi,) 79.3 (PCi,)	9.66	9.66		
	Duplicate RPD			*				
22		Ra-336	1.395 (PC:1)	395 (PCify) 1.085 (PCify)	9.71	17.71		
	Chemical recovery	Ba - 133		•				-,-
		for Ra-328	367.7 (cpm)	367.7 (cpm) 308.9 (cpm)	86.7	86.7	>	

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 21990 E 29 SDG #: 235208

CF = %R, Self-absorbance, abundance, ect.

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	1_of_1
Reviewer:_	MG
2nd reviewer:	

		noviewer i i G
METHOD: Radio	ochemistry (Method: See cover	2nd reviewer:
Z . \	fications below for all questions answered "N". Not a Have results been reported and calculated correctly? Are results within the calibrated range of the instrum	/
Analyte results fo	or # 1, Ra-228 g the following equation:	reported with a positive detect were recalculated
Activity =	Recalculation:	
(cpm - bckgrd cpr (2.22)(E)(Vol)(CF)	17.630 - 0.4681	
E = Efficiency Vol = Volume	(2.22)(0.6303)(1.0100g)(0.8666)	$\times \frac{1}{0.993} \times \frac{1}{0.757} \times 1.058 = 1.3584 \frac{PC}{2}$

#	Sample ID	Analyte	Reported Concentration (PCi/q)	Calculated Concentration	Acceptable (Y/N)
-4-		Ra-228	1.36	1.36	Ý
		Ra-226	1.12	1.12	
2	11				
<u> </u>	! (Ra-228	1.20	1.20	
		Ra-226	2.09	2.10	
-					
					· · · · · · · · · · · · · · · · · · ·
					······································

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: August 20 through August 21, 2009

LDC Report Date: December 4, 2009

Matrix: Soil/Water

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 235782

Sample Identification

SA198-10B

SA198-27B

SA175-10B

SA175-28B

SA139-0.5B

SA139-10B

SA139-25B

SA139009-25B

SA139-35B

RSAT5-0.5B

RSAT5-10B

RSAT5-25B

RSTA5-40B

RSAT5-51B

EB082009-SO2

RSAO6-10B

RSAO6-20B

RSAO6-34B

RSAO6-34BMS

RSAO6-34BDUP

Introduction

This data review covers 19 soil samples and one water sample listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA) with the following exceptions:

Method Blank ID	Isotope	Activity	Associated Samples
PBS (prep blank)	Radium-228	0.444 pCi/g	All soil samples in SDG 235782

Sample concentrations were compared to concentrations detected in the method blanks as required by the QAPP. No sample data was qualified.

Samples EB082109-SO (from SDG 235860) and EB082009-SO2 were identified as equipment blanks. No radium-226 or radium-228 was found in these blanks with the following exceptions:

Equipment Blank ID	Sampling Date	Analyte	Concentration	Associated Samples
EB082009-SO2	8/20/09	Radium-226	0.428 pCi/L	RSAT5-0.5B RSAT5-10B RSAT5-25B RSTA5-40B RSAT5-51B

Sample concentrations were compared to concentrations detected in the equipment blanks as required by the QAPP. No sample data was qualified.

Samples FB072909-SO (from SDG 234267), FB082809-SO (from SDG 236238), and FB080309-SO (from SDG 234414) were identified as field blanks. No radium-226 or radium-228 was found in these blanks with the following exceptions:

Field Blank ID	Sampling Date	Analyte	Concentration	Associated Samples
FB082809-SO	8/28/09	Radium-228 Radium-226	3.83 pCi/L 1.75 pCi/L	SA139-0.5B SA139-10B SA139-25B SA139009-25B SA139-35B

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Although the LCS/LCSD relative percent difference (RPD) was not within QC limits for one isotope, the LCS/LCSD percent recoveries (%R) were within QC limits and no data were qualified.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL pCi/g	QAPP PQL pCi/g	Flag	A or P
SA139-25B	Radium-228	0.632	0.5	None	Р

Sample	Isotope	Lab DL pCi/g	QAPP PQL pCi/g	Flag	A or P
SA139-35B	Radium-228	0.592	0.5	None	Р
RSAT5-10B	Radium-228	0.523	0.5	None	Р

The MDA was greater than the PQL as listed above.

V. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 235782	All isotopes reported below the PQL.	J (all detects)	Α

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA139-25B and SA139009-25B were identified as field duplicates. No radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentration (pCi/g)		DDD	D.W.		
Analyte	SA139-25B	SA139009-25B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	1.16	1.16	-	0 (≤0.50)	-	-
Radium-226	1.23	1.13	-	0.10 (≤0.50)	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 235782

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
235782	SA139-25B SA139-35B RSAT5-10B	Radium-228	None	Р	Minimum detectable activity (PQL)
235782	SA198-10B SA198-27B SA175-10B SA175-28B SA139-0.5B SA139-0.5B SA139-25B SA139-25B SA139-35B RSAT5-0.5B RSAT5-0.5B RSAT5-10B RSAT5-25B RSAT5-10B RSAT5-51B EB082009-SO2 RSAO6-10B RSAO6-20B RSAO6-34B	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 235782

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Equipment Blank Data Qualification Summary - SDG 235782

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 235782

No Sample Data Qualified in this SDG

Tronox Northgate Henderson

LDC #: 21990F29	VALIDATION COMPLETENESS WORKSHEET	Date: 12 - 2 - 00
SDG #: 235782	Stage 2B	Page: <u> </u> of <u> </u>
Laboratory: GEL Laboratories	<u>LLC</u>	Reviewer: MG
		2nd Reviewer: V

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 8-20-09 through 8-21-09
lla.	Initial calibration	Α	V
IIb.	Calibration verification	A	
III.	Blanks	5W	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/DUP
IVb.	Laboratory control samples	SW	LCS/LCSD
IVc.	Chemical recovery	A	
V.	Sample result verification	N	
VI.	Minimum dectectable activity (MDA)	SW	
VII.	Overall assessment of data	A	
VIII.	Field duplicates	SW	D=7+8
ΧIV	Field blanks	SW	EB=15, *EB082109-501 (SDG: 235860)

FB= *FB072909-S0 (SDG:234267)

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet

★ = ND = No compounds detected R = Rinsate FB = Field blank

D = Duplicate

TB = Trip blank

EB = Equipment blank
FB = F8082809-S0 (SDG: 236238) FB= * FB080309-SO (SDG: 234414)

Validated Samples:

			·	<u>., </u>		(30-10-11)
1	SA198-10B S	11	RSAT5-10B 5	21	PBS	31
2	SA198-27B	12	RSAT5-25B	22 2	PBW	32
3	SA175-10B	13	RSTA5-40B	23		33
4 5	SA175-28B	14	RSAT5-51B	24		34
5	SA139-0.5B	15	EB082009-SO2 ₩	25		35
6	SA139-10B	16	RSAO6-10B 5	26		36
7	SA139-25B	17	RSAO6-20B	27		37
8	SA139009-25B	18	RSAO6-34B	28		38
9	SA139-35B	19	776 778 RSAO6-34BMS	29		39
10	RSAT5-0.5B	20	RSAO6-34BDUP 728	30_		40

Notes:	 	
	 1.200	

LDC #: 31990 £ 39 SDG #: 235782

VALIDATION FINDINGS WORKSHEET Blanks

Page: Oof Reviewer: MG

METHOD: Radiochemistry (Method: Sec cover

Were blank analyses performed as required? If no, please see qualifications below. (Y) N/A (Y) N/A

Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see qualifications below.

gualifie Sample Identification 80 re 7 86 Sample 501 2 a Associated Samples: Associated Samples: Blank Action Level Blank ID 0.444 PBS Ra-338 Units: **lsotope** Units:

Sample Identification		+		-					
Sample	•							•	
Blank Action	Level						-		
Blank ID									
Isotope									

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT: If there is activity in the blank above the MDA, sample results within 10x the blank activity will be qualified as not detected "U".

LDC #: 31990 F39 235 782 SDG #:

VALIDATION FINDINGS WORKSHEET Field Blanks

Page: | of | 2nd Reviewer: Reviewer:

> Cover Sec METHOD: Radiochemistry (Method:_

Were target isotopes detected in the field blanks? Were field blanks identified in this SDG?

Blank units:

Blank units: Pci/L Associated sample units: Pci/Sampling date: 8-38-09
Field blank type: (circle one) Field Blank// Rinsate / Other:

(x or X) alifie 270 2 Sample identification Associated Samples:_ 3 Samples No 0.0383 0.0175 Blank Action Limit FB 08 2 809 - 50 1.75 3.83 Blank ID Ra-338 Ra-226 Analyte <u>م</u> ح

Blank units: PCi/a L Associated sample units: PCi/a Sampling date: 8-30-09

EB Field blank type: (circle one) Field Blank / Rinsate / Other

(> RL) Associated Samples: Blank ID

五 ↑ 01

	Analyte	Blank ID	Blank	Semmis Idonatile
		,	Action	HOURSHIP Adding
		え	Ę	NO Semalo Civioso
				11 3 milyes was gual. 7 100
RL	RL Ra-326 0.438	0.438		
	Some Sun Sold Mark			

Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected. "U".

Version 1 n (3/2/2/20

21990 F39 335782 DC #: DG #:

VALIDATION FINDINGS WORKSHEET Laboratory Control Sample (LCS)

Page: 1 of 1 Reviewer: 2nd Reviewer:_

ETHOD: Radiochemistry (Method: See Cover

ease see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

N/A

Was a laboratory control sample (LCS) analyzed at the required frequency in this SDG?

N/A

Were all LCS percent recoveries (%R) within the control limits of 75-125%?

EVEL IV ONLY:

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. N N/A

	Qualifications	* No 0,101	700														
	Associated Samples	all water															
LCS/LCSD % RPD	/ar-(ilmits)	31.8 (< 30)														limit for Ra-228	
	7	Ka-338														rec in	
Matrix		Nater														LCS/LCSD %	
# rcs ID	L	752/753													H	mments: * LCS	

LDC #: 31990 F39 SDG #: 335782

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

VORKSHEET Activities

Page: 1 of 1 Reviewer: MC

METHOD: Radiochemistry (Method: See Cover

The following sample MDAs are above the RDL:

#	Sample ID	lsotope	QAPP POL	- Lab DL		
_	7	Ra-238	0.50 (pci/d)	1 0.633 (pc://)	9	None / P
			_	P -	-	70::01
7	6			0.592		
2	-					
1		*	 	0.593		->
_comments:	3,					

LDC #: <u>31990F</u> 39 SDG #: <u>335782</u>

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:	of
Reviewer:	MG
2nd reviewer:	1/

OD: Radiochemistry (Method: 56	e cover		
N/A Were field duplicate pairs N/A Were target isotopes dete	identified in this SDG? ected in the field duplicate p	airs?	
	Activity (P	ci/g)	by difference
Isotopes	7	88	-RPD
Ra - 278	1.16	1.16	0.00 (±0.50)
Ra-226	1.23	1.13	0.10 ()
		·····	
	Activity ()	
Isotopes	- Academy -		RPD
isotopes			
	Activity (_
Isotopes			RPD
•	Activity () .	
Isotopes			RPD
· · · · · · · · · · · · · · · · · · ·			

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: August 21 through August 26, 2009

LDC Report Date: December 4, 2009

Matrix: Soil/Water

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 235860

Sample Identification

RSAN6-10B SA185-41B RSAN6009-10B SA185-10BMS

RSAN6-20B SA185-10BDUP

RSAN6-33B

RSAS7-0.5B

RSAS7009-0.5B

RSAS7-10B

RSAS7-25B

RSAS7-42B

RSAS4-0.5B

RSAS4-10B

RSAS4-30B

RSAS4-45B

RSAS4009-45B

EB082109-SO1

SA65-10B

SA65-20B

SA65-32.5B

SA185-10B

SA185-25B

Introduction

This data review covers 22 soil samples and one water sample listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample EB082109-SO1 was identified as an equipment blank. No radium-226 or radium-228 was found in this blank.

Samples FB072909-SO (from SDG 234267) and FB080309-SO (from SDG 234414) were identified as field blanks. No radium-226 or radium-228 was found in these blanks.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
SA185-10BDUP (RSAN6-10B RSAN6-09-10B RSAN6-20B RSAN6-33B SA65-10B SA65-20B SA65-32.5B SA185-10B SA185-10B SA185-25B SA185-41B)	Radium-228	-	0.742 pCi/g (≤0.50)	J (all detects) UJ (all non-detects)	А

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Although the LCS/LCSD relative percent difference (RPD) was not within QC limits for one isotope, the LCS/LCSD percent recoveries (%R) were within QC limits and no data were qualified.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL pCi/g	QAPP PQL pCi/g	Flag	A or P
RSAN6-20B	Radium-228	0.527	0.50	None	Р
RSAS7-0.5B	Radium-228	0.696	0.50	None	Р
RSAS7-10B	Radium-228	0.772	0.50	None	Р
RSAS7-25B	Radium-228	0.739	0.50	None	Р
RSAS7-42B	Radium-228	0.607	0.50	None	Р
RSAS4-0.5B	Radium-228	0.631	0.50	None	Р
RSAS4-10B	Radium-228	0.809	0.50	None	Р
RSAS4-30B	Radium-228	0.718	0.50	None	Р

Sample	Isotope	Lab DL pCi/g	QAPP PQL pCi/g	Flag	A or P
SA65-20B	Radium-228	0.681	0.50	None	Р
SA65-32.5B	Radium-228	0.691	0.50	None	Р
SA185-10B	Radium-228	0.583	0.50	None	Р
SA185-25B	Radium-228	0.613	0.50	None	Р
SA185-41B	Radium-228	0.659	0.50	None	Р

The MDA was greater than the PQL as listed above.

V. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 235860	All isotopes reported below the PQL.	J (all detects)	A

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples RSAN6-10B and RSAN6009-10B, samples RSAS7-0.5B and RSAS7009-0.5B, and samples RSAS4-45B and RSAS4009-45B were identified as field duplicates. No radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentration (pCi/g)		222			
Analyte	RSAN6-10B	RSAN6009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	0.550	0.629	-	0.079 (≤0.50)	-	-
Radium-226	0.941	1.21	-	0.269 (≤0.50)	-	-

	Concentra	tion (pCl/g)				
Analyte	RSAS7-0.5B	RSAS7009-0.5B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	1.18	0.649	-	0.531 (≤0.50)	J (all detects)	А
Radium-226	0.864	0.765	-	0.099 (≤0.50)	-	-

	Concentra	tion (pCl/g)	RPD (Limits)			
Analyte	RSAS4-45B	RSAS4009-45B		Difference (Limits)	Flags	A or P
Radium-228	0.657 0.724		-	0.067 (≤0.50)	-	-
Radium-226	3.69	2.58	35 (≤50)	-	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 235860

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
235860	RSAN6-10B RSAN6-09-10B RSAN6-20B RSAN6-33B SA65-10B SA65-20B SA65-32.5B SA185-10B SA185-25B SA185-41B	Radium-228	J (all detects) UJ (all non-detects)	Α	Duplicate sample analysis (Difference) (Id)
235860	RSAN6-20B RSAS7-0.5B RSAS7-10B RSAS7-25B RSAS7-42B RSAS4-0.5B RSAS4-10B RSAS4-30B SA65-20B SA65-32.5B SA185-10B SA185-41B	Radium-228	None	Р	Minimum detectable activity (PQL)
235860	RSAN6-10B RSAN6-20B RSAN6-20B RSAN6-33B RSAS7-0.5B RSAS7-0.5B RSAS7-10B RSAS7-25B RSAS7-42B RSAS4-0.5B RSAS4-10B RSAS4-10B RSAS4-30B RSA	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)
235860	RSAS7-0.5B RSAS7009-0.5B	Radium-228	J (all detects)	A	Field duplicates (Difference) (fd)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 235860

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Equipment Blank Data Qualification Summary - SDG 235860

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 235860

No Sample Data Qualified in this SDG

Tronox Northgate Henderson

LDC #: 21990G29	VALIDATION COMPLETENESS WORKSHEET
SDG #: 235860	Stage 2B

Page: I of I Reviewer: *MG* 2nd Reviewer:

Laboratory: GEL Laboratories LLC

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	Α	Sampling dates: 8-21-09 through 8-26-09
IIa.	Initial calibration	Α	
IIb.	Calibration verification	Α	
III.	Blanks	A	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	5W	MS/DUP
IVb.	Laboratory control samples	SW	LCS/LCSD
IVc.	Chemical recovery	A	
V.	Sample result verification	N	
VI.	Minimum dectectable activity (MDA)	SW	
VII.	Overall assessment of data	A	
VIII.	Field duplicates	SW	D= 1+2 D=5+6, D=13+14
XIV	Field blanks	ND	EB = 15 , FB = FB072909-50 (506:234267)

FB= FB080309-SO (SDG: 234414)

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

D = Duplicate TB = Trip blank

FB = Field blank EB = Equipment blank

Validated Samples:

	PSANG 10P 5	Γ		-			
1	RSAN6-10B	11	RSAS4-10B	<u> </u>	21	SA185-41B S	31
2	RSAN6009-10B	12	RSAS4-30B	_	22	7 % 778 SA185-10BMS	32
3	RSAN6-20B	13	RSAS4-45B		23	SA185-10BDUP	33
4	RSAN6-33B	14	RSAS4009-45B	J	24 1	የBS	34
5	RSAS7-0.5B	152	EB082109-SO1	W	25 2	PBW	35
6	RSAS7009-0.5B	16	SA65-10B	S	26		36
7	RSAS7-10B	17	SA65-20B		27		37
8	RSAS7-25B	18	SA65-32.5B		28		38
9	RSAS7-42B	19	SA185-10B		29		39
10	RSAS4-0.5B	20	SA185-25B	<u> </u>	30		40

Notes:		

LDC #: 31990639 SDG #: 335860

VALIDATION FINDINGS WORKSHEET **Duplicate Analysis**

2nd Reviewer: Reviewer:__

METHOD: Radiochemistry (Method: See Cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A". Y N N/A

Act = sample activity $\delta = 1$ sigma error Was a duplicate sample analyzed the required frequency of 5% in this SDG? Were all duplicate sample duplicate error ratio (DER) \leq 1.42? DER= $\frac{|Act_1-Act_2|}{2^{-1/2}}$

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. LEVEL IV ONLY:

_		
		Qualifications
		Associated Samples
	by difference	DER (Limits)
ı		Isotope
		Matrix
		Duplicate ID
		*
•		

				by difference		
#	Duplicate ID	Matrix	Isotope	, DER (Limits)	Associated Samples	
	93	soil	Ra-338	0.742 Pcif (\$0.50)	~	J/U5/A 19
				0		
$\neg \neg$						
ı						

Comments:__

91990639 335860 LDC #: SDG #:

VALIDATION FINDINGS WORKSHEET Laboratory Control Sample (LCS)

Page: 1 of 2nd Reviewer:_ Reviewer:

METHOD: Radiochemistry (Method: See Cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a laboratory control sample (LCS) analyzed at the required frequency in this SDG? Were all LCS percent recoveries (%R) within the control limits of 75-125%? (X) N N/A Was (X) N/A Wei LEVEL IV ONLY:

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. Y N N/A

DG #: 335860

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: of I Reviewer: MC

Reviewer: M

ne following sample MDAs are above the RDL:

ETHOD: Radiochemistry (Method: SEE Cover

*.	Sample ID	Isotope	AAPP POL R	La 6 DL MBA (units)	Finding	Qualifications
	3	Ra-338	0.50 (pc:/4)	0.537 (PC:14)	Lab D	None/P
K			A .	ρ (J
8	5			969.0		
,						
0				0.773		
2	۵			0.739		
4	6			10,0		
				7,00		
٥	0)			0.631		
,						
-				0.809		
2						
ρ	8			0.718		
9	7					
,				0.681		
9	8			169.0		
	Ş					
	5			0.583		
(2)	70					
6				0.613		
70	2)					
	9	→	4	0.659	->	-
mmente.						

LDC #: <u>21990</u>G29 SDG #: <u>235860</u>

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	<u>l_of_l_</u>
Reviewer:	MG
2nd reviewer:	\overline{V}

METHOD: Radiochemistry	/ (Method:	see	cover	
ME I HOD: Dadiochemian	y (ivieulou		/	

N N/A

Were field duplicate pairs identified in this SDG?

Were target isotopes detected in the field duplicate pairs?

	Activity (oci/g)	by difference
Isotopes	1	2	-RPD-
Ra-∂28	0.550	0.629	0.079 (±0.50)
Ra-226	0.941	1.21	0.269 ()

	Activity (Activity (PC:/5)	
Isotopes	5	6	By difference Qual parentonly APP
. Ra- 228	1.18	0.649	0.531 (=0.50) Jdets/A fd
Ra-226	0.864	0.765	0.099 (1)

	Activity (x:/g)	
Isotopes	13	14	difference / RPD
Ra-228	0.657	0.724	d:fference 0.067 (≤0.50)
Ra-226	3.69	2.58	35 (±50)
		·	

	Activity ()	·
Isotopes			RPD
		-	
			·

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date:

August 25 through August 27, 2009

LDC Report Date:

December 4, 2009

Matrix:

Soil

Parameters:

Radium-226 & Radium-228

Validation Level:

Stage 2B

Laboratory:

GEL Laboratories, LLC.

Sample Delivery Group (SDG): 236043

Sample Identification

RSAN7-0.5B

RSAO5-41BDUP

RSAN7-10B

RSAN7-25B

RSAN7-38B

SA113-0.5B

SA 1 13-0.5D

SA113-10B

SA113-30B

SA196-0.5B

SA196-10B

SA196-29B

SA200-10B

SA200-20B

SA200-31B

SA200009B-31B

RSAT3-40B

RSAT3-53B

RSAO5-10B

RSAO5-25B

RSA05-41B

RSAO5-41BMS

Introduction

This data review covers 21 soil samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Samples FB072909-SO (from SDG 234267) and FB080309-SO (from SDG 234414) were identified as field blanks. No radium-226 or radium-228 was found in these blanks.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL pCi/g	QAPP PQL pCi/g	Flag	A or P
RSAN7-38B	Radium-228	0.561	0.50	None	Р
SA113-10B	Radium-228	0.554	0.50	None	Р
SA113-30B	Radium-228	0.560	0.50	None	Р
SA196-0.5B	Radium-228	0.523	0.50	None	Р
SA196-29B	Radium-228	0.669	0.50	None	Р
SA200-10B	Radium-228	0.581	0.50	None	Р
RSAT3-40B	Radium-228	0.555	0.50	None	P

The MDA was greater than the PQL as listed above.

V. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 236043	All isotopes reported below the PQL.	J (all detects)	А

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA200-31B and SA200009B-31B were identified as field duplicates. No radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentra	ition (pCi/g)	222	D:##		
Analyte	SA200-31B	SA200009B-31B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	1,22	1.82	-	0.60 (≤0.50)	J (all detects)	А
Radium-226	1.45	1.59	-	0.14 (≤0.50)	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 236043

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
236043	RSAN7-38B SA113-10B SA113-30B SA196-0.5B SA196-29B SA200-10B RSAT3-40B	Radium-228	None	Р	Minimum detectable activity (PQL)
236043	RSAN7-0.5B RSAN7-10B RSAN7-25B RSAN7-38B SA113-0.5B SA113-10B SA113-30B SA196-0.5B SA196-10B SA196-29B SA200-10B SA200-20B SA200-31B SA20009B-31B RSAT3-40B RSAT3-53B RSAO5-10B RSAO5-25B RSAO5-41B	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)
236043	SA200-31B SA200009B-31B	Radium-228	J (all detects)	А	Field duplicates (Difference) (fd)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 236043

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 236043

No Sample Data Qualified in this SDG

Tronox Northgate Henderson VALIDATION COMPLETENESS WORKSHEET

LDC #: 21990H29 VALID	PATION COMPLETENESS WORKSHEET	Date: 12 - 2 - 09
SDG #:236043	Stage 2B	Page: <u>1</u> of_1_
Laboratory: GEL Laboratories LLC	_	Reviewer: MG
		2nd Reviewer:

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 8-25-09 through 8-27-09
lla.	Initial calibration	Α	0
IIb.	Calibration verification	A	
111,	Blanks	A	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/DUP
IVb.	Laboratory control samples	A	LCS
IVc.	Chemical recovery	A	
V.	Sample result verification	N	
VI.	Minimum dectectable activity (MDA)	SW	
VII.	Overall assessment of data	A	
VIII.	Field duplicates	SW	D= 13+14
XIV	Field blanks	ND	FB= FB072909-SO (SDG: 234267)

FB= FB080309-SO (506: 234414)

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

R = Rinsate

D = Duplicate TB = Trip blank

FB = Field blank

EB = Equipment blank

Validated Samples:

	011 3011						
1	RSAN7-0.5B	11	SA200-10B	21	2% 228 RSAO5-41BDUP	31	
2	RSAN7-10B	12	SA200-20B	22	PBS	32	
3	RSAN7-25B	13	SA200-31B	23		33	
4	RSAN7-38B	14	SA200009B-31B	24		34	
5	SA113-0.5B	15	RSAT3-40B	25		35	
6	SA113-10B	16	RSAT3-53B	26		36	
7	SA113-30B	17	RSAO5-10B	27		37	
8	SA196-0.5B	18	RSAO5-25B	28		38	
9	SA196-10B	19	RSAO5-41B	29		39	
10	SA196-29B	20	RSAO5-41BMS 236 238	30		40	

Notes:	_		 		

DC #: 21990H39

VALIDATION FINDINGS WORKSHEET

Minimum Detectable Activities

Page: of

he following sample MDAs are above the RDL:

COVEV

See

IETHOD: Radiochemistry (Method:___

*	Sample ID	Isotope	AAPP POL LAG D RDL (units) MBA (un	DL LAG DL MBA (units)	Finding	Qualifications
_	7		05.0	1/4) 0.561 (Pci/g)	Lab D	None/P
				0		
6	9			0.554		
,						
2			-	0.560		
2	8			0.533		
2	01			699.0		
٥				0.581		
1						
	5		->	0.555	->	->
omments:	ورو ورو					

LDC #: 31990H39 SDG #: 336043

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page:	<u>l</u> of <u>l</u>
Reviewer:	MG
2nd reviewer:	

METHOD: Radiochemistry (Method: See c	over		
Were field duplicate pairs ider N N/A Were target isotopes detected	ntified in this SDG? d in the field duplicate		
	Activity (pci/q,	by difference
isotopes	13	14	Oval parent only
Ra-228	1.22	1.82	0.60 (=0.50) Jdets/A fd
Ra-226	1.45	1.59	0.14 ()
			ı
	Activity ()	
Isotopes			RPD
·			
	Activity (
Isotopes			RPD

	Activity ()	
Isotopes			RPD
			·

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: September 23 through October 5, 2009

LDC Report Date: December 4, 2009

Matrix: Soil

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 237785

Sample Identification

SA148-10BSPLP

SA148-35BSPLP

RSAR3-0.5BSPLP

RSAR3-35BSPLP

RSAQ4-10BSPLP

RSAQ4-32BSPLP

SA148-10BSPLPMS

SA148-10BSPLPDUP

RSAQ4-10BSPLPMS

RSAQ4-10BSPLPDUP

Introduction

This data review covers 10 soil samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

No field blanks were identified in this SDG.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Although the MS percent recovery (%R) was not within QC limits for one isotope due to the not being spiked by the laboratory, a second MS analysis percent recovery (%R) was within QC limits and no data were qualified.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
RSAQ4-10BSPLPDUP (RSAQ4-10BSPLP)	Radium-226	-	1.26 pCi/L (≤1.00)	J (all detects) UJ (all non-detects)	A

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs.

V. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 237785	All isotopes reported below the PQL.	J (all detects)	A

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 237785

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
237785	RSAQ4-10BSPLP	Radium-226	J (all detects) UJ (all non-detects)	Α	Duplicate sample analysis (Difference) (Id)
237785	SA148-10BSPLP SA148-35BSPLP RSAR3-0.5BSPLP RSAR3-35BSPLP RSAQ4-10BSPLP RSAQ4-32BSPLP	All isotopes reported below the PQL.	J (all detects)	А	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 237785

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 237785

No Sample Data Qualified in this SDG

Tronox Northgate Henderson **VALIDATION COMPLETENESS WORKSHEET**

SDG #: 237785 Laboratory: GEL Laboratories LLC

LDC #: 21990I29

Stage 2B

Page: L of L Reviewer: MG 2nd Reviewer: ____

Date: 12-2-09

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Technical holding times	Α	Sampling dates: 9-33-09 through 10-5-09
IIa.	Initial calibration	Α	0
IIb.	Calibration verification	A	
III.	Blanks	A	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS/DUP (SDG: 237795)
IVb.	Laboratory control samples	Α	LCS
IVc.	Chemical recovery	A	
V.	Sample result verification	N	
VI.	Minimum dectectable activity (MDA)	Α	
VII.	Overall assessment of data	Α	
VIII.	Field duplicates	7	
XIV	Field blanks	2	

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate

TB = Trip blank

EB = Equipment blank

Validated Samples:

	<u> </u>				
1	SA148-10BSPLP	11	PBSI	21	31
2	SA148-35BSPLP	12	PB52 226	22	32
3	RSAR3-0.5BSPLP	13	PBSPLP	23	33
4	RSAR3-35BSPLP	14		24	34
5	RSAQ4-10BSPLP	15		25	35
6	RSAQ4-32BSPLP	16		26	36
7	SA148-10BSPLPMS	17		27	37
8	SA148-10BSPLPDUP	18		28	38
9	RSAQ4-10BSPLPMS	19		29	39
10	RSAQ4-10BSPLPDUP	20		30	40

Notes:	Ka	- 076	batch	was	combined	With	SDG: 237795	
Flu	id	2 (West)		******			

3 1990 I 39 337785 LDC #:

VALIDATION FINDINGS WORKSHEET Matrix Spike Analysis

Page:

2nd Reviewer: Reviewer:

METHOD: Radiochemistry (Method: See cover

) If the sample concentration exceeded the spike concentration by Were matrix spike percent recoveries (%R) within the control limits of a factor of 4 or more, no action was taken.

LEVEL IV ONLY:

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. Y N N/A

*	Matríx Spike ID	Matrix	Analyte	***	A Legisland	
_	7	9192	0		Saldillac national	Qualifications
		,,,,	Ka-338	(261-22)	===	- 7 : - *
						20 000
+						
\parallel						
-						
+						
+						
-						
-						
+						
-						
+						
ommente.	× ×	00		ll .		
, -	Sample	AC CONSUMENT	atrix S		added to the OC s	was not added to the Oc sample due to lot from
	(Sample SAI48	SA148-108 SPLP	SDG.	327795) red a	a different sample	Which was within limits
	•			16);		

pc 106616 # 30 "# 9Q!

VALIDATION FINDINGS WORKSHEET **Duplicate Analysis**

2nd Reviewer: Page: Reviewer:_

> see cover **AETHOD**: Radiochemistry (Method:_

Rease see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a duplicate sample analyzed the required frequency of 5% in this SDG? Was a duplicate sample activity $\delta=1$ sigma error Were all duplicate sample duplicate error ratio (DER) ≤ 1.42 ? DER= $\frac{|Act_1-Act_2|}{2|\delta_1^2+\delta_2^2|^{1/2}}$ Act = sample activity $\delta=1$ sigma error Y N N/A

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. EVEL IV ONLY:
Y N N/A We

				by difference		
*	Duplicate ID	Matrix	Isotope	DER (Limits)	Associated Samples	Qualifications
-	(C)	SPLP	Ra-336	1.26 PC:/ (41.00)	5	J/UJ/A 19
+						
		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		,		

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: September 23 through October 5, 2009

LDC Report Date: December 4, 2009

Matrix: Soil

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 237795

Sample Identification

SA148-10BSPLP

SA148-35BSPLP

RSAR3-0.5BSPLP

RSAR3-35BSPLP

RSAQ4-10BSPLP

RSAQ4-32BSPLP

SA148-10BSPLPMS

SA148-10BSPLPDUP

Introduction

This data review covers 8 soil samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA) with the following exceptions:

Method Blank ID	Isotope	Activity	Associated Samples
SPLP PB (prep blank)	Radium-228	2.74 pCi/L	All samples in SDG 237795

Sample concentrations were compared to concentrations detected in the method blanks as required by the QAPP. No sample data was qualified.

No field blanks were identified in this SDG.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Although the DUP difference was not within QC limits for one isotope, the second DUP analysis difference was within QC limits and no data were qualified since the parent sample is not in this SDG.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs.

V. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 237795	All isotopes reported below the PQL.	J (all detects)	Α

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 237795

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
237795	SA148-10BSPLP SA148-35BSPLP RSAR3-0.5BSPLP RSAR3-35BSPLP RSAQ4-10BSPLP RSAQ4-32BSPLP	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 237795

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 237795

No Sample Data Qualified in this SDG

Tronox Northgate Henderson

LDC #: 21990J29	VALIDATION COMPLETENESS WORKSHEET
SDG #: 237795	Stage 2B
Laboratory: GEL Laboratories L	<u>LC</u>

	Date:	19	-3	-09
	Page:_	1	of_	<u> </u>
	Reviewer:		16	
2nd	Reviewer:		\vee	

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	Α	Sampling dates: 9-23-09 through 10-5-09
lla.	Initial calibration	Α	0
IIb.	Calibration verification	Α	
III.	Blanks	SW	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS/DUP (SDG: 237785)
IVb.	Laboratory control samples	A	LCS
IVc.	Chemical recovery	A	
V.	Sample result verification	N	
VI.	Minimum dectectable activity (MDA)	A	
VII.	Overall assessment of data	Α	
VIII.	Field duplicates	N	
XIV	Field blanks	7	

A = Acceptable Note:

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

D = Duplicate TB = Trip blank

R = Rinsate FB = Field blank

EB = Equipment blank

Validated Samples:

all soil

1	SA148-10BSPLP	11	PBSI	21	31	
2	SA148-35BSPLP	12 J	PB52 226	22	32	
3	RSAR3-0.5BSPLP	13	PBSPLP	23	33	
4	RSAR3-35BSPLP	14		24	34	
5	RSAQ4-10BSPLP	15		25	35	
6	RSAQ4-32BSPLP	16		26	36	
7	ეგა ემშ SA148-10BSPLPMS	17		27	 37	
8	<i>77</i> 6 <i>778</i> SA148-10BSPLPDUP	18		28	38	
9		19		29	39	
10		20		30	40	

Notes:	Flu	id 3	(Reag	ent Water)				
Ra-	226	batch	h was	combined	with	SDG:	237785		

21990.T39 LDC #:_

RL

Page: lotReviewer: $\mathcal{H}_{\mathcal{G}}$ 2nd Reviewer:

SDG #: 037795	VALIDATION	VALIDATION FINDINGS WORKSHEET Blanks	Page: Lof Reviewer: HC
METHOD: Radiochemistry (Method: See Ceve	See cover		Znd Reviewer:
Were blank analyses p Were any activities der	Were blank analyses performed as required? If no, please see qualifications below.	Were blank analyses performed as required? If no, please see qualifications below. Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see qualifications below.	ase see qualifications below.
Units:	Associated Samples: 91	all (all N.D.)	

Isotope	Blank ID	Blank	Sample Identification
	PBSPLP	Level	No samples were profit to
Ra-338	J.74		
Units:			Associated Samples:
Isotope	Blank ID	Blank	Sample Identification
		Level	

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT: If there is activity in the blank above the MDA, sample results within 10x the blank activity will be qualified as not detected "U".

LDC #: 31990539 337795 SDG #:

VALIDATION FINDINGS WORKSHEET **Duplicate Analysis**

Page: Reviewer:_ 2nd Reviewer:_

METHOD: Radiochemistry (Method: Sec Cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a duplicate sample analyzed the required frequency of 5% in this SDG?

Were all duplicate sample duplicate error ratio (DER) ≤ 1.42 ? DER= $\frac{|Act_{12}|Act_{2}|}{2|\delta_1^2+\delta_2^2|^{1/2}}$ Act = sample activity $\delta = 1$ sigma error Y (N N/A

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. LEVEL IV ONLY:

Y N N/A W

1.36 Pc/L (\$1.00) * None * No Quel No Quel In limit so quel parent only (DUP from SDG: 337785)	Matrix
limit so qual pavent only (DUP from	Ra-336
limit so qual pavent only (DUP from	
limit so qual parent only (DUP from	
limit so qual parent only (DUP from	
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	2nd DUP for this batch is in

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: September 24 through October 7, 2009

LDC Report Date: December 4, 2009

Matrix: Water

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 237885

Sample Identification

M-89B

FiltB092509-A2

M-2AB

M-2009AB

M-76B

M-76009B

PB100209-A2

MC-94B

M-89BMS

M-89BDUP

Introduction

This data review covers 10 water samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Samples FB060409 (from SDG 230340) and FB080409-GW (from SDG 233776) were identified as field blanks. No radium-226 or radium-228 was found in these blanks with the following exceptions:

Field Blank ID	Sampling Date	Analyte	Concentration	Associated Samples
FB080409-GW	8/4/09	Radium-228 Radium-226	2.33 pCi/L 0.396 pCi/L	M-89B M-2AB M-2009AB M-76B M-76009B

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified with the following exceptions:

Sample	Isotope	Reported Concentration	Modified Final Concentration
M-89B	Radium-226	0.405 pCi/L	1.00U pCi/L

Sample	Isotope	Reported Concentration	Modified Final Concentration
M-2AB	Radium-228	2.84 pCi/L	3.00U pCi/L
	Radium-226	0.525 pCi/L	1.00U pCi/L
M-2009AB	Radium-228	2.56 pCi/L	3.00U pCi/L
	Radium-226	0.640 pCi/L	1.00U pCi/L
M-76009B	Radium-228	1.85 pCi/L	3.00U pCi/L

Sample FiltB092509-A2 was identified as a filter blank. No radium-226 or radium-228 was found in this blank with the following exceptions:

Filter Blank ID	Sampling Date	Analyte	Concentration	Associated Samples
FiltB092509-A2	9/25/09	Radium-228	1.88 pCi/L	No associated samples in this SDG

Sample PB100209-A2 was identified as a pump blank. No radium-226 or radium-228 was found in this blank.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs.

V. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 237885	All isotopes reported below the PQL.	J (all detects)	А

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples M-2AB and M-2009AB and samples M-76B and M-76009B were identified as field duplicates. No radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentrat	ion (pCi/L)		D.11		
Analyte	M-2AB	M-2009AB	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	2.84	2.56	-	0.28 (≤3.00)	-	-
Radium-226	0.525	0.640		0.115 (≤1.00)	-	<u>-</u>

	Concentrat	ion (pCi/L)				
Analyte	M-76B	M-76009B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	0.791U	1.85	-	1.059 (≤3.00)	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 237885

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
237885	M-89B FitB092509-A2 M-2AB M-2009AB M-76B M-76009B PB100209-A2 MC-94B	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 237885

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 237885

SDG	Sample	Isotope	Modified Final Concentration	A or P	Code
237885	M-89B	Radium-226	1.00U pCi/L	A	bf
237885	M-2AB	Radium-228 Radium-226	3.00U pCi/L 1.00U pCi/L	А	bf
237885	M-2009AB	Radium-228 Radium-226	3.00U pCi/L 1.00U pCi/L	A	bf
237885	M-76009B	Radium-228	3.00U pCi/L	А	bf

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Filter Blank Data Qualification Summary - SDG 237885

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Pump Blank Data Qualification Summary - SDG 237885

No Sample Data Qualified in this SDG

Tronox Northgate Henderson VALIDATION COMPLETENESS WORKSHEET

		-	 	
SDG #: <u>23788</u> 5				
Laboratory: GEL Laboratories LL	\mathbf{c}			

LDC #: 21990K29

Stage 2B

Date: 10-3-4	71
Page:of	
Reviewer: MG	
2nd Reviewer: V	/

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Technical holding times	Α	Sampling dates: 9-24-09 through 10-7-09
IIa.	Initial calibration	Α	
IIb.	Calibration verification	Α	
III.	Blanks	Α	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/DUP
IVb.	Laboratory control samples	A	LCS
IVc.	Chemical recovery	Α	
V.	Sample result verification	N	
VI.	Minimum dectectable activity (MDA)	Α	
VII.	Overall assessment of data	A	
VIII.	Field duplicates	5W	D=3+4, D=5+6
XIV	Field blanks	SW	Filter blank = 2 Pump blank = * 7

FB = *FB060409 (5D6: 230340)
FB = FB080409 - GW (5D6: 23337
*= ND = No compounds detected D = Duplicate (506: 233776)

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

R = Rinsate FB = Field blank

TB = Trip blank EB = Equipment blank

Validated Samples:

all Water

·	all water				
1	M-89B	11	PBW	21	31
2	FiltB092509-A2	12		22	32
3	M-2AB	13		23	33
4	M-2009AB	14		24	34
5	M-76B	15		25	35
6	M-76009B	16		26	36
7	PB100209-A2	17		27	37
8	MC-94B	18		28	38
9	726 298 M-89BMS	19		29	39
10	M-89BDUP 236 228	20		30	40

Notes:		

LDC #: 31990 K39 337885

VALIDATION FINDINGS WORKSHEET Field Blanks

ধ Page: of 2nd Reviewer: Reviewer:

> sec cover METHOD: Radiochemistry (Method:_

Were field blanks identified in the field blanks?

Were target isotopes detected in the field blanks?

Blank units: PCi/L Associated sample units: PCi/L As

Field blank type: (circle one) Field Blank) Rinsate / Other:

4a 7 Qual: 1,376 Sample Identification Associated Samples: 3.00 Q 1.85 3.56/3.00 0.595/1.00 0.640/1.00 7 3.00 9.84 0.405/1.00 Blank Action Limit FB (100) 409 -GW 0.396 Blank ID 2.33 Ra-226 Ra-338 Analyte RL

Associated sample units: PC: /L PC: 1 Blank units:

Sampling date: 9-95-09

Field blank type: (circle one) Field Blank / Rinsate / Other) Filter (3/ank Associated Samples:

None

Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected. o B 20/2 Sample Identification 6 2 δ Σ Sample 2 Blank Action Limit Blank ID 1.88 7 Ra-338 Analyte

LDC #: <u>21990 K29</u> SDG #: <u>23788</u>5

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1
Reviewer: MG
2nd reviewer:

METHOD: Radiochemistry (Method:	see	cover)
INCITIOD. I LEGICOLIETING A LINEUROG.			,

N N/A

Were field duplicate pairs identified in this SDG?

Were target isotopes detected in the field duplicate pairs?

	Activity (oci/L)	by difference
Isotopes	3	4	- APD
Ra-228	2.84	2.56	0.28 (± 3.00)
Ra- 226	0.525	0.640	0.115 (£1.00)

	Activity (pci/Lj	by difference
Isotopes	5	6	-RPD
. Ra-228	0.791 U	1.85	1.059 (= 3.00)
		·	

	Activity ()		
isotopes			RPD
		·	
			•

	Activity ()	
sotopes			RPD
	·		

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: October 5 through October 6, 2009

LDC Report Date: December 4, 2009

Matrix: Soil/Water

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 238405

Sample Identification

RSAQ4-0.5B SA111-25BDUP

RSAQ4-10B

RSAQ4-25B

RSAQ4-32B

SA214-0.5B

0/12/14-0.00

SA214-15B

SA214-30B

SA214-43B

SA111-1.5B

SA111-10B

SA111-25B

SA111-39B

EB100509-SO1A4

SA103-0.5B

SA103-10B

SA103009-10B

SA103-25B

SA103-35B

EB100609-SO1A4

SA111-25BMS

Introduction

This data review covers 19 soil samples and 2 water samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA) with the following exceptions:

Method Blank ID	Isotope	Activity	Associated Samples
PBS (prep blank)	Radium-226	0.226 pCi/g	All soil samples in SDG 238405

Sample concentrations were compared to concentrations detected in the method blanks as required by the QAPP. No sample data was qualified with the following exceptions:

Sample	Isotope	Reported Activity	Modified Final Activity
SA111-10B	Radium-226	0.464 pCi/g	0.50U pCi/g

Samples EB100509-SO1A4 and EB100609-SO1A4 were identified as equipment blanks. No radium-226 or radium-228 was found in these blanks with the following exceptions:

Equipment Blank ID	Sampling Date	Analyte	Concentration	Associated Samples
EB100509-SO1A4	10/5/09	Radium-228	4.73 pCi/L	RSAQ4-0.5B RSAQ4-10B RSAQ4-25B RSAQ4-32B SA214-0.5B SA214-15B SA214-30B SA214-43B SA111-1.5B SA111-1.5B SA111-19B SA111-25B SA111-39B

Sample concentrations were compared to concentrations detected in the equipment blanks as required by the QAPP. No sample data was qualified.

Sample FB080309-SO (from SDG 234414) was identified as a field blank. No radium-226 or radium-228 was found in these blanks.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL pCi/g	QAPP PQL pCi/g	Flag	A or P
SA214-15B	Radium-228	0.646	0.50	None	P

Sample	Isotope	Lab DL pCi/g	QAPP PQL pCi/g	Flag	A or P	
SA111-25B	Radium-228	0.581	0.50	None	Р	
SA111-39B	Radium-228	0.572	0.50	None	Р	

The MDA was greater than the PQL as listed above.

V. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 238405	All isotopes reported below the PQL.	J (all detects)	Α

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA103-10B and SA103009-10B were identified as field duplicates. No radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentration (pCl/g)			D.W.		
Analyte	SA103-10B	SA103009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	0.887	0.995		0.108 (≤0.50)	•	-
Radium-226	0.626	0.762	-	0.136 (≤0.50)	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 238405

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
238405	SA214-15B SA111-25B SA111-39B	Radium-228	None	Р	Minimum detectable activity (PQL)
238405	RSAQ4-0.5B RSAQ4-10B RSAQ4-25B RSAQ4-32B SA214-0.5B SA214-15B SA214-30B SA214-43B SA111-1.5B SA111-1.0B SA111-25B SA111-39B EB100509-S01A4 SA103-0.5B SA103-10B SA103-09-10B SA103-25B SA103-35B SA103-35B EB100609-S01A4	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 238405

SDG	Sample	Isotope	Modified Final Activity	A or P	Code
238405	SA111-10B	Radium-226	0.50U pCi/g	Α	bl

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Equipment Blank Data Qualification Summary - SDG 238405

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 238405

No Sample Data Qualified in this SDG

Tronox Northgate Henderson

_DC #: 21990L29	VALIDATION COMPLETENESS WORKSHEET
SDG #:238405	Stage 2B
aboratory: GEL Laboratories L	

Date: 12 - 3 - 09 Page:_i of i Reviewer: MG 2nd Reviewer: -

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments				
I.	Technical holding times	A	Sampling dates: 10-5-09 through 10-6-09				
lla.	Initial calibration	A	0				
IIb.	Calibration verification	Α					
111.	Blanks	Sw					
IVa.	Matrix Spike/(Matrix Spike) Duplicates	Α	MS/DUP				
IVb.	Laboratory control samples	Α	LCS /LCSD				
IVc.	Chemical recovery	Α					
V.	Sample result verification	N					
VI.	Minimum dectectable activity (MDA)	SW					
VII.	Overall assessment of data	Α					
VIII.	Field duplicates	SW	D= 15+16				
ΧIV	Field blanks	SW	EB= 13*19				

FB=*FB080309-50 (From 294414)

A = Acceptable Note:

N = Not provided/applicable SW = See worksheet

= ND = No compounds detected R = Rinsate

FB = Field blank

D = Duplicate TB = Trip blank
EB = Equipment blank

Validated Samples:

1	RSAQ4-0.5B	11	SA111-25B	S	21	996 998 S SA111-25BDUP	31
2	RSAQ4-10B	12	SA111-39B	1	₂₂ [PBS	32
3	RSAQ4-25B	13	EB100509-SO1A4	W	23 2	PBW	33
4	RSAQ4-32B	14	SA103-0.5B	S	24		34
5	SA214-0.5B	15	SA103-10B		25		35
6	SA214-15B	16	SA103009-10B		26		36
7	SA214-30B	17	SA103-25B		27		37
8	SA214-43B	18	SA103-35B	1	28		38
9	SA111-1.5B	19	EB100609-SO1A4	W	29		39
10	SA111-10B	20	SA111-25BMS	S	30		40

Notes:			

60706618 338405 LDC #:__ SDG #:

VALIDATION FINDINGS WORKSHEET Blanks

Page: Lof Reviewer:_ 2nd Reviewer:

Qual: U bi

METHOD: Radiochemistry (Method: See Cover

PCi/g

Were blank analyses performed as required? If no, please see qualifications below. Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see qualifications below. KN N/A

*				+				
	ntification							
	Sample Identification							
, (
all soil								
amples:								
Associated Samples:		01	0.464/0.50					
1	Blank Action	Level						
۲۵۰/۵	Blank ID	PBS	9ee.0					
Units:	lsotope		: RI Ra-336					
⊃[3	 	 	 <u> </u>	<u></u>	

k ID Blenk Action Sample Identification				
	-			· · · · · i
Isotope Blank ID				

Associated Samples:

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT: If there is activity in the blank above the MDA, sample results within 10x the blank activity will be qualified as not detected "U",

ot	MG	3
Page:	Reviewer:	2nd Reviewer:

SDG #: 01990L39	38405		VALIDATION FI	VALIDATION FINDINGS WORKSHEET FIELD Blanks		
METHOD: Radiochemistry (Method:	adiochemistr	y (Method:	See cover			
ØN N/A	Were field	l blanks iden	Were field blanks identified in this SDG?			
N N/A Blank units:		Jet isotopes (Were target isotopes detected in the field blanks?			
Sampling date: 10-5-09	te: 10-5	-09				
Field blank type: (circle one) Field	ype: (circle α	one) Field Bl	Blank / Rinsate /Other.) EB	Associated Samples:	(-) ×	×)
Analyte	Blenk in	Rienk	-			

	fied +					
	quali					
intification	Weve					
Sample Identification	samples were qualitied					
	οN					
Diank	Action	0.0473	,			
DIANK ID	13	4.73				
Analyte		·Ra-328 4.73 0.0473				
		ġ		<u>L</u>	 	ائس

		Associated Samples:	
Diam units: Associated sample units:	Sampling date:	Field blank type: (circle one) Field Blank / Rinsate / Other:	

Analyte	Blank ID	Blank		S	Sample Identification		
		Action	-				
Samples with	isotope conc	entrations w	Samples with isotope concentrations within five times the associated field here	1 #0/a blonk concentration			

be 7066 #: 9140 F 3d 338405 SDG #:

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: of | Reviewer: 2nd Reviewer:

METHOD: Radiochemistry (Method: SPE Cover

The following sample MDAs are above the RDL:

#	Sample ID	Isotope	QAPP POL RDL (units)	OL Late DL MBA (units)	Finding	Qualifications
_	9	Ra - 238	0.50 (PC	(p/:) 0.646 (pc:/4)	Lab D	None/P
			_	0 1		
2				0.581		
6	1.2					
		-	*	0.572	7	→
						·
Somments:	in					
	The state of the s					

LDC #: 11990 L 29 SDG #: 238405

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:	<u>of</u>
Reviewer:	MG
2nd reviewer:	1~

да #. <u></u>	. 10.1.1		2nd reviewer:
IETHOD: Radiochemistry (Method: See C	over 1		
Were field duplicate pairs ident N N/A Were target isotopes detected	tified in this SDG? in the field duplicate	pairs?	
			T 1.1100000
F	Activity (1	by difference
Isotopes	15	16	RPD
Ra-228	0.887	0.995	0.108 (± 0.50)
Ra-226	0.626	0.762	0.136 ()
·	Activity (
Isotopes			RPD
	Activity ()	
Isotopes			RPD
	Activity ()	*
Isotopes	<u></u>		RPD
		á	
1	. 1		

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: October 6 through October 7, 2009

LDC Report Date: December 8, 2009

Matrix: Soil

Parameters: Radium-226 & Radium-228

Validation Level: Stage 4

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 238477

Sample Identification

SA138-0.5B RSAR5-40BDUP

SA138-10B

SA138009-10B

SA138-30B

SA138-45B

RSAR5-0.5B

RSAR5-10B

RSAR5-25B

RSAR5-40B

RSAS5-0.5B

RSAS5-10B

RSAS5-25B

RSAS5-36B

RSAS5009-36B

RSAP5-0.5B

RSAP5-10B

RSAP5009-10B

RSAP5-25B

RSAP5-39B

RSAR5-40BMS

Introduction

This data review covers 21 soil samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample EB100609-SO1A4 (from SDG 238405) was identified as an equipment blank. No radium-226 or radium-228 was found in this blank.

Sample FB080309-SO (from SDG 234414) was identified as a field blank. No radium-226 or radium-228 was found in these blanks.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs.

V. Sample Result Verification and Project Quantitation Limit

All sample result verifications were acceptable.

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 238477	All isotopes reported below the PQL.	J (all detects)	Α

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA138-10B and SA138009-10B, samples RSAS5-36B and RSAS5009-36B, and samples RSAP5-10B and RSAP5009-10B were identified as field duplicates. No radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentra	tion (pCi/g)	222	D.11		
Analyte	SA138-10B	SA138009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	1.36	1.55	-	0.19 (≤0.50)	-	-
Radium-226	0.812	1.12	-	0.308 (≤0.50)	-	-

	Concentra	tion (pCi/g)	222				
Analyte	RSAS5-36B	RSAS5009-36B	RPD (Limits)	Difference (Limits)	Flags	A or P	
Radium-228	0.571	1.42	-	0.849 (≤0.50)	J (all detects)	А	
Radium-226	1.61	1.74	-	0.13 (≤0.50)	•	-	

	Concentra	tion (pCi/g)	222	D.44		
Analyte	RSAP5-10B	RSAP5009-10B	(Limits)	RPD Difference (Limits) (Limits)		A or P
Radium-228	1.13	1.03	-	0.10 (≤0.50)	-	-
Radium-226	0.718	1.01	-	0.292 (≤0.50)	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 238477

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
238477	SA138-0.5B SA138-10B SA138-30B SA138-35B SA138-45B RSAR5-0.5B RSAR5-10B RSAR5-40B RSAS5-0.5B RSAS5-10B RSAS5-25B RSAS5-36B RSAS5-36B RSAS5-36B RSAS5-36B RSAS5-36B RSAS5-10B RSAS5-10B RSAS5-10B RSAS5-39B	All isotopes reported below the PQL.	J (all detects)	Α	Sample result verification (PQL) (sp)
238477	RSAS5-36B RSAS5009-36B	Radium-228	J (all detects)	А	Field duplicates (Difference) (fd)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 238477

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Equipment Blank Data Qualification Summary - SDG 238477

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 238477

No Sample Data Qualified in this SDG

DC :	#: 24000M20	٧/٨			_	lenderson ESS WORKSHEE ⁻	r	Data: 13 - 3 - 0
	#: <u>21990M29</u> #: <u>238477</u>	_ V A	LIDATIO		Stage 2B		•	Date: <u>≀∂ - 3 - 0</u> Page: <u>I</u> of <u>I</u>
	atory: GEL Laboratories	LLC		•	an A	•		Reviewer: MG
					70.14			2nd Reviewer:
METH	HOD: Radium 226 and R	adiun	n 228 (EPA	Method 90	03.1 & 904	4)		
			•			,		P
	amples listed below were tion findings worksheets.		ewed for ea	cn of the f	ollowing v	alidation areas. Validat	ion find	dings are noted in attached
		·					w	
	Validation	Area				Com	ments	
1.	Technical holding times			Α	Sampling of	dates: 10 - 6 - 09	+4	rough 10-7-09
IIa.	Initial calibration			A				0
IIb.	Calibration verification			Α				
III.	Blanks			Α				
IVa.	Matrix Spike/(Matrix Spike)	Duplica	ates	A	MS/	DUP		
IVb.	Laboratory control samples			Α	LCS			
IVc.	Chemical recovery			A				
V.	Sample result verification			A w				
VI.	Minimum dectectable activit	ty (MD	۹)	Α				
VII.	Overall assessment of data			A				
VIII.	Field duplicates			SW	D= 3)+3, D=13+14.	D=1	6+17
ΧIV	Field blanks			ND				4 (506:238405)
				·	FB=	FB080309-	50	(SDG: 234414)
Note:	A = Acceptable N = Not provided/applicable	<u>.</u>	ND = N R = Rin	o compound sate	s detected	D = Duplicate TB = Trip blank		·
	SW = See worksheet	-		eld blank		EB = Equipment bla	ank	
√alidat	red Samples:							
		1,,	D0405 40B			206 228 200 200 200		
1	SA138-0.5B	11	RSAS5-10B		21	RSAR5-40BDUP	31	
2	SA138-10B	12	RSAS5-25B	· • · · ·	22	PBS	32	
3	SA138009-10B	13	RSAS5-36B		23		33	
4	SA138-30B	14	RSAS5009-3	•	24		34	
5	SA138-45B	15	RSAP5-0.5B		25		35	
6	RSAR5-0.5B	16	RSAP5-10B		26		36	
7	RSAR5-10B	17	RSAP5009-1	08	27		37	
8	RSAR5-25B	18	RSAP5-25B		28		38	
9	RSAR5-40B	19	RSAP5-39B	376 2	29 28		39	
10	RSAS5-0.5B	20	RSAR5-40BN	/IS	30		40	

Notes:			
William Co.			
	 	 	

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: MG
2nd Reviewer:

Method:Radiochemistry(EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
i. Technical holding times				
All technical holding times were met.	1			
II. Calibration				
Were all instruments and detectors calibration as required?	1			
Were NIST traceable standards used for all calibrations?	. 🗸			
Was the check source identified by activity and radionuclide?	/			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	/			
III. Blanks				
Were blank analyses performed as required?	/			
Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see the Blanks validation completeness worksheet.		/		
IV. Natrix spikes and Duplicates				
Were a matrix spike (MS) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	1			
Were the MS percent recoveries (%R) within the QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	• 🗸			
Was a duplicate sample analyzed at the required frequency of 5% in this SDG?	!			
Were all duplicate sample duplicate error rations (DER) ≤1.42?.				
y Laboratory control samples				
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	1			
VI Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?	√			
Were tracer/carrier recoveries within the QC limits?	/			
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		/		
Were the performance evaluation (PE) samples within the acceptance limits?				
Viii. Sample Result Varification			Г	
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	1			
Were the Minimum Detectable Activities (MDA) < RL?	/			

LDC #: 21990M29 SDG #: 238477

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: MG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
X Diverall assessment of datas				
Overall assessment of data was found to be acceptable.	/			
Y. Figit duplicates				
Field duplicate pairs were Identified in this SDG.	\			1
Target analytes were detected in the field duplicates.	/			
C. Field blanks				
Field blanks were identified in this SDG.	/			
Target analytes were detected in the field blanks.		/		

LDC #: <u>31990 M</u>39 SDG #: <u>33847</u>7

VALIDATION FINDINGS WORKSHEET Field Duplicates

Reviewer: MG 2nd reviewer:____

METHOD:	Radiochemistry	(Method:	see	cover)	
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(

Were field duplicate pairs identified in this SDG? Were target isotopes detected in the field duplicate pairs?

	Activity (P	ci/g)	by difference
Isotopes	2	3	-RPD-
Ra-228	1.36	1.55	0.19 (40.50)
Ra-226	0.812	1.12	0.308 ()

	Activity (PC	1/9)	by difference
!sotopes	13	14	by difference Qual parent only
. Ra-228	0.571	1.42	0.849 (=0.50) Jacts/A fd
Ra-226	1.61	1-74	0.13 ()
	1		

	Activity (pcily,	by difference
isotopes	16	. 17	-RPD
Ru- 278	1.13	1.03	0.10 (= 0.50)
Ra-226	0.718	1.01	0.292 ()
		*	

	Activity ()	·
lactopes			RPD
	·		
		•	

LDC #: 21990 Mg9 411

VALIDATION FINDINGS WORKSHEET **Level IV Recalculation Worksheet**

2nd Reviewer: Reviewer:

> cover see METHOD: Radiochemistry (Method:_

Percent recoveries (%R) for a laboratory control sample, a matrix spike and a matrix spike duplicate sample were recaluculated using the following formula:

%R = Found x 100 True

Found = activity of each analyte measured in the analysis of the sample. True = activity of each analyte in the source. Where,

A matrix spike and matrix spike duplicate relative percent difference (RPD) was recalculated using the following formula:

Where, RPD = $\frac{|S-D|}{(S+D)/2} \times 100$

S = Original sample activity D = Duplicate sample activity

					Recalculated	Reported	
Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	%R or RPD	%R or RPD	Acceptable (Y/N)
	Laboratory control sample						
527		Ra-336	8.815 (Pcid) 11.2 (Pcid)	11.2 (PC/g)	78.7	78.7	>
	Matrix spike sample						
20		Ra-338	70.22 (Pc./g)	70.32 (Pcid) 68.4 (pcid)	102	601	
	Duplicate RPD						
16		Ra - 236	1.932 (PC:/4)	1.932 (PC:/4) 2.141 (PC:/4)	10.8	10.8	
	Chemical recovery	133		÷			
_		for Ra-228	384.2 (cpm)	384.2 (cpm) 302.0 (cpm)	94.1	94.1	> >

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #:_	21990M29
SDG #:	238 477

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	1 of	
Reviewer:	MG	
2nd reviewer:	W	_

METHOD: Radiochemistry	(Method:	see	cover)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A

Have results been reported and calculated correctly?

Are results within the calibrated range of the instruments?

Analyte results for # 1, Ra- 226 reported with a positive detect were recalculated and verified using the following equation:

Activity =

Recalculation:

 $\frac{\text{(cpm - bckgrd cpm)}}{\text{(2.22)(E)(Vol)(CF)}} \frac{\left(65./_{30.}\right) - \left(8./_{30.}\right)}{\left(3.33\right)\left(3.1819\right)\left(1.0130g\right)} \times \frac{1}{0.430} \times \frac{1}{0.978} \times 1.002 = 0.9239 \text{ PCi/g}$ E = Efficiency
Vol = Volume

CF = %R, Self-absorbance, abundance, ect.

#	Sample ID	Analyte	Reported Concentration (PCi/a)	Calculated Concentration	Acceptable (Y/N)
1	(-Tu Ra-228	1,42	1.42	Y
		Ra-226	0.921	0.924	
2	11	Ra-228	1.40	1.40	
		Ra-226	0.725	0.728	V
-					
_					
_					

Note:

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Data Validation Reports LDC #21990

Isotopic Uranium & Isotopic Thorium



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date:

July 15 through July 27, 2009

LDC Report Date:

December 1, 2009

Matrix:

Water

Parameters:

Isotopic Uranium & Isotopic Thorium

Validation Level:

Stage 2B

Laboratory:

GEL Laboratories, LLC.

Sample Delivery Group (SDG): 233580

Sample Identification

M-92BDISS

M-97B

TR-6B

EB-071709-GW

M-33B

CLD-4RB

MW-6RB

M-52B

M-35B

M-11B

M-11BDISS

M-11009B

M-11009BDISS

M-92BDISSMS

M-92BDISSDUP

Introduction

This data review covers 15 water samples listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample EB-071709-GW was identified as an equipment blank. No isotopic uranium or isotopic thorium were found in this blank.

Sample FB080409-GW (from SDG 233776) was identified as a field blank. No isotopic uranium or isotopic thorium was found in this blank.

Sample MC-3B-Filt (from SDG 230340) was identified as a filter blank. No isotopic uranium or isotopic thorium was found in this blank with the following exceptions:

Filter Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
MC-3B-Filt	5/21/09	Uranium-235/236	0.0163 pCi/L	M-92BDISS M-11BDISS M-11009BDISS

Sample concentrations were compared to concentrations detected in the filter blanks as required by the QAPP. No sample data was qualified.

Sample PB100209-A2 (from SDG 237885) was identified as a pump blank. No isotopic uranium or isotopic thorium was found in this blank.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Tracer Recovery

All tracer recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
M-92BDISS	Thorium-228 Thorium-230 Thorium-232	0.0858 0.0323 0.0421	0.03 0.03 0.03	None None None	Р
TR-6B	Thorium-228 Uranium-233/234	0.0334 0.0385	0.03 0.03	None None	Р
EB-071709-GW	Thorium-228 Thorium-230 Thorium-232 Uranium-238	0.0803 0.0747 0.0499 0.0391	0.03 0.03 0.03 0.03	None None None None	Р
M-33B	Thorium-228 Uranium-233/234 Uranium-235/236	0.0497 0.0518 0.034	0.03 0.03 0.03	None None None	Р
CLD-4RB	Thorium-228 Thorium-230 Thorium-232	0.0585 0.0353 0.0353	0.03 0.03 0.03	None None None	Р
MW-6RB	Thorium-228 Thorium-230 Uranium-233/234	0.519 0.033 0.0382	0.03 0.03 0.03	None None None	Р

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
M-52B	Uranium-238	0.0324	0.03	None	Р
M-35B	Uranium-233/234 Uranium-238	0.0463 0.0321	0.03 0.03	None None	Р
M-11B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	0.0471 0.120 0.103 0.0326	0.03 0.03 0.03 0.03	None None None None	P
M-11BDISS	Thorium-228 Thorium-230	0.042 0.0394	0.03 0.03	None None	Р
M-11009B	Thorium-228 Uranium-238	0.038 0.0338	0.03 0.03	None None	Р
M-11009BDISS	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	0.0397 0.0353 0.0651 0.0643 0.052	0.03 0.03 0.03 0.03 0.03	None None None None None	P

The MDA was greater than the PQL as listed above.

VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 233580	All isotopes reported below the PQL.	J (all detects)	А

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples M-11B and M-11009B and samples M-11BDISS and M-11009BDISS were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

	Concentral	tion (pCi/L)		5.44		
Analyte	M-11B	M-11009B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-230	0.0128	0.00U	-	0.0128 (≤0.03)	-	-
Uranium-233/234	8.13	7.69	6 (≤30)	-		-
Uranium-235/236	0.241	0.261	8 (≤30)	-	-	-
Uranium-238	4.37	4.98	13 (≤30)	-	-	-

	Concentra	tion (pCi/L)	222		, , , , , , , , , , , , , , , , , , ,	
Analyte	M-11BDISS	M-11009BDISS	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	0.0439	0.0295U	-	0.0144 (≤0.03)	-	-
Uranium-233/234	7.68	7.31	5 (≤30)	-	-	-
Uranium-235/236	0.200	0.244	20 (≤30)	-	-	-
Uranium-238	4.65	4.38	6 (≤30)	-	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 233580

				<u> </u>	<u> </u>
SDG	Sample	Isotope	Flag	A or P	Reason (Code)
233580	M-92BDISS CLD-4RB	Thorium-228 Thorium-230 Thorium-232	None None None	P	Minimum detectable activity (PQL)
233580	TR-6B	Thorium-228 Uranium-233/234	None None	Р	Minimum detectable activity (PQL)
233580	EB-071709-GW	Thorium-228 Thorium-230 Thorium-232 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
233580	M-33B	Thorium-228 Uranium-233/234 Uranium-235/236	None None None	Р	Minimum detectable activity (PQL)
233580	MW-6RB	Thorium-228 Thorium-230 Uranium-233/234	None None None	P	Minimum detectable activity (PQL)
233580	M-52B	Uranium-238	None	Р	Minimum detectable activity (PQL)
233580	M-35B	Uranium-233/234 Uranium-238	None None	P	Minimum detectable activity (PQL)
233580	M-11B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
233580	M-11BDISS	Thorium-228 Thorium-230	None None	Р	Minimum detectable activity (PQL)
233580	M-11009B	Thorium-228 Uranium-238	None None	Р	Minimum detectable activity (PQL)
233580	M-11009BDISS	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None None	P	Minimum detectable activity (PQL)

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
233580	M-92BDISS M-97B TR-6B EB-071709-GW M-33B CLD-4RB MW-6RB M-52B M-35B M-11B M-11BDISS M-11009B M-11009BDISS	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 233580

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Equipment Blank Data Qualification Summary - SDG 233580

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 233580

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Filter Blank Data Qualification Summary - SDG 233580

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Pump Blank Data Qualification Summary - SDG 233580

No Sample Data Qualified in this SDG

LDC #:	21990A59	VA	Tro LIDATIO		PLET	ENE			SHE	ET		Date: (1-2	<u> </u>
SDG#				S	Stage	2B						Page: Lof	
Labora	tory: GEL Laboratories	LLC									Re	eviewer: M	<u>`</u>
											∠na Re	eviewer: <u>/</u>	
Modifie	OD: Isotopic Uranium ([ed)												
validati	ion findings worksheets.		-										
	Validation	Area				·			Co	mments			
l.	Technical holding times			Α	Samp	oling d	ates:	7-15-0	29	through	1 7-27	1-09	
lla.	Initial calibration			Α						0			
IIb.	Calibration verification			Α									
III.	Blanks			Α									
IVa.	Matrix Spike/(Matrix Spike)	Duplica	ates	Α	M	5/1	JUP						
IVa.	Laboratory control samples			Α	L	CS							
V.	Tracer Recovery			A									
VI.	Minimum Detectable Activity	y (MDA	۸)	5 W									
VII.	Sample result verification			N									
VIII.	Overall assessment of data			A									
IX.	Field duplicates			SW	1			D=11-					
_ <u>x_</u>	Field blanks	91	14 SW	NB	EB	: * I	1, F	3=*FBO	804	09-GW	(500	. 233776	
Note: Validate	A = Acceptable N = Not provided/applicable SW = See worksheet d Samples: CII WA+ er	e	¥ : ND = N R = Rin FB = Fi		ls dete	cted		D = Duplic TB = Trip EB = Equi	ate blank pmen	09-A2 t blank C-3B-		7885) SDG: 230	340
1 1	M-92BDISS	11	M-11BDISS			21				31			$\overline{}$
	M-97B	12	M-11009B		- 4	22				32			
	TR-6B	13	M-11009BDI	 SS		23				33			
	EB-071709-GW	14	M-92BDISSN	ИТ		24				34		H-t	
	M-33B	15	M-92BDISSE	// 7	'n	25				35		**************************************	
6 (CLD-4RB	16	PBW			26				36			
	MW-6RB	17				27				37			
8 1	M-52B	18				28				38			
9 1	M-35B	19				29				39			
9 1		1	1]		·		40			1

21990A59	233580
LDC #:	SDG #:

VALIDATION FINDINGS WORKSHEET Field Blanks

Page: 2nd Reviewer: Reviewer:

cover METHOD: Radiochemistry (Method: 50e

\chi		Sample identification .	Jo Sample West Control				
official blanks?	Quel Samples:		I No Smol				
(Y) N N/A Were field blanks identified in this SDG? (Y) N N/A Were target isotopes detected in the field blanks? Blank units: 0 / Associated sample units: PCi/L Sampling date: 5 - 21 - 09 Field blank tyne: (circle one) Field Blank (Direct one)	To (Since Since) The Diamy This are	Blank ID Blank	-38-Filt Limit	0.0163			
MNA N/A Blank units: Sampling date		Attalyte		RL 10-335/336 0.0163			

Associated sample units: Blank units:

Sampling date:

Field blank type: (circle one) Field Blank / Rinsate / Other:_

Sample Identification Associated Samples: Blank Blank 10 Analyto

,	Action		
	Limit		
samples with isotope conce	entrations w	s within five times the associated field heart concount the second to th	
ָרָ.		"U".	e qualified as not detected.

DC #: 31990A59 DG #: 333580

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: of 2 sviewer: MG

see cover

IETHOD: Radiochemistry (Method:__

he following sample MDAs are above the RDL;

#	Sample ID	- Isotope	QAPP POL	Lab DL		
-	_		UDF (MURE)	MEDA (UNITS)	Fin	Qualifications
+			0.03 (pc//L)	0.0858 (pci/L)	Lab DL > GAPP Par	None / P
				0.0333		J
	->		1640.0	0.0431		
(q					
8	5	Tn-328		0.0334		
	->	U-233/234		0.0385		
2	7	T4-228		0.0803		
		Th-230		0.0747		
		Tu-232		0.0499		
		U-238		0.0391		
2	21	Th-238		0.0497		
		U-333/234		0.0518		
	7	U-235/236		0.22.0		
				1000		
2	و	Th - 229		1010		
		0.00-11		0.0585		
+		Th-230	<u> </u>	0.0353		
	→	Th-232		0.0353		
و	7	Th-238		0.0519		
		Tu-230		0.033		
	-	U-333/234		0.0383		
	හ	U-738		0.0324		
K						
α	6	U-333/334		27700		
	7	U-338	3	0.0331	3	
mmonte.					>	J.

LDC #: 31990A59 SDG #: 333580

VALIDATION FINDINGS WORKSHEET

see cover

METHOD: Radiochemistry (Method:__

The following sample MDAs are above the RDL;

Page: 2 of 2

2nd Reviewer:__ Reviewer:

Minimum Detectable Activities

Qualifications None, > GAPP POL Finding 2 Lab 0.03 (Pcih) 0.0471 (pcih) 0.0338 0.0353 0.0336 0.0643 0.120 0.0394 0.038 0.0397 0.0651 0.052 0.042 0.103 QAPP POL RDL (units) U-333/334 74-338 U-235/236 Th- 238 U-333/334 Th- 230 U-335/236 8ee-n1 Th-238 Isotope Tu-230 U-338 U-338 U-238 Sample ID 0 ~ Somments: 0 <u>~</u> = 6

LDC #: 21990459 SDG #: 233580

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	1_of_\
Reviewer:	MG
2nd reviewer:	1~

METHOD: Radiochemistry	(Method:_	see	cover)

N N/A
 N N/A

Were field duplicate pairs identified in this SDG?

Were target isotopes detected in the field duplicate pairs?

	Activity (oci/L)	
isotopes	10	12	difference APD
Tu-230	0.0138	0.00 U	difference 0.0128 (±0.03)
U-233/234	8.13	7.69	6 (≤ 30)
U- 235/236	0.241	0.261	8 RPD (= 30)
U- 238	4.37	4.98	RPD 13 (≤ 30)

	Activity (pci/L)		
Isotopes	11	13	difference / RPD	
Tu-228	0.0439	0.0295 U	difference 0.0144 (±0.03)	
U-233/234	7.68	7-31	5 (< 30)	
U-235/236	0.200	0.244	20 RPD (≤ 30)	
U-238	4.65	4.38	6 RPD (= 30)	

	Activity ()		
isotopes			RPD
			·

	Activity ()		
Isotopes			RPD
		-	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: July 20 through August 4, 2009

LDC Report Date: December 1, 2009

Matrix: Water

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 233776

Sample Identification

M-77B

M-77BDISS

M-50B

M-31-AB

M-31-ABDISS

M-21B

FB080409-GW

M-77BMS

M-77BDUP

Introduction

This data review covers 9 water samples listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA) with the following exceptions:

Method Blank ID Isotope		Activity	Associated Samples	
PBW (prep blank) Uranium-238		0.0168 pCi/L	All samples in SDG 233776	

Sample concentrations were compared to concentrations detected in the method blanks as required by the QAPP. No sample data was qualified.

Sample FB080409-GW was identified as a field blank. No isotopic uranium or isotopic thorium was found in this blank.

Sample MC-3B-Filt (from SDG 230340) was identified as a filter blank. No isotopic uranium or isotopic thorium was found in this blank with the following exceptions:

Filter Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
MC-3B-Filt	5/21/09	Uranium-235/236	0.0163 pCi/L	M-77BDISS M-31-ABDISS

Sample concentrations were compared to concentrations detected in the filter blanks as required by the QAPP. No sample data was qualified.

Sample PB100209-A2 (from SDG 237885) was identified as a pump blank. No isotopic uranium or isotopic thorium was found in this blank.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Isotope	RPD (Limits)	Difference (Limits)	Flag	A or P
M-77BDUP (M-77B M-77BDISS M-50B M-31-AB M-31-ABDISS)	Thorium-228	57.6 (≤20)	-	J (all detects) UJ (all non-detects)	А

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

c. Tracer Recovery

All tracer recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
M-77B	Thorium-228	0.133	0.03	None	Р
	Thorium-230	0.0869	0.03	None	
	Thorium-232	0.0869	0.03	None	
M-77BDISS	Thorium-228	0.0679	0.03	None	Р
	Thorium-230	0.080	0.03	None	
	Thorium-232	0.0639	0.03	None	

Sample	isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
M-50B	Thorium-228 Thorium-230 Thorium-232	0.0912 0.0696 0.0696	0.03 0.03 0.03	None None None	Р
M-31-AB	Thorium-228 Thorium-230 Thorium-232 Uranium-238	0.0731 0.0558 0.0558 0.032	0.03 0.03 0.03 0.03	None None None None	Р
M-31-ABDISS	Thorium-228 Thorium-230 Thorium-232 Uranium-233/234 Uranium-235/236 Uranium-238	0.0612 0.0585 0.0732 0.0443 0.0417 0.0443	0.03 0.03 0.03 0.03 0.03 0.03	None None None None None None	Р
M-21B	Thorium-228 Thorium-230 Thorium-232	0.0762 0.0728 0.0728	0.03 0.03 0.03	None None None	P
FB080409-GW	Thorium-228 Thorium-230 Thorium-232	0.074 0.0584 0.0584	0.03 0.03 0.03	None None None	Р

The MDA was greater than the PQL as listed above.

VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 233776 All isotopes reported below the PQL.		J (all detects)	Α

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 233776

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
233776	M-77B M-77BDISS M-50B M-31-AB M-31-ABDISS	Thorium-228	J (all detects) UJ (all non-detects)	A	Duplicate sample analysis (RPD) (ld)
233776	M-77B Thorium-228 M-77BDISS Thorium-230 M-50B Thorium-232 M-21B FB080409-GW		None None None	Р	Minimum detectable activity (PQL)
233776	M-31-AB	Thorium-228 Thorium-230 Thorium-232 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
233776	M-31-ABDISS	Thorium-228 Thorium-230 Thorium-232 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None None None	Р	Minimum detectable activity (PQL)
233776	M-77B M-77BDISS M-50B M-31-AB M-31-ABDISS M-21B FB080409-GW	All isotopes reported below the PQL.	J (all detects)	А	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 233776

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 233776

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Filter Blank Data Qualification Summary - SDG 233776

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Pump Blank Data Qualification Summary - SDG 233776

No Sample Data Qualified in this SDG

Tronox Northgate Henderson VALIDATION COMPLETENESS WORKSHEET

LDC #:_	21990B59	VALIDATION COMPLETENESS WORKSHEET	Date:11-20-09
SDG #:_	233776	Stage 2B	Page: <u> of </u>
Laborato	ory: GEL Laboratories	LLC	Reviewer: MG
			2nd Reviewer:

METHOD: Isotopic Uranium (DOE EML HASL-300, U-02-RC Modified), Isotopic Thorium (DOE EML HASL-300, Th-01-RC Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 7-20-09 through 8-4-09
lla.	Initial calibration	Α	•
IIb.	Calibration verification	A	
Hi.	Blanks	SW	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS/DUP
IVa.	Laboratory control samples	Α	LCS
V.	Tracer Recovery	Α	
VI.	Minimum Detectable Activity (MDA)	SW	
VII.	Sample result verification	N	
VIII.	Overall assessment of data	Α	
IX.	Field duplicates	N	
X	Field blanks SW	NA	FB=77

Note:

9

A = Acceptable

N = Not provided/applicable SW = See worksheet

water

4 Th

19

20

★ - ND = No compounds detected R = Rinsate

FB = Field blank

Pump Blank = PB100209-A2 (SDG: 237885)
ected D = Duplicate

TB = Trip blank EB = Equipment blank

Filter Blank = MC-3B-Filt (SDG; 23034

39

40

Validated Samples:

M-77B 11 21 31 M-77BDISS 12 22 32 M-50B 13 23 33 M-31-AB 14 24 34 5 M-31-ABDISS 15 25 35 26 M-21B 16 36 7 FB080409-GW 17 27 37 U Th M-77BMS 8 18 28 38

29

30

Notes:	 	
•		

M-77BDUP

PBW

31990B59 333776 SDG #: LDC #:_

VALIDATION FINDINGS WORKSHEET

Blanks

Page: Lot L 2nd Reviewer:_ Reviewer:

	see cover
(See
	(Method:_
	: Radiochemistry (
	METHOD: R

Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see qualifications below. Were blank analyses performed as required? If no, please see qualifications below. ON N/A

pci/L

	II.	_	7		7	 7	 _
		164					
	tification	qualit ied -	S				· · · · · · · · · · · · · · · · · · ·
> RL or ND.	Sample Identification	Nere					
) × R		mples					
a [No samples					
amples:							
Associated Samples:							
A	Blank Action	Level	,				
ر٦,	Blank ID	PBW	8910.				
Units: PC/L	fsotope		: Re U-738 0.0168				
n]		Ze de	ر ع]

Units: Isotope	Blank ID	Blank Action Level	Associated Samples: Sample Identification	
				<u> </u>
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				T
				T-
				
				<u> </u>

Units:

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT: If there is activity in the blank above the MDA, sample results within 10x the blank activity will be qualified as not detected "U".

31990 BS9	333776
LDC #:	SDG #:

VALIDATION FINDINGS WORKSHEET Field Blanks

Page: 2nd Reviewer:_ Reviewer:

> COVEN METHOD: Radiochemistry (Method: 500

Were target isotopes detected in the field blanks? Were field blanks identified in this SDG?

Note: PC: Associated sample units: PC:

Sampling date: 5-21-09

				==	_					_	_	_	 	
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> RL)	,			_										
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2, 5 (all diss) (> RL)		•	C. J. I. Zan on on	7 2 2	.									
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ples:		Sample Identification	 -	╬					······································	1				
ited Sam		Sample	010	1										
Filter Blank Associated Samples:			Sam olo											
Blank			N		-	+		1	_		_	ļ	 +	
34:					<u></u>									
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insate /						l						-	 +	
Blank / I	L													
ne) Field		Blank	Limit											
(circle o	4	Blank ID	-38-Filt	7	0163									
ık type:	H	-	-38	_	36 O	_								_
Fleid blank type: (circle one) Field Blank / Rinsate / Other	4.4	Anaiyte		17	c Kr 10-235/336 0.0163								!	
) <u>II. [</u>		<u>ئال</u> ــــ		Ġ	בן צר גר		1			- X			 • •	_

Associated sample units: Blank units:

Sampling date:

Field blank type: (circle one) Field Blank / Rinsate / Other:

Associated Samples:

Analyte	Blank ID	Blank	Samula Identification	
	,	Action		
		THE STATE OF		
Samples with	sotope conc	entrations w	Samples with isotope concentrations within five times the second and the concentrations within the times the second and the concentrations within the times the second and the concentrations within the times the second and the concentrations are also as the concentration and the concentration are also as the concentration are also as the concentration and the concentration are also as the	

within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, . 5

Version 1 n 191010000

91990 BS9 233776 LDC #:_ SDG #:

VALIDATION FINDINGS WORKSHEET

Duplicate Analysis

2nd Reviewer:__ Reviewer:

Page: 1

500 cover METHOD: Radiochemistry (Method:_ Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Act = sample activity $\delta = 1$ sigma error Was a duplicate sample analyzed the required frequency of 5% in this SDG? Were all duplicate sample duplicate error ratio (DER) \leq 1.42? DER= $\frac{|Act_1-Act_2|}{2}$ Were all duplicate sample duplicate error ratio (DER) Y N N/A

LEVEL IV ONLY:

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. Y N N/A

*	Duplicate ID	Matrix	Isotope	RPD DER (Limits)	Associated Samples	Qualifications
	6	Water	Tu-998	57.6 (±20)	\^	J/ UJ/A 19

DC #: 21990 B59

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 1 of 2
Reviewer: MC
2nd Reviewer:

ETHOD: Radiochemistry (Method: SCC Cover

ne following sample MDAs are above the RDL:

*	Sample ID	lsotope	QA PP POL RDL (units)	Lab DL MBA (units)	Finding	Qualifications
-		14-938	(9.03 (pc:/٢)	· ~	Lab DL > GAPP Par	None/P
		TH-230		0.0869		J
		Tn-133		0.0869		
رد	6	Th-338		0.0679		
		Tu-230		0.080		
	>	T4-232		0.0639		
~	3	Th-238		0.0912		
		TH-930		0.0696		
	>	Tu-332		0.0096		
7	7	Th-238		0.0731		
		Tu-230		0.0558		
		Tu-332		0.0558		
	\	U - 338		0.033		
٧	7.	Tu-238		0.0612		
		Tu-230		0.0585		
		Th-332		0.0732		
		U-233/234		0.0443		
		U-335/336		7140.0		
	,	0-338		0.0443		
ی	9	Th-338		0.0763		
		T4-330		0.0738		
	7	Th-232	->	↑ 8ero.0	->	
omments:						

31990 B 59 DG #: 233776)C #:

VALIDATION FINDINGS WORKSHEET

Minimum Detectable Activities

Page: 3 of 2 2nd Reviewer:__ Reviewer:

R

ETHOD: Radiochemistry (Method: SCC Cover

ne following sample MDAs are above the RDL:

*	Sample (D	edojosj	QAPP POL RDL (units)	Lab DL MBA (units)	10 10 10 10 10 10 10 10 10 10 10 10 10 1	
1		Tu-228	1/:04 60:0	/ 'O' U' (PC: /	NIIINII I	
		Tu-230		nayo o	7	None
		70 320		10000		
	>	0 0 M	3	↑ haso.o	->	>
mments:	:.:					

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: August 7 through August 10, 2009

LDC Report Date: December 1, 2009

Matrix: Soil/Water

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 234964

Sample Identification

RSAM8-10B SA92-10BMS SA92-10BDUP

RSAM8009-20B RSAM8-31B SA62-10B

SA62-24B

SA144-10B

SA144009-10B

SA144-28B SA92-10B

SA92-20B

SA92-20B SA92-31B

SA119-0.5B

SA119-10B

SA119-30B

SA119-48B

SA158-10B

SA158-20B SA158-31B

EB081009-SO2

Introduction

This data review covers 21 soil samples and one water sample listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA) with the following exceptions:

Method Blank ID	Isotope	Activity	Associated Samples
PBW (prep blank)	Thorium-228	0.024 pCi/L	All water samples in SDG 234964
PBS (prep blank)	Uranium-233/234 Uranium-238	0.0331 pCi/g 0.020 pCi/g	All soil samples in SDG 234964

Sample concentrations were compared to concentrations detected in the method blanks as required by the QAPP. No sample data was qualified.

Sample EB081009-SO2 was identified as an equipment blank. No isotopic uranium or isotopic thorium were found in this blank with the following exceptions:

Equipment Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
EB081009-SO2	8/10/09	Thorium-228	0.0416 pCi/L	SA119-0.5B SA119-10B SA119-30B SA119-48B

Sample concentrations were compared to concentrations detected in the equipment blanks as required by the QAPP. No sample data was qualified.

Samples FB072909-SO (from SDG 234267) and FB080309-SO (from SDG 234414) were identified as field blanks. No isotopic uranium or isotopic thorium was found in these blanks with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB080309-SO	8/3/09	Uranium-238	0.0126 pCi/L	SA119-0.5B SA119-10B SA119-30B SA119-48B
FB072909-SO	7/29/09	Thorium-228	0.0321 pCi/L	RSAM8-10B RSAM8-20B RSAM8009-20B RSAM8-31B SA62-10B SA62-24B SA144-10B SA144-10B SA144-28B SA92-10B SA92-10B SA92-20B SA92-31B SA158-10B SA158-31B

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Isotope	RPD (Limits)	Difference (Limits)	Flag	A or P
SA92-10BDUP (RSAM8-10B RSAM8-20B RSAM8-31B SA62-10B SA62-24B SA144-10B SA144-10B SA144-28B SA92-10B SA92-20B SA92-31B SA158-31B SA158-31B)	Uranium-235/236	-	0.0431 pCi/g (≤0.04)	J (all detects) UJ (all non-detects)	A

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

c. Tracer Recovery

All tracer recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
RSAM8-10B	Thorium-228 Thorium-230	0.0694 0.0796	0.05 0.05	None None	Р
RSAM8-20B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	0.0828 0.0823 0.045 0.045	0.05 0.05 0.04 0.04	None None None None	Р
RSAM8009-20B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	0.135 0.0975 0.0504 0.0501	0.05 0.05 0.04 0.04	None None None None	P
RSAM8-31B	Thorium-228 Thorium-230 Uranium-233/234	0.103 0.0844 0.0419	0.05 0.05 0.04	None None None	Р

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
SA62-10B	Thorium-228 Thorium-230	0.130 0.0973	0.05 0.05	None None	Р
SA62-24B	Thorium-228 Thorium-230	0.129 0.0555	0.05 0.05	None None	Р
SA144-10B	Thorium-228 Thorium-230 Thorium-232	0.196 0.110 0.110	0.05 0.05 0.10	None None None	Р
SA144009-10B	Thorium-228 Thorium-230	0.143 0.103	0.05 0.05	None None	Р
SA144-28B	Thorium-228 Thorium-230	0.124 0.0583	0.05 0.05	None None	Р
SA92-10B	Thorium-228 Thorium-230 Thorium-232	0.184 0.0827 0.103	0.05 0.05 0.10	None None None	Р
SA92-20B	Thorium-228 Thorium-230	0.134 0.0706	0.05 0.05	None None	Р
SA92-31B	Thorium-228 Thorium-230 Thorium-232	0.139 0.0787 0.114	0.05 0.05 0.10	None None None	Р
SA119-0.5B	Thorium-228 Thorium-230	0.109 0.0846	0.05 0.05	None None	Р
SA119-10B	Thorium-228 Thorium-230	0.120 0.0863	0.05 0.05	None None	Р
SA119-30B	Thorium-228 Thorium-230	0.105 0.094	0.05 0.05	None None	Р
SA119-48B	Thorium-228 Thorium-230	0.135 0.0918	0.05 0.05	None None	Р
SA158-10B	Thorium-228 Thorium-232	0.117 0.101	0.05 0.10	None None	Р
SA158-20B	Thorium-228 Thorium-230 Thorium-232	0.182 0.166 0.149	0.05 0.05 0.10	None None None	Р

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
SA158-31B	Thorium-228 Thorium-230 Thorium-232 Uranium-233/234	0.144 0.0818 0.164 0.0463	0.05 0.05 0.10 0.04	None None None None	Р

The MDA was greater than the PQL as listed above.

VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 234964	All isotopes reported below the PQL.	J (all detects)	Α

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples RSAM8-20B and RSAM8009-20B and samples SA144-10B and SA144009-10B were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

	Concentral	ion (pCi/g)		5.4		
Analyte	RSAM8-20B RSAM8009-		RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	2.26	2.01	12 (≤50)	-	-	-
Thorium-230	1.56	1.56 1.45		-	-	-
Thorium-232	1.86	1.61	14 (≤50)	-	-	-
Uranium-233/234	1.38	1.47	6 (≤50)	-	-	-
Uranium-235/236	0.0509	0.0855	-	0.0346 (≤0.04)	-	-
Uranium-238	1.29	1.23	5 (≤50)	-	-	-

	Concentra	tion (pCi/g)	555			
Analyte	SA144-10B	SA144009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.95	1.75	11 (≤50)	-	-	-
Thorium-230	1.56	0.881	56 (≤50)	-	J (all detects)	Α
Thorium-232	1.57	1.63	4 (≤50)	-	-	-
Uranium-233/234	1.62	1.57	3 (≤50)	-	-	-
Uranium-235/236	0.0542	0.0762	-	0.0150 (≤0.04)	-	-
Uranium-238	1.38	1.33	4 (≤50)	-	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 234964

		1		T			
SDG	Sample	Isotope	Flag	A or P	Reason (Code)		
234964 RSAM8-10B RSAM8-20B RSAM8009-20B RSAM8-31B SA62-10B SA62-24B SA144-10B SA144-09-10B SA144-28B SA92-10B SA92-20B SA92-31B SA158-10B SA158-31B		Uranium-235/236	J (all detects) UJ (all non-detects)	Α	Duplicate sample analysis (Difference) (Id)		
234964	RSAM8-20B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)		
234964	RSAM8009-20B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	None None None None	Р	Minimum detectable activity (PQL)		
234964	RSAM8-31B	Thorium-228 Thorium-230 Uranium-233/234	None None None	Р	Minimum detectable activity (PQL)		
234964	RSAM8-10B SA62-10B SA62-24B SA144009-10B SA144-28B SA119-0.5B SA119-10B SA119-30B SA92-20B SA119-48B	Thorium-228 Thorium-230	None None	Р	Minimum detectable activity (PQL)		
234964	SA144-10B SA92-10B SA92-31B SA158-20B	Thorium-228 Thorium-230 Thorium-232	None None None	Р	Minimum detectable activity (PQL)		
234964	SA158-10B	Thorium-228 Thorium-232	None None	Р	Minimum detectable activity (PQL)		

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
234964	SA158-31B	Thorium-228 Thorium-230 Thorium-232 Uranium-233/234	None None None None	Р	Minimum detectable activity (PQL)
234964	RSAM8-10B RSAM8-20B RSAM8009-20B RSAM8-31B SA62-10B SA62-24B SA144-10B SA144-10B SA144-28B SA92-10B SA92-20B SA92-20B SA92-31B SA119-0.5B SA119-10B SA119-30B SA119-48B SA158-10B SA158-10B SA158-20B SA158-31B EB081009-SO2	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)
234964	SA144-10B SA144009-10B	Thorium-230	J (all detects)	А	Field duplicates (RPD) (fd)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 234964

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Equipment Blank Data Qualification Summary - SDG 234964

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 234964

No Sample Data Qualified in this SDG

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SDG#	21990C59 :23 3 964	734 ories l	964	LIDATIOI ———————————————————————————————————	_		FENI e 2B	ESS WOF	RKSHE	ET	2ne	Date: 11- 90- 0 Page:of Reviewer:MG d Reviewer:
Modifie The sa	ed)	were						,		·		ASL-300, Th-01-RC re noted in attached
	Valida	tion	Area						Co	mment	s	
1.	Technical holding time		Α	Sam	pling d	ates: 8-	7-09	+4.	rough	8-10-09		
IIa.	Initial calibration			A		····			***************************************	0		
IIb.	Calibration verification			· · ·	A							
III.	Blanks				SW							
IVa.	Matrix Spike/(Matrix S	ites	SW	~	IS/c	OUP						
IVa.	Laboratory control san		Α	LCS/LCSD								
V.	Tracer Recovery	Α										
VI.	Minimum Detectable A	۸)	SW									
VII.	Sample result verificat	tion			N							
VIII.	Overall assessment of	f data			Α							
IX.	Field duplicates				5W	D= 2+3 D= 7+8						
_x	Field blanks				SW	EB=20 FB= FB072909-SO (506:234267)						(506: 234267)
	A = Acceptable N = Not provided/appl SW = See worksheet d Samples:			R = Rin	o compounds sate eld blank	s dete	ected	TB = `	Ø Ø Ø 3 € uplicate Trip blank Equipment) (500	5: 234414)
1 F	RSAM8-10B	S	11	SA92-20B		5	21	SA92-10BMS	UTh	S 31		
	RSAM8-20B		12	SA92-31B			22	SA92-10BDL	U Th	J 32		
	RSAM8009-20B		13	SA119-0.5B			23	PBS		33		
4 F	RSAM8-31B		14	SA119-10B			24 2	PBW		34		
5 5	SA62-10B		15	SA119-30B		$oxed{J}$	25			35		
6 5	SA62-24B		16	SA119-48B		\prod	26			36		
7 5	SA144-10B		17	SA158-10B			27			37		
8 9	SA144009-10B		18	SA158-20B			28			38		
9 9	SA144-28B		19	SA158-31B		Ţ	29			39		
10 5	SA92-10B		20 J	EB081009-S0	D2	W	30			40		

Notes:	 	

SDG #: 334964

VALIDATION FINDINGS WORKSHEET Blanks

Page: of C Reviewer: AG 2nd Reviewer:

•

Were blank analyses performed as required? If no, please see qualifications below. METHOD: Radiochemistry (Method: See covery N N/A Were blank analyses performed as recovery N N/A Were any activities detected in the least

Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see qualifications below.

Samples: all water (> RL)	Sample Identification	No sample was analitied						Samples: All soil (>RL)	Sample Identification	No sample with a line of	+				
	dentification	$\overline{}$							lentification	9	200				
all water	Sample I	l						(> RL)	Sample Ic	9 4	2				
		Sample						all		Samolo	3				
	-	ON -								-	+				
Associated Samples								Associated Samples:							
As	Blank Action	Level						As	Blank Action	Level					
PCi /L	Blank ID	PBW	٥.09 ا				, ,	, /a	Blank ID	PBS	0.0331	0.020			
Units: PC	lsotope		21 Th- 338				,,,	Units:	- 1		U- 333/234 C	U-938 C			

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT: If there is activity in the blank above the MDA, sample results within 10x the blank activity will be qualified as not detected "U".

cover 948 334964 METHOD: Radiochemistry (Method: See LDC #: 31990C59 438864

VALIDATION FINDINGS WORKSHEET

Field Blanks

Page: Lof L 2nd Reviewer:__ Reviewer:

(V 10x)) > RL 13410 13716 020/020 Sample Identification Associated Samples: Associated Samples:_ were Samples o Z EB Were field blanks identified in this obtain Were target isotopes detected in the field blanks?

Blank units: PC:/L Associated sample units: PC:/G
Sampling date: 8-3-09
Sampling date: 100 - 100 Sampling date: 8-10-09 Field blank type: (circle one) Field Blank/ Rinsate / Other: Field blank type: (circle one) Field Blank / Rinsate (Other:) Blank Action Limit FB 08 0309-50 0.0136 Blank ID PCi/L Analyte U-338 Analyte

Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, gulalified Sample Identification Were Samples 0 Z 0.00042 Blank Action Limit 0.04 6 Blank ID 90 Th-338

LDC #: 21990C59 738964

VALIDATION FINDINGS WORKSHEET Field Blanks

りるし	•
Reviewer: M	

Were field blanks identified in this SDG? See cover 334964 METHOD: Radiochemistry (Method:_ K N NA

(V) N N/A Were target isotopes detected in the field blanks?

Blank units: Pci/L Associated sample units: pci/4

Sampling date: 7-39-09

Associated Samples: Field blank type: (circle one) Field Blany / Rinsate / Other:

× RL

								,		
		1.1.00								-
ntification		9	322	.						
Sample Identification		24					-			•
		Lest 11 and on our reliance of N								
		77								
		1								
					-					
Blank	Action	ij		0.0003						
Blank ID	0000	05-40461		(4-338 0.0331 0.0003						
Analyte		0 L	١	8CE-4)						

Blank units:
Sampling date:
Field blank / Rinsate / Other:

Associated Samples:

Limit	within five times the associated field blank concentration	Analyte	Blank ID	Blank	Sample Identification
	Samples with isotope concentrations within five times the associated field blank concentration are listed them. It			Acuon	
	Samples with isotope concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within the first times the associated field blank concentration are listed of the concentration and the concentration are listed to the concentration are listed t				
	Samples with isotope concentrations within five times the associated field blank concentration and listed at the concentrations within five times the associated field blank concentration and listed at the concentration and the concentration and the concentrations within five times the associated field blank concentration and the concentrations within five times the associated field blank concentration and the concentrations within five times the associated field blank concentration and the concentrati				
	Samples with isotope concentrations within five times the associated field blank concentration are listed obtained.				
	Samples with isotope concentrations within five times the associated field blank concentration are listed obtain the				
	Samples with isotope concentrations within five times the associated field blank concentration are listed obtain the				
	Samples with isotope concentrations within five times the associated field blank concentration are listed chair.				
	Samples with isotope concentrations within five times the associated field blank concentration are listed obesit.				
	Samples with isotope concentrations within five times the associated field blank concentration are listed obtain the				
	Samples with isotope concentrations within five times the associated field blank concentration are listed obtain the				
	Samples with isotope concentrations within five times the associated field blank concentration are listed obtain the				
	Samples with isotope concentrations within five times the associated field blank concentration are listed above. the				
	Samples with isotope concentrations within five times the associated field blank concentration are listed obey.				

21990059 734964 LDC #: SDG #:

VALIDATION FINDINGS WORKSHEET

Duplicate Analysis

2nd Reviewer:__ Reviewer:

METHOD: Radiochemistry (Method: See cove

Was a duplicate sample analyzed the required frequency of 5% in this SDG? Were all duplicate sample duplicate error ratio (DER) \leq 1.42? DER= $\frac{|A_{CL_1}-A_{CL_2}|}{2|\delta_1^2|^2}$ Act = sample activity 2 $|\delta_1^2+\delta_2^2|^{1/2}$ Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A". \overrightarrow{Y} N N/A Was a duplicate sample analyzed the required frequency of 5% in this SDG? \overrightarrow{Y} N/A Were all duplicate sample duplicate error ratio (DER) \leq 1.42? DER = $|Act_1 - Act_2|$ Act = sar

δ = 1 sigma error

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. LEVEL IV ONLY: Y N N/A

r		- T	 	T	-	ī	 1	- 1	- -T		T	1	 _	 1]	
Qualifications	5/05/A AT 19	T &														
Associated Samples	1-12 17-19															
by difference DER(Limits)	0.0431 PCA (±0.04)	ρ														
Isotope	. 0															
Matrix	Soil															
Duplicate ID	22									-						
*	_															

)C#: 21990C59

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 1 of 3

MG

Reviewer:

ETHOD: Radiochemistry (Method: See Cover

le following sample MDAs are above the RDL:

1 Th - 320 0.05 (pc/4) 0.0694 (pc/4) Lab DL > 0.040 PP							Onelification
Th-230 0.05 0.0936 0 Th-230 0.05 0.0833 Th-230 0.05 0.0883 Th-230 0.04 0.045 Th-230 0.04 0.045 U-33/234 0.04 0.0504 U-33/234 0.04 0.0504 U-33/234 0.04 0.0504 U-33/234 0.05 0.130 Th-230 0.05 0.130			74-938	0.05 (PC:/4)	0.0694 (PC:/4)	Lat DL > GAPP	None, / P
Tu-928 Tu-938 Tu-938 Tu-938 Tu-938 U-933/934 U-933/934 U-933/934 U-933/934 U-933/934 U-933/934 U-933/934 Tu-938 Tu-938 Tu-938 Tu-938		-	Th -230	0.05	0.0796 ,		J
Tu-328 6.05 Tu-320 6.05 Tu-320 6.04 U-338 6.04 U-338 9.05 Tu-328 6.05 U-335/334 0.04 U-335/334 0.04 U-335/334 0.04 U-335/334 0.05 U-333/334 0.05 Tu-330 0.05 Tu-330 0.05 Tu-330 0.05 Tu-330 0.05							
Tu-230 0.05 Tu-230 0.05 Tu-330 0.04 U-338/340.04 U-338/340.04 U-338/334 0.04 U-338/334 0.04 U-338/236 0.05 Tu-238 0.05 Tu-238 0.05 Tu-238 0.05 Tu-238 0.05 Tu-238 0.05 Tu-238 0.05	2	6	Tu-328	0.05	0.0838		
3 The 33/314 0.04 3 The 338 0.05 The 330 0.05 The 33/314 0.04 U - 335/334 0.04 U - 335/334 0.04 U - 335/334 0.05 The 330 0.05			TH-230	0.05	0.0833		
The 38 0.04 The 38 0.05 The 33/314 0.05 United to 10.04 United to 10.05 United to 10.05 United to 10.05 United to 10.05 The 33/314 0.04 United to 10.05 The 33/314 0.05 United to 10.05 The 33/314 0.05 United to 10.05 The 33 0.05 The 33 0.05			ŧ	40.04	0.045		
3 Th-338 0.05 Th-330 0.05 Th-330 0.05 U-335/334 0.04 Th-330 0.05		^	u - 338	h0.04	5#0.0		
3 Tr-238 0.05 Tr-330 0.05 U-335/334 0.04 U-335/336 0.04 Tr-330 0.05 U-335/334 0.04 U-333/334 0.05 U-333/334 0.05 U-333/334 0.05 Tr-338 0.05 Tr-338 0.05 Tr-338 0.05 Tr-338 0.05							
Th-330 0.05 U-333/334 0.04 U-335/336 0.04 Th-330 0.05 Th-330 0.05 Th-330 0.05 Th-330 0.05 Th-330 0.05 Th-330 0.05	3	3	T4-238	0.05	0.135		
0.04 0.035/236 0.04 14 14.730 0.05 14.739 0.05 14.730 0.05			Tu-230	0.05	0.0975		
4 Th-336 0.04 4 Th-330 0.05 Th-330 0.05 U-333/334 0.04 5 Th-330 0.05 U Th-330 0.05 U Th-330 0.05 U Th-330 0.05 U Th-330 0.05			U-233/234	0.04	0.050y		
4 Tu-336 0.05 Tu-330 0.05 U-333/334 0.04 5 Tu-338 0.05 U Tu-338 0.05 U Tu-238 0.05 U Tu-330 0.05		>	U - 335/236	0.04	0.0501		
4 Tu-330 0.05 Tu-330 0.05 U-333/334 0.04 5 Tu-330 0.05 U-333/334 0.05 U-333/334 0.05 U-333/334 0.05 Tu-330 0.05 Tu-330 0.05							
Tu-330 0.05 U-333/334 0.04 Tu-338 0.05 U-333/334 0.05 U-338 0.05 U-338 0.05 Tu-338 0.05 Tu-338 0.05 Tu-338 0.05	7	7	Th- 338	0.05	0.103		
6 Tu-338 0.05 Lu-338 0.05 Lu-338 0.05 Tu-338 0.05 Tu-338 0.05 Tu-338 0.05 Tu-338 0.05			T4-330	0.05	0.0844		
5 Tu-338 0.05 Later 1238 0.05 Later 1238 0.05 Tu-238 0.05 Tu-238 0.05 Tu-330 0.05		→ >		0.04	0.0419		
5 Tu-338 0.05 b Tu-338 0.05 c Tu-238 0.05 c Tu-238 0.05 c Tu-338 0.05 c Tu-338 0.05							
L Tu-230 0.05 L Tu-238 0.05 T Tu-238 0.05 T Tu-238 0.05 Tu-330 0.05 Tu-332 0.10 Lu-332 0.10	5	5	Tu-238	0.05	0.130		
6 Tu-238 0.05 J Tu-230 0.05 Tu-338 0.05 Tu-330 0.05		4	Tu-230	0.05	0.0973		
6 Tu-238 0.05 Tu-230 0.05 Tu-330 0.05 Tu-330 0.05							
Tu-230 0.05 Tu-238 0.05 Tu-330 0.05	9	9	Tu-238	0.05	0.139		
0.05		7	T4-930	0.05	0.0555		
0.05	ı	r					
0.00			14-23C	0.05	0.196		
01.0			TH-330	0.05	0.110		
		•	Tu-232	0.00	0.110		-3

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VALIDATION FINDINGS WORKSHEET

Minimum Detectable Activities

Page: 2 of 3 N Reviewer: 2nd Reviewer:

ETHOD: Radiochemistry (Method: SEE Cover e following sample MDAs are above the RDL:

*	Ç		OF PP POL	Lab DL		
*	Sample ID	edojosi	HDL (units)	MAN (E	Finding	Qualifications
8	ဆ	T4-238	0.05 (PCi/4)) 0.143 (PC/4)	Lab DL > GAPP POL	None/P
		Tu-230	0.05	0.103	_	
6	6	Tu-338	0.05	P.C.0		
	_	Tu-330	0.05	0.0583		
0	0	74-338	0.05	0.184		
		Tu-230	90.05	0.0897		
	-	Tu-232	01.0	0.103		
=		Th-338	0.05	0.134		
	-	Th-330	0.05	90.000		
त	12	T4-238	0.05	0.139		
		Th-230	0.05	0.0787		
	٠,	Th-332	0.10	0.114		
(3	13	Tn-328	50.0	0.109		
		Th - 230	0.05	0.0846		
<u> </u>	٦٩	Th-238	0.05	0.130		
	->	T4-230	0.05	6.0863		
1						
15	15	Th-338	0.05	0.105		
	->	Tu-230	0.05	0.094		
9	9	Tu-398	0.05	0.135		
	7	Th-330	0.05	0.0918	•	
mments:	35					

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VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

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Page: Reviewer: 2nd Reviewer:

Cover See ETHOD: Radiochemistry (Method:___

le following sample MDAs are above the RDL:

*	Sample ID	isotope	QAPP F©L RDL (units)	Lab MBA (Finding	Qualifications
\neg	17	Th- 230	0.05 (PC:/4		Lab D	None / P
\neg		Th-232	0.10	0.101	-	1
丁						
\neg	(8	TH-338	0.05	0.182		
丁		TH-230	0.05	0.166		
\neg	→	Th-332	0.10	661.0		
丁		,				
	19	Th-228	0.05	D.144		
7		Tu-230	0.05	0.0818		
\dashv		Th -233	0.10	19.0		
_	~	U- 333/334	0.0H	0.0463	-	
\top						
1						
十						
寸						
\dashv						
-						
_						
\dashv						
-						
$\neg +$						
\dashv						
\dashv						
\dashv						
mments:						

LDC #: 21990C 59 SDG #: 234964

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	of
Reviewer:_	MG
2nd reviewer:_	1~
	1/

METHOD: Radiochemistry (Method: See caver

YN N/A

Were field duplicate pairs identified in this SDG?

Were target isotopes detected in the field duplicate pairs?

	Activity (pci/q)	
Isotopes	ð	3	RPD
Th-228	2.26	2.01	12 (≤50)
Th-230	1.56	1.45	7(1)
Tu-232	1.86	1.61	14 ()
	•		
			·

	Activity (oci/g	
Isotopes	a a	3	difference/RPD
U-233/234	1.38	1.47	6 RPD (< 50)
U-235/236	0.0509	0.0855	difference 0.0346 (≤0.04)
U-238	1.29	1.23	5 (≤ 50)
		·	,

	Activity (pcila,	Qual parent only
Isotopes	7	8	RPD
Tu-228	1.95	1.75	11 (450)
Tu-230	1.56	0.881	56 () Joets/A fa
Tu-232	1.57	1.63	4 ()
			-

	Activity (PC: /4)		· · · · · · · · · · · · · · · · · · ·
!sotopes	7	6	difference/RPD
U-233/234	1.62	1.57	3 RPD (< 50)
U - 235 / 236	0.0542	0.0762	difference 0.0220 (≤0.04)
U-238	1.38	1.33	RPD 4 (≤ 50)

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: August 11, 2009

LDC Report Date: December 5, 2009

Matrix: Soil/Water

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 235177

Sample Identification

SA107-0.5B EB081109-SO SA107-10B RSAU6-0.5BMS RSAU6-0.5BDUP

SA107-29B SA61-10B

SA61-30B

SA155-0.5B

SA155009-0.5B

SA155-10B

SA155-30B

SA115-0.5B

SA115-10B

SA115009-10B

SA115-25B

SA115-40B

SA115-51B

RSAU6-0.5B

RSAU6-10B

RSAU6-25B

RSAU6-40B

Introduction

This data review covers 22 soil samples and one water sample listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample EB081109-SO was identified as an equipment blank. No isotopic uranium or isotopic thorium were found in this blank with the following exceptions:

Equipment Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
EB081109-SO	8/11/09	Thorium-228 Thorium-230	0.0703 pCi/L 0.0215 pCi/L	SA107-0.5B SA107-10B SA107009-10B SA107-29B SA61-10B SA61-30B SA155-0.5B SA155009-0.5B SA155-10B SA155-30B

Sample concentrations were compared to concentrations detected in the equipment blanks as required by the QAPP. No sample data was qualified.

Samples FB072909-SO (from SDG 234267) and FB080309-SO (from SDG 234414) were identified as field blanks. No isotopic uranium or isotopic thorium was found in these blanks with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB072909-SO	7/29/09	Thorium-228	0.0321 pCi/L	SA107-0.5B SA107-10B SA107009-10B SA107-29B SA61-10B SA61-30B SA155-0.5B SA155009-0.5B SA155-10B SA155-30B
FB080309-SO	8/3/09	Uranium-238	0.0126 pCi/L	SA115-0.5B SA115-10B SA115009-10B SA115-25B SA115-40B SA115-51B RSAU6-0.5B RSAU6-10B RSAU6-25B RSAU6-40B

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

c. Tracer Recovery

All tracer recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample SA107-0.5B SA107-10B SA107009-10B	Thorium-228 Thorium-230 Thorium-232 Thorium-230 Uranium-233/234 Uranium-238 Thorium-230 Uranium-238	0.146 0.0909 0.127 0.0782 0.0601 0.0499 0.0955 0.0444 0.0444	0.05 0.05 0.10 0.05 0.04 0.04	None None None None None None None	P P
SA107-10B	Thorium-230 Thorium-230 Uranium-233/234 Uranium-238 Thorium-230 Uranium-230	0.0909 0.127 0.0782 0.0601 0.0499 0.0955 0.0444	0.05 0.10 0.05 0.04 0.04	None None None None None	
	Thorium-232 Thorium-230 Uranium-233/234 Uranium-238 Thorium-230 Uranium-233/234	0.127 0.0782 0.0601 0.0499 0.0955 0.0444	0.10 0.05 0.04 0.04 0.05 0.04	None None None None	
	Thorium-230 Uranium-233/234 Uranium-238 Thorium-230 Uranium-233/234	0.0782 0.0601 0.0499 0.0955 0.0444	0.05 0.04 0.04 0.05 0.04	None None None	P
	Uranium-233/234 Uranium-238 Thorium-230 Uranium-233/234	0.0601 0.0499 0.0955 0.0444	0.04 0.04 0.05 0.04	None None	P
	Uranium-233/234 Uranium-238 Thorium-230 Uranium-233/234	0.0601 0.0499 0.0955 0.0444	0.04 0.04 0.05 0.04	None None	Р
SA107009-10B	Uranium-238 Thorium-230 Uranium-233/234	0.0499 0.0955 0.0444	0.04 0.05 0.04	None	
SA107009-10B	Thorium-230 Uranium-233/234	0.0955 0.0444	0.05 0.04		
SA107009-10B	Uranium-233/234	0.0444	0.04	None	
SA107009-10B	Uranium-233/234	0.0444	0.04	None	1
	•	1		None	P
	Oraniam-200	0.0444	0.04	None	
			0.04	None	
SA107-29B	Thorium-230	0.0671	0.05	None	Р
	Uranium-233/234	0.0443	0.04	None	
					1
SA61-10B	Thorium-228	0.119	0.05	None	Р
	Thorium-230	0.0976	0.05	None	
	Thorium-232	0.127	0.10	None	
	Uranium-233/234	0.0455	0.04	None	
	Uranium-235/236	0.0452	0.04	None	
SA61-30B	Thorium-228	0.0662	0.05	None	P
0/10/ 005	Uranium-233/234	0.0427	0.04	None	1 '
	014.114.111 200/2011	0.0127	3.51	1 TOTIC	
SA155-0.5B	Thorium-228	0.0665	0.05	None	Р
	Thorium-230	0.0663	0.05	None	
CA455000 0 5D	Theritana 000	0.100	0.05	Mana	
SA155009-0.5B	Thorium-228 Thorium-230	0.122	0.05	None	P
	Thorium-232	0.0839 0.105	0.05 0.10	None None	1
	1110110111-232	0.103	0.10	None	
SA155-10B	Thorium-228	0.143	0.05	None	Р
	Thorium-230	0.109	0.05	None	
	Uranium-233/234	0.0456	0.04	None	
				.,	
SA155-30B	Thorium-228	0.113	0.05	None	Р
	Thorium-230	0.0596	0.05	None	
	Uranium-238	0.0419	0.04	None	
SA115-0.5B	Thorium-228	0.129	0.05	None	Р
	Thorium-230	0.0802	0.05	None	1
	Thorium-232	0.112	0.10	None	
				 	
SA115-10B	Thorium-228	0.114	0.05	None	Р
	Thorium-230	0.0935	0.05	None	
	Thorium-232	0.122	0.10	None	
	Uranium-233/234	0.0428	0.04	None	
SA115009-10B	Thorium-228	0.0715	0.05	None	P

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
SA115-25B	Thorium-228 Thorium-230 Uranium-233/234	0.0749 0.0746 0.0416	0.05 0.05 0.04	None None None	Р
SA115-40B	Thorium-228 Thorium-230	0.106 0.0731	0.05 0.05	None None	Р
SA115-51B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	0.0848 0.0759 0.0464 0.0402	0.05 0.05 0.04 0.04	None None None None	Р
RSAU6-0.5B	Thorium-228 Thorium-230	0.0811 0.105	0.05 0.05	None None	Р
RSAU6-10B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	0.0731 0.0631 0.0468 0.0401 0.0406	0.05 0.05 0.04 0.04 0.04	None None None None None	Р
RSAU6-25B	Thorium-228	0.0956	0.05	None	Р
RSAU6-40B	Thorium-228 Thorium-230 Uranium-233/234	0.126 0.110 0.0422	0.05 0.05 0.04	None None None	Р

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
EB081109-SO	EB081109-SO Uranium-238		0.03	None	Р

The MDA was greater than the PQL as listed above.

VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 235177	All samples in SDG 235177 All isotopes reported below the PQL.		Α

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA107-10B and SA107009-10B, samples SA155-0.5B and SA155009-0.5B, and samples SA115-10B and SA115009-10B were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

	Concentration (pCi/g)					
Analyte	SA107-10B	SA107009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	2.01	2.07	3 (≤50)	-	-	-
Thorium-230	1.55	1.16	29 (≤50)	-	-	-
Thorium-232	2.08	1.57	28 (≤50)	-	-	-
Uranium-233/234	1.36	1.87	32 (≤50)	-	-	-
Uranium-235/236	0.0874	0.0877	-	0.0003 (≤0.04)	-	
Uranium-238	1.18	1.36	14 (≤50)	-	-	-

	Concentration (pCi/g)					
Analyte	SA155-0.5B	SA155009-0.5B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	2.06	1.83	12 (≤50)	-	-	-
Thorium-230	0.979	0.745	27 (≤50)	-	-	-
Thorium-232	1.77	1.97	11 (≤50)	-	-	-
Uranium-233/234	0.905	0.938	4 (≤50)	-	-	
Uranium-235/236	0.0552	0.0702	-	0.0150 (≤0.04)	-	-
Uranium-238	0.839	0.878	5 (≤50)	-	-	-

	Concentral	Concentration (pCi/g)		D:#		
Analyte	SA115-10B	SA115009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.93	1.91	1 (≤50)	-	-	-
Thorium-230	1.22	1.71	33 (≤50)	-	-	-
Thorium-232	1.49	2.07	33 (≤50)	-	-	-
Uranium-233/234	1.06	1.11	5 (≤50)	-	-	-
Uranium-235/236	0.0623	0.0547	-	0.0076 (≤0.04)	-	-
Uranium-238	1.15	1.06	8 (≤50)	-	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 235177

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
235177	SA107-0.5B SA155009-0.5B SA115-0.5B	Thorium-228 Thorium-230 Thorium-232	None None None	P	Minimum detectable activity (PQL)
235177	SA107-10B SA107009-10B	Thorium-230 Uranium-233/234 Uranium-238	None None None	Р	Minimum detectable activity (PQL)
235177	SA107-29B	Thorium-230 Uranium-233/234	None None	Р	Minimum detectable activity (PQL)
235177	SA61-10B	Thorium-228 Thorium-230 Thorium-232 Uranium-233/234 Uranium-235/236	None None None None None	P	Minimum detectable activity (PQL)
235177	SA61-30B	Thorium-228 Uranium-233/234	None None	Р	Minimum detectable activity (PQL)
235177	SA155-0.5B SA115-40B RSAU6-0.5B	Thorium-228 Thorium-230	None None	Р	Minimum detectable activity (PQL)
235177	SA155-10B SA115-25B RSAU6-40B	Thorium-228 Thorium-230 Uranium-233/234	None None None	Р	Minimum detectable activity (PQL)
235177	SA155-30B	Thorium-228 Thorium-230 Uranium-238	None None None	Р	Minimum detectable activity (PQL)
235177	SA115-10B	Thorium-228 Thorium-230 Thorium-232 Uranium-233/234	None None None None	Р	Minimum detectable activity (PQL)
235177	SA115009-10B RSAU6-25B	Thorium-228	None	Р	Minimum detectable activity (PQL)
235177	SA115-51B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
235177	RSAU6-10B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None None	Р	Minimum detectable activity (PQL)
235177	EB081109-SO	Uranium-238	None	Р	Minimum detectable activity (PQL)
235177	SA107-0.5B SA107-10B SA107009-10B SA107-29B SA61-10B SA61-30B SA155-0.5B SA155-0.5B SA155-10B SA155-10B SA115-0.5B SA115-0.5B SA115-0.5B SA115-0.5B SA115-10B SA115-25B SA115-40B SA115-51B RSAU6-0.5B RSAU6-0.5B RSAU6-10B RSAU6-25B RSAU6-25B RSAU6-40B EB081109-SO	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 235177

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Equipment Blank Data Qualification Summary - SDG 235177

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 235177

No Sample Data Qualified in this SDG

Tronox Northgate Henderson

LDC #:	21990D59	VALIDATION COMPLETENESS WORKSHEET
SDG #:	235177	Stage 2B
Laborator	y: <u>GEL Laboratories l</u>	LC

Page: I of I Reviewer: MG 2nd Reviewer:

METHOD: Isotopic Uranium (DOE EML HASL-300, U-02-RC Modified), Isotopic Thorium (DOE EML HASL-300, Th-01-RC Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

chnical holding times tial calibration	A	Sampling dates: 8-11 - 09
	Α	
		
libration verification	Α	
anks	Α	
atrix Spike/(Matrix Spike) Duplicates	Α	MS/DUP LCS/LCSD
boratory control samples	Α	LCS/LCSD
acer Recovery	Α	
nimum Detectable Activity (MDA)	SW	
imple result verification	N	
verall assessment of data	Α	
eld duplicates	SW	D= 2+3 D=7+8 D=12+13
eld blanks	SW	EB= 21 FB= FB072909- SO (SDG: 234267
	boratory control samples acer Recovery nimum Detectable Activity (MDA) ample result verification verall assessment of data	atrix Spike/(Matrix Spike) Duplicates A boratory control samples A acer Recovery nimum Detectable Activity (MDA) simple result verification verall assessment of data A ald duplicates Sw ald blanks

Note: A = Acceptable

N = Not provided/applicable

ND = No compounds detected R = Rinsate

SW = See worksheet FB = Field blank

FB080309-SO
D = Duplicate
TB = Trip blank EB = Equipment blank

Validated Samples:

1	SA107-0.5B S	11	SA115-0.5B S	212	EB081109-SO W	31
2	SA107-10B	12	SA115-10B	22	RSAU6-0.5BMS S	32
3	SA107009-10B	13	SA115009-10B	23	RSAU6-0.5BDUP	33
4	SA107-29B	14	SA115-25B	24 1	PBS	34
5	SA61-10B	15	SA115-40B	₂₅ ∂	PBW	35
6	SA61-30B	16	SA115-51B	26		36
7	SA155-0.5B	17	RSAU6-0.5B	27		37
8	SA155009-0.5B	18	RSAU6-10B	28		38
9	SA155-10B	19	RSAU6-25B	29		39
10	SA155-30B	20	RSAU6-40B	30		40

Notes:		
	•	

31990D59 235177 SDG #: LDC #:

VALIDATION FINDINGS WORKSHEET

Field Blanks

Z 0	(
Page: Reviewer: 2nd Reviewer	

(× 0×)

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See cover METHOD: Radiochemistry (Method:_

Were field blanks idenumed in the field blanks?

Were target isotopes detected in the field blanks?

Blank units: Pci/L Associated sample units: Pci/lo Associated sample units: Pci/lo Associated sample units: Pci/lo Associated Sampling date: Associated

gualitied Sample Identification Associated Samples: 290 Samples 2 0.0003 Blank Action Limit FB 07 2909-50 0.0331 Blank ID Th-238 Analyte 7 RL

Associated sample units: PCi /a PS: /2 Blank units:

Sampling date: 8-11 - 09 Field blank type: (circle one) Field Blank / Rinsate (Other:

EB

Associated Samples:

21

31990D59 335177 LDC #:_ SDG #:

VALIDATION FINDINGS WORKSHEET

Field Blanks

cover METHOD: Radiochemistry (Method: 5ee

Field blank type: (circle one) Field Blank/ Rinsate / Other:

(> RL)

0611

gualitie Sample Identification Associated Samples: Weve No samples Blank Action Limit FB 08 0309-50 0.0136 Blank ID Analyte U-338

Associated sample units: Blank units:

Sampling date:

Field blank type: (circle one) Field Blank / Rinsate / Other:_

Sample Identification Associated Samples: Blank Action Limit Blank 1D Analyte

Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected,

LDC #: 31990D59 SDG #: 235177

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 1 of 3

Reviewer: 2nd Reviewer:

METHOD: Radiochemistry (Method: SEE Cover

The following sample MDAs are above the RDL;

*	Sample ID	- actor	WAPP POL	Lab DL		
. –		Admines	HDL (units)	MBA (units)	Finding	Qualifications
	_	14-938	0.05 (PC:/4) 0.146 (Pci/d)	Lah D	/ V V V
		TH-930	0.05 ,0	0.0909		1 9502
	4	Tu-232	0.10	0.137		
,						
1	4	Tu-330	0.05	0.0782		
		U-333/234	0.04	0.0601		
	→	J-238	HO.0	0.0499		
ľ						
	3	Th-238	0.05	0.0955		
		U- 333/234	9.04	0.0444		
	4	U-238	0.04	0.0444		
2	3	TH-230	0.05	17.00		
	7	()- 333/33.1		0.00 (1		
		2 6 2 3 / 6 3 4	2.01	0.0443		
V	1.1	, , , , , , , , , , , , , , , , , , ,				
	2	866-41	0.05	611.0		
		Th-230	0.05	0.0976		
		Th. 232	2. 0			
		11 - 000 / 000	5.5	0.127		
		•	0.04	0.0485		
	A	0-735/336	0.04	0.0452		
9						
	9 -		0.05	0.0663		
	-	0-233/234	PO.04	0.0437		
7						
	~		0.05	0.0665		
	7	Tu-230	0.05	0.0663	 	
					•	>
omments:						
1						

LDC #: 31990D59 SDG #: 235177

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 2 of 3

2nd Reviewer:_

Reviewer:

See METHOD: Radiochemistry (Method:

COVEV

Qualifications None, > GAPP POL Finding 2 Lab 0.122 (Pci/g) MBA (units) 0.0839 0.0456 0.0803 0.0596 0.0419 0.0935 0.0749 0.0746 0.0428 0.0715 0.0416 0.143 0.109 1 a c 0.113 0.112 261.0 0.129 0.114 POL (RS:/4) QAPP PG RDL (units) 0.05 0.05 0.05 0.05 P. 04 0.0 0.05 0.04 0.04 0.05 50.0 0.05 0.60 0.05 0.05 0.04 0.10 0.05 0.04 0.05 U-333/334 U-233/234 TH-230 Th-238 Th -338 Tu-230 Th-330 Tu-228 Tu-330 Th- 338 T4-230 Th. 338 Th-338 Tn-230 Tu-232 Th-228 U-238 Isotope U-333/ The following sample MDAs are above the RDL: Sample ID 3 2 $\boldsymbol{\omega}$ 6 omments: ω 0 9 3

LDC #: 31990D59 SDG #: 235177

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 3 of 3

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2nd Reviewer: Reviewer:__

METHOD: Radiochemistry (Method: SEE Cover

The following sample MDAs are above the RDL:

				,		
*	Sample ID	Sotope	AAPP POL	Lab DL		
瓦	(5	Th. 228	(/ . July) Lo (I (ACC)	Fin	Qualifications
		7	0.05	10.106 (P~19)	Lab DL > GAPP POL	None / P
	*	14 -d 50	0.05	0.0731		
9	16.	71770	1			
	9 -	200 H	0.05	0.0848		
		OS 6-430	0.05	0.0759		
		0-333/234	0.04	0.0464		
	>	0-238	0.04	0.0402		
		Tu-238	0.05	0.0811		
	*	Tu-230	0.05	0.105		
) o	0.					
	0		0.05	0.0731		
		Tu-230	0.05	0.0631		
		U-233/234	0.04	0.0468		
		1	0.04			
		a	700	0.0401		
			0.07	0.0406		
o,	9					
)	866-NI	0.05	0.0956		
30	7,7					
	00		0.05	0.126		
		330	0.05	0.110		
	>	U-233/234	0.04 b	0.0422		
16	21	020-11				
		0-0-0	0.03 (pci/L)	0.0302 (pc://)	-	
						>
omments:						

LDC #: 21990D59 SDG #: 235177

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 2

Reviewer: MG

2nd reviewer: 1

METHOD: Radiochemistry (Method: See Cover

YN N/A YN N/A Were field duplicate pairs identified in this SDG?

Were target isotopes detected in the field duplicate pairs?

	Activity (pci/g,	
isotopes	2	3	RPD
Tu-228	2.01	2.07	3 (±50)
Tn-230	1. 55	1.16	29 ()
Tu-232	2.08	1.57	28 (↓)

	Activity (PC	:/91	
Isotopes	2	3	difference / RPD
. U-233/234	1.36	1.87	32 ^{RPD} (≤ 50)
U-235/236	0.0874	0.0877	difference 0.0003 (50.04)
U-238	1.18	1.36	RPD
			,

	Activity (ci/q,	
isotopes	7	· 8	RPD
Tu-228	2.06	1.83	12 (450)
Tu-230	0.979	0.745	27 ()
Th-232	1.77	1.97	11 (1)

	Activity (pci/g,	
isotopes	7	8	difference / RPD
U-233/234	0.905	0.938	4 RPD (450)
U-235/236	0.0552	0.0702	d: fference 0.0150 (≤0.04)
U-238	0.839	0.878	5 (50)
			Α

SDG #: 235177

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	2 of 2
Reviewer:	MG
2nd reviewer:	1~

METHOD: Radiochemistry	(Method:	see	cover	
IVIL I I IOD. I INCHIOCITOTICIO	111100100			

Were field duplicate pairs identified in this SDG? Were target isotopes detected in the field duplicate pairs?

	Activity (P	ci/g)	
Isotopes	12	13	RPD
Tu-228	1.93	1.91	1 (±50)
Tu-230	1. 22	1.71	33 ()
Tu-232	1.49	2.07	33 ()

	Activity (P	ci/q	
isotopes	12	13	d:fference / RPD
U-233/234	1.06	1.11	5 (50)
U-235/236	0.0623	0.0547	difference 0.0076 (±0.04)
U-238	1.15	1.06	8 (450)
			,

	Activity (
Isotopes			RPD

·	Activity (
Isotopes			RPD

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: August 11 through August 20, 2009

LDC Report Date: December 4, 2009

Matrix: Soil/Water

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 4

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 235208

Sample Identification

RSAU6-53B SA70-10BMS SA86-10B SA70-10BDUP

SA86009-10B

SA86-28B

RSAM6-10B

RSAM6-28B

RSAM6009-28B

SA70-10B

SA70-30B

SA167-0.5B

SA167-10B

SA167009-10B

SA167-28B

EB081909-SO1

SA197-10B

SA197009-10B

SA197-21B

SA104-10B

SA104009-10B

SA104-30B

Introduction

This data review covers 21 soil samples and one water sample listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA) with the following exceptions:

Method Blank ID	Isotope	Activity	Associated Samples
PBS (prep blank)	Thorium-228	0.191 pCi/g	All soil samples in SDG 235208

Sample concentrations were compared to concentrations detected in the method blanks as required by the QAPP. No sample data was qualified with the following exceptions:

Sample	Isotope	Reported Activity	Modified Final Activity
RSAU6-53B	Thorium-228	1.41 pCi/g	1.41J+ pCi/g
SA86-10B	Thorium-228	1.60 pCi/g	1.60J+ pCi/g
SA86009-10B	Thorium-228	1.85 pCi/g	1.85J+ pCi/g
SA86-28B	Thorium-228	0.618 pCi/g	0.618J+ pCi/g
RSAM6-28B	Thorium-228	1.43 pCi/g	1.43J+ pCi/g

Sample	Isotope	Reported Activity	Modified Final Activity
RSAM6009-28B	Thorium-228	1.19 pCi/g	1.19J+ pCi/g
SA70-30B	Thorium-228	1.48 pCi/g	1.48J+ pCi/g
SA167-0.5B	Thorium-228	1.84 pCi/g	1.84J+ pCi/g
SA167-10B	Thorium-228	1.77 pCi/g	1.77J+ pCi/g
SA167009-10B	Thorium-228	1.76 pCi/g	1.76J+ pCi/g
SA167-28B	Thorium-228	1.23 pCi/g	1.23J+ pCi/g
SA197-10B	Thorium-228	1.72 pCi/g	1.72J+ pCi/g
SA197-21B	Thorium-228	1.55 pCi/g	1.55J+ pCi/g
SA104-10B	Thorium-228	1.68 pCi/g	1.68J+ pCi/g
SA104009-10B	Thorium-228	1.84 pCi/g	1.84J+ pCi/g
SA104-30B	Thorium-228	1.38 pCi/g	1.38J+ pCi/g

Sample EB081909-SO1 was identified as an equipment blank. No isotopic uranium or isotopic thorium were found in this blank with the following exceptions:

Equipment Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
EB081909-SO1	8/19/09	Thorium-228 Thorium-230	0.0548 pCi/L 0.038 pCi/L	RSAM6-10B RSAM6-28B RSAM6009-28B SA70-10B SA70-30B SA167-0.5B SA167-10B SA167009-10B SA167-28B

Sample concentrations were compared to concentrations detected in the equipment blanks as required by the QAPP. No sample data was qualified.

Samples FB072909-SO (from SDG 234267) and F080309-SO (from SDG 234414) were identified as field blanks. No isotopic uranium or isotopic thorium was found in these blanks with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB072909-SO	7/29/09	Thorium-228	0.0321 pCi/L	SA86-10B SA86009-10B SA86-28B RSAM6-10B RSAM6-28B RSAM6009-28B SA70-10B SA70-30B SA167-0.5B SA167-10B SA167-10B SA167-10B SA167009-10B SA197-10B SA197-10B SA197-10B SA197-21B SA104-10B SA104-30B
FB080309-SO	8/3/09	Uranium-238	0.0126 pCi/L	RSAU6-53B

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

c. Tracer Recovery

All tracer recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
RSAU6-53B	Thorium-228	0.0631	0.05	None	Р
	Uranium-233/234	0.0417	0.04	None	
	Uranium-238	0.0506	0.04	None	
SA86-10B	Thorium-228	0.136	0.05	None	Р
	Thorium-230	0.0611	0.05	None	
	Uranium-233/234	0.0722	0.04	None	
	Uranium-235/236	0.0484	0.04	None	
	Uranium-238	0.060	0.04	None	
SA86009-10B	Thorium-228	0.150	0.05	None	Р
-,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Thorium-230	0.0747	0.05	None	'
	Uranium-233/234	0.0539	0.04	None	
	Uranium-238	0.041	0.04	None	
SA86-28B	Thorium-228	0.122	0.05	None	Р
	Thorium-230	0.0931	0.05	None	
	Uranium-233/234	0.0588	0.04	None	
	Uranium-238	0.0402	0.04	None	
RSAM6-10B	Thorium-228	0.0766	0.05	None	Р
110/11110 102	Thorium-230	0.0761	0.05	None	· '
	Uranium-233/234	0.0577	0.04	None	
RSAM6-28B	Thorium-228	0.192	0.05	None	P
	Thorium-230	0.146	0.05	None	
	Uranium-233/234	0.060	0.04	None	
	Uranium-235/236	0.0401	0.04	None	
	Uranium-238	0.0454	0.04	None	
RSAM6009-28B	Thorium-228	0.0923	0.05	None	P
NSAM0009-20D	Thorium-230	0.0923	0.05	None	
	Uranium-233/234	0.0638	0.03	None	
	Uranium-235/236	0.0426	0.04	None	
	Uranium-238	0.0518	0.04	None	
				1.55	
SA70-10B	Thorium-228	0.132	0.05	None	Р
	Uranium-233/234	0.0607	0.04	None	
	Uranium-235/236	0.0513	0.04	None	
	Uranium-238	0.0503	0.04	None	
SA70-30B	Thorium-228	0.138	0.05	None	P
J. 17 J J J J	Thorium-230	0.0955	0.05	None	'
	Uranium-233/234	0.0429	0.04	None	
SA167-0.5B	Thorium-228	0.109	0.05	None	Р
	Thorium-230	0.0577	0.05	None	
	Uranium-233/234	0.053	0.04	None	
	Uranium-238	0.0407	0.04	None	1

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
SA167-10B	Thorium-228	0.0746	0.05	None	Р
	Thorium-230	0.0593	0.05	None	ŀ
	Uranium-233/234	0.0702	0.04	None	1
	Uranium-235/236	0.042	0.04	None	
SA167009-10B	Thorium-228	0.115	0.05	None	Р
	Thorium-230	0.0543	0.05	None	
	Uranium-233/234	0.0472	0.04	None	
	Uranium-235/236	0.0583	0.04	None	
SA167-28B	Thorium-228	0.0596	0.05	None	P
	Thorium-230	0.0743	0.05	None	
	Uranium-233/234	0.0551	0.04	None	
	Uranium-235/236	0.0453	0.04	None	
SA197-10B	Thorium-228	0.0741	0.05	None	P
	Uranium-233/234	0.0594	0.04	None	
SA197009-10B	Thorium-230	0.105	0.05	None	Р
SA197-21B	Thorium-228	0.109	0.05	None	P
	Thorium-230	0.068	0.05	None	
	Uranium-233/234	0.0446	0.04	None	
SA104-10B	Thorium-230	0.0608	0.05	None	P
	Uranium-233/234	0.0522	0.04	None	
	Uranium-238	0.0578	0.04	None	
SA104009-10B	Thorium-228	0.0815	0.05	None	P
5,1,04000 105	Uranium-233/234	0.0408	0.04	None	1 .
	Uranium-235/236	0.0403	0.04	None	
SA104-30B	Thorium-230	0.0596	0.05	None	Р

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
EB081909-SO1	Thorium-228	0.0395	0.03	None	Р

The MDA was greater than the PQL as listed above.

VI. Sample Result Verification and Project Quantitation Limit

All sample result verifications were acceptable.

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 235208	All isotopes reported below the PQL.	J (all detects)	Α

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA86-10B and SA86009-10B, samples RSAM6-28B and RSAM6009-28B, samples SA167-10B and SA167009-10B, samples SA197-10B and SA197009-10B, and samples SA104-10B and SA104009-10B were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

	Concentrat	ion (pCi/g)		5.2		
Analyte	SA86-10B	SA86009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.60	1.85	14 (≤50)	-	-	-
Thorium-230	1.78	1.77	1 (≤50)	-	-	-
Thorium-232	1.64	1.66	1 (≤50)	-	-	-
Uranium-233/234	1.83	1.69	8 (≤50)	-	-	-
Uranium-235/236	0.0963	0.0948	-	0.0015 (≤0.04)	-	-
Uranium-238	1.51	1.31	14 (≤50)	-	-	-

	Concentration (pCi/g)		555	D '''		
Analyte	RSAM6-28B	RSAM6009-28B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.43	1.19	18 (≤50)	-	<u>-</u>	-
Thorium-230	3.35	2.87	15 (≤50)	-	-	-
Thorium-232	1.32	1.30	2 (≤50)	-	-	-

	Concentration (pCi/g)		DDD D#4-11-11-11			
Analyte	RSAM6-28B	RSAM6009-28B	RPD (Limits)	Difference (Limits)	Flags	A or P
Uranium-233/234	2.95	2.97	1 (≤50)	-	_	-
Uranium-235/236	0.159	0.147	-	0.012 (≤0.04)	-	-
Uranium-238	2.70	2.52	7 (≤50)	-	-	

	Concentrat	ion (pCi/g)	200	D.#		·
Analyte	SA167-10B	SA167009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.77	1.76	1 (≤50)	-	-	-
Thorium-230	2.59	2.74	6 (≤50)	-	-	-
Thorium-232	1.82	1.60	13 (≤50)	-	-	-
Uranium-233/234	2.29	2.18	5 (≤50)	-	-	-
Uranium-235/236	0.0921	0.0827	-	0.0094 (≤0.04)	-	-
Uranium-238	2.15	2.00	7 (≤50)	-	-	<u>-</u>

	Concentration (pCi/g)		DDD.	D!#		
Analyte	SA197-10B	SA197009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.72	2.21	25 (≤50)	-	-	-
Thorium-230	2.80	2.85	2 (≤50)	-	-	-
Thorium-232	1.54	1.68	9 (≤50)	-	-	-
Uranium-233/234	2.33	2.74	16 (≤50)	-	-	-
Uranium-235/236	0.139	0.145	-	0.006 (≤0.04)	-	-
Uranium-238	2.31	2.45	6 (≤50)	-	-	-

	Concentration (pCi/g)		222	D:#		
Analyte	SA104-10B	SA104009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.68	1.84	9 (≤50)	-	-	-
Thorium-230	1.48	1.25	17 (≤50)	-	-	-
Thorium-232	1.64	1.72	5 (≤50)	-	-	-
Uranium-233/234	1.15	1.03	11 (≤50)	-	-	-
Uranium-235/236	0.0717	0.105	-	0.0333 (≤0.04)	-	-
Uranium-238	1.02	1.06	4 (≤50)	-	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 235208

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
235208	RSAU6-53B	Thorium-228 Uranium-233/234 Uranium-238	None None None	Р	Minimum detectable activity
235208	SA86-10B RSAM6-28B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None None	Р	Minimum detectable activity
235208	SA86009-10B SA86-28B SA167-0.5B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	None None None None	Р	Minimum detectable activity
235208	RSAM6-10B SA70-30B SA197-21B	Thorium-228 Thorium-230 Uranium-233/234	None None None	Р	Minimum detectable activity
235208	RSAM6009-28B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None None	Р	Minimum detectable activity
235208	SA70-10B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity
235208	SA167-10B SA167009-10B SA167-28B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	None None None None	Р	Minimum detectable activity
235208	SA197-10B	Thorium-228 Uranium-233/234	None None	Р	Minimum detectable activity
235208	SA197009-10B SA104-30B	Thorium-230	None	Р	Minimum detectable activity
235208	SA104-10B	Thorium-230 Uranium-233/234 Uranium-238	None None None	Р	Minimum detectable activity
235208	SA104009-10B	Thorium-228 Uranium-233/234 Uranium-235/236	None None None	Р	Minimum detectable activity

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
235208	EB081909-SO1	Thorium-228	None	Р	Minimum detectable activity
235208	RSAU6-53B SA86-10B SA86009-10B SA86-28B RSAM6-10B RSAM6-28B RSAM6009-28B SA70-10B SA70-30B SA167-0.5B SA167-10B SA167-10B SA167-28B EB081909-SO1 SA197-10B SA197-10B SA197-10B SA197-10B SA197-10B SA197-21B SA104-10B SA104-30B	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 235208

SDG	Sample	Isotope	Modified Final Activity	A or P	Code
235208	RSAU6-53B	Thorium-228	1.41J+ pCi/g	А	bl
235208	SA86-10B	Thorium-228	1.60J+ pCi/g	А	bl
235208	SA86009-10B	Thorium-228	1.85J+ pCi/g	А	bl
235208	SA86-28B	Thorium-228	0.618J+ pCi/g	А	bl
235208	RSAM6-28B	Thorium-228	1.43J+ pCi/g	А	bl
235208	RSAM6009-28B	Thorium-228	1.19J+ pCi/g	А	bl
235208	SA70-30B	Thorium-228	1.48J+ pCi/g	А	bl
235208	SA167-0.5B	Thorium-228	1.84J+ pCi/g	А	bl
235208	SA167-10B	Thorium-228	1.77J+ pCi/g	Α	þl

SDG	Sample	Isotope	Modified Final Activity	A or P	Code
235208	SA167009-10B	Thorium-228	1.76J+ pCi/g	А	Ы
235208	SA167-28B	Thorium-228	1.23J+ pCi/g	Α	þl
235208	SA197-10B	Thorium-228	1.72J+ pCi/g	Α	bl
235208	SA197-21B	Thorium-228	1.55J+ pCi/g	Α	bl
235208	SA104-10B	Thorium-228	1.68J+ pCi/g	Α	bl
235208	SA104009-10B	Thorium-228	1.84J+ pCi/g	А	bl
235208	SA104-30B	Thorium-228	1.38J+ pCi/g	Α	bl

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Equipment Blank Data Qualification Summary - SDG 235208

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 235208

No Sample Data Qualified in this SDG

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LDC #:	21990E59	_ VALIDATION COMPLETENESS WORKSHEE
SDG #:	235208	Stage 4
Laborato	y: GEL Laboratories	LLC

Date: 12-1-09 Page: [of [Reviewer: MG 2nd Reviewer:_

METHOD: Isotopic Uranium (DOE EML HASL-300, U-02-RC Modified), Isotopic Thorium (DOE EML HASL-300, Th-01-RC Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Technical holding times	A	Sampling dates: 8-11-09 through 8-20-09
ila.	Initial calibration	Α	•
IIb.	Calibration verification	Α	
111.	Blanks	SW	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/DUP
IVa.	Laboratory control samples	Α	LCS/LCSD
V.	Tracer Recovery	A	
VI.	Minimum Detectable Activity (MDA)	SW	
VII.	Sample result verification	A	
VIII.	Overall assessment of data	Α	
IX.	Field duplicates	SW	D=2+3, D=6+7, D=11+12, D=15+16, D=18+19
Lx	Field blanks	SW	EB = 14 FB = FB072909-50 (500:234267)

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

FB= FB080309-SO (506: 234414) D = Duplicate

TB = Trip blank

EB = Equipment blank

Validated Samples:

1	RSAU6-53B 5	11	SA167-10B	5	21	SA70-10BMS Th S	31	
2	SA86-10B	12	SA167009-10B	1	22	SA70-10BDUP	32	
3	SA86009-10B	13	SA167-28B	ļ	23	PBS	33	
4	SA86-28B	142	EB081909-SO1	W	24 2	PBW	34	
5	RSAM6-10B	15	SA197-10B	S	25		35	
6	RSAM6-28B	16	SA197009-10B		26		36	
7	RSAM6009-28B	17	SA197-21B		27		37	
8	SA70-10B	18	SA104-10B		28		38	
9	SA70-30B	19	SA104009-10B	L	29		39	
10	SA167-0.5B	20	SA104-30B	}	30		40	

Notes:		

	Page:_	1	_of_
	Page:_ Reviewer:		46
2nd	Reviewer:		~

Method:Radiochemistry(EPA Method See cover)

Validation Area	Ye	No	NA	Findings/Comments
Tachnical holding times				
All technical holding times were met.	T	1		
E Celitration				
Were all instruments and detectors calibration as required?	1/		T	
Were NIST traceable standards used for all calibrations?	1			
Nas the check source identified by activity and radionuclide?	1	1		
Were check sources including background counts analyzed at the required requescy and within laboratory control limits?	1			
Dianks				
Vere blank analyses performed as required?	1/			
Vere any activities detected in the blanks greater than the minimum detectable ctivity (MDA)? If yes, please see the Blanks validation completeness worksheet.	1			•
Matrix opplies and Displication				
ere a matrix spike (MS) analyzed for each matrix in this SDG? If no, indicate hich matrix does not have an associated MS/MSD or MS/DUP. Soil /(Water)		/		
ere the MS percent recoveries (%R) within the QC limits? If the sample encentration exceeded the spike concentration by a factor of 4 or more, no stion was taken.				
as a duplicate sample anayized at the required frequency of 5% in this SDG?			-	
ere all duplicate sample duplicate error rations (DER) ≤1.42?.	7		\neg	
aboratory control carrapted				
as an LCS analyzed per analytical batch?	./		T	
ore the LCS percent recoveries (%R) and relative percent difference (RPD) hin the 75-125%	1		\top	
Semple Chambal/Cattle (Recover)				
s a tracer/carrier added to each sample?				
re tracer/carrier recoveries within the QC limits?	7	+	_	
Regional Guality Assistance and Guality Control				
re performance evaluation (PE) samples performed?		7		
e the performance evaluation (PE) samples within the acceptance limits?	_	+	1	
Sample Result Verticator (
e activities adjusted to reflect all sample dilutions and dry weight factors licable to level IV validation?				
e the Minimum Detectable Activities (MDA) < RL?				

LDC #: 71990 E 57 SDG #: 735208

VALIDATION FINDINGS CHECKLIST

Page: 2 of Reviewer: 46
2nd Reviewer: \(\sum \)

Validation Area	Yes	No	NA	Findings/Comments
X Dverall assessment of data				
Overall assessment of data was found to be acceptable.				
X. Field duplicates				
Field duplicate pairs were identified in this SDG.	/			
Target analytes were detected in the field duplicates.	/			
© Field blanks	,			
ield blanks were identified in this SDG.				
arget analytes were detected in the field blanks.			\dashv	

LDC #: 31990E59 335308 SDG #:

VALIDATION FINDINGS WORKSHEET

9 Qual: J+

2nd Reviewer:__ Reviewer:_

METHOD: Radiochemistry (Method: See cover

(Y) N N/A Y)N N/Y

Were blank analyses performed as required? If no, please see qualifications below. Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see qualifications below.

1.76 3 1.84 0 Ø - 1 σ Sample Identification 1.43 ৩ 0.618 1 50;1 Soil 1.85 <u>z</u> 3 1.60 Associated Samples: Associated Samples: 3 Blank Action Level 1.91 Blank ID 0.191 PBS PCi /q pc:/4 74-338 Isotope Units: Units:_

				Associated Samples.	Jannings.							
Isotope Blank ID	ank ID		Blank Action					Sample Ide	Sample Identification			
PBS	785		Level	(3	15	17	8/	61	90			
Th-338 0.191	161		1.91	1.23	1.72	1.55	1.55 1.68	1.84	1			
		Γ									•	
-		T									 -	
_												
			_	_	_	_		•		_	-	

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT: If there is activity in the blank above the MDA, sample results within 10x the blank activity will be qualified as not detected "U".

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S C	SDG #: 01740E	LDC #: 01740 E54 SDG #: 735308			VAI	LIDATIO	N FIN	FINDINGS W	VALIDATION FINDINGS WORKSHEET Field Blanks	TEET.				Page:_ Reviewer:	6, 5
Z	THOD: R	METHOD: Radiochemistry (Method:_	ry (Method:_	See	Cover		٦							2nd Reviewer	<u>`</u> ₹
	YN N/A YN N/A Blank units:	Were field by N/A Were field by N/A Were target Blank units: Pc i /L As Sampling date: 7 - 39 - 09	Were field blanks identified in this SDG? Were target isotopes detected in the field blank Blank units: Pci / Associated sample units: Pci / Associated s	ntified in thi detected in sample un	s SDG? I the field blanks? Its: Pc:/q	anks?					~	5,15	2-514- x		
Fie	ld blank t	ype: (circle	Fleid blank type: (circle one) Field Blank / Rinsate / Other:	anly / Rinsa	te / Other:		l	Associa	Associated Samples:	.; .;	7	30-	(× 10 ×)	0x)	
	Analyte	Blank ID	Blank						Sample Identification	entificatio	u u				- 11
	FB 07	F B 07 2909-50	Limit				No.	Sampl	Samples were	ře	Court I. Lia	Lo. 1			
<u>ا</u> لا	Th-338	0.0331	0.0003												
											-				
							-	1			-				
							-								
							-				-				[
Bla	nk units:	pci /L 1	Blank units: PC: /L Associated sample units:	sample uni	ts: PCi/a										- []
Han I	npling dai id blank ty	Sampling date: 8-19-09 Field blank type: (circle one)	Sampling date: 8-19-09 Field blank type: (circle one) Field Blank / Rinsate	ink / Rinsat	o Other:	EB	[Associate	Associated Samples:	e A	12	5 7 13	* 01 X)	<u> </u>	

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0110	200					1	<u> </u>	+	
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									five times
Limit	25000	900038							Samples with isotope concentrations within five times the accordance of the concentrations within the times the accordance of the concentration of the
ュ	0.0548 0.	0.038 0.		-					otope concen
	Th- 338 (Th-230 (mples with isc
	14 Limit Na samolas Morres and 1.1.2	No samples	Th-330 0.038 0.00038	Th-238 0.0548 0.00055 Th-230 0.038 0.00038	Th-338 0.0548 0.00055 Th-330 0.038 0.00038	Th-238 0.0548 0.00055 Th-230 0.038 0.00038	Th-338 0.0548 0.00055 Th-330 0.038 0.00038	Th-338 0.0548 0.00055 Th-330 0.038 0.00038	Th-338 0.0548 0.00055 Th-330 0.038 0.00038

LDC #: 31990E 59 SDG #:

VALIDATION FINDINGS WORKSHEET Field Blanks

of	シェ)
Page:	Reviewer:	2nd Reviewer:

cover
566
(Method:
METHOD: Radiochemistry

Were field blanks identified in this SDG?	(Blank units: PC/L Associated sample units: PC//g
N N/A	AN NA	Blank units:

ò Sampling date:

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(> RL)							
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	ntification	was and lifted					
Associated Samples:	Sample Identification						
Associat		No Sample					
		S					
/ Other:							
nk/ Rinsate							
ne) Field Bla	Blank	Action					
pe: (circle o	Blank ID	FB 08 0309-50	0.0136				
Field blank type: (circle one) Field Blank / Rinsate / Other:	Analyte	FBCB	RL U-338 0.0136				
(السينات.	الننديي	28		 		

Associated sample units:	
Blank units:	ıl

Fleid blank type: (circle one) Field Blank / Rinsate / Other:_

Limit	

DC #: 31990E59 DG #:__

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

MG

2nd Reviewer: Reviewer:_

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SPE cover IETHOD: Radiochemistry (Method:____

he following sample MDAs are above the RDL:

*	Sample ID	isotope	AAPP POL RDL (units)	Lab DL MDA (units)	Flading	in the state of
		Th-228	0.05 (pc:/4) 0.0631 (pci/)	Lot D	A A A A A A A A A A A A A A A A A A A
		U-333/234	0.04	0.0417	-	
	→	U - 938	0.04	0.0506		
4	8	Tn-328	0.05	0.136		
		Th-230	0.05	0.0611		
		U-333/334	HO.04	0.0722		
		U-335/236	40.04	0.0484		
	*	U - 338	O.04	0.060		
,						
9	3	Tu-228	0.05	0.150		
		Th-230	0.05	0.0747		
		U-333/334	PO.04	0.0539		
	>	U - 238	0.0y	0.041		
5	7	Th-338	0.05	0.122		
		TH-230	0.05	0.0931		
		U-333/234	0.04	0.0588		
		U - 338	0.04	0.0403		
2	5	Tn-238	0.05	0.0766		
		Th-330	0.05	0.0761		
	7	U-233/234	₽ HO.0	0.0577	2	
						A
omments:						

DC #: 31990E59 DG #: 335308

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 2 of 4

2nd Reviewer: Reviewer:

see cover

IETHOD: Radiochemistry (Method:____

he following sample MDAs are above the RDL:

*	Sample ID	Sotone	QAPP POL	Lab DL		
. 9		4. 250		(Silling) Young	rinding	Qualifications
3	9	200-4)	0.05 (PC1/4	1 0.192 (Pci/g)	Lab DL > GAPP POL	None / P
		Tu-330	0.05	0.146		. 1
		N-333/334	6.04	0.00.0		
		U-335/336	6.04	0.0401		
	,	U - 338	0.04	0.0454		
1	-			-		
	,	Th- 338	0.05	0.0923		
		Tu-230	0.05	0.0636		
		- 233,	ь.оч	0.0638		
		U - 235/236	p.04	0.0496		
	7	U - 338	0.04	0.0518		
7						
α	8	TH-338	0.05	0.132		
		U-233/234	h0.0	0.0607		
		0 - 335/336	0.04	0.0513		
		U - 338	0.04	0.0503		
				2000		
9	D					
		866-4)	0.05	0.138		
		14-23	0.05	0.0955		
	→	U-333/334	6.04	0.0439		
3						
2	0	Tu-238	0.05	901.0		
		Th - 230	0.05	0.0577		
		U-333/334	ро.о	0.053		
	>	U-238	₹ 10.0	0.0407		
					•	*
mments:						

LDC #: 31990E59 SDG #: 335308

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 3 of 4

METHOD: Radiochemistry (Method: See cover The following sample MDAs are above the RDL:

*	Cl dame?		WAPP POL			
		edojosi	RDL (units)	MBA (units)	Finding	Qualifications
	-	T4-338	0.05 (pc:/4	0.0746 (pci/d)	Lat D	المام مام
		Th - 230	0.05	0.0593	200	L Janoni
T		U-233/234	0.04	0.0702	1	
	~	U-235/236	0.0H	0.043		
T,						
0	12	Th-338	0.05	0.115		
		TH-330	0.05	0.0543		
		0-333/234	0.04	0.0473		
	->	0-235/336	6.0ч	0.0583		
^	13	Tu-338	0.05	0.0596		
T		Tu-230	0.05	0.0743		
T		U-333/234	0.04	0.0551		
T	A	0 - 335/336	0.04	0.0453		
T						
\top	7	Th - 338	0.03 (PC:1)	0.0395 (PC.A)		
1,						
1	15	Th-338	0.05 (PCi/4)	0.0741 (pc:/4)		
\top	->	U-233/234	1 40.0	0.0594		
T						
ه	9)	Tr-330	0.05	0.105		
T	17	Tt 220				
T		200-41	7.05	0,109		
†		14-230	0.05	890.0		
\dagger	7	0 - 333/334	0.04 V	0.0446 J	>	
						•

Jomments:

LDC #: 31990E59 SDG #: 335208

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 4 of 4

METHOD: Radiochemistry (Method: SEE Cover

ACM Standard School of

The following sample MDAs are above the RDL:

*	Games	•	WAPP POL	Lab DL		
٥		edojosi	RDL (units)	MBA (units)	Finding	Qualifications
0	0	1 h - 230	0.05 (pci/q)0.0608 (pci/4)	Lab DL > GAPP FOL	None / P
		U-933/934	0.04	0.0523 1	_	. I
	*	U-238	0.04	0.04 0.0578		
9	<u>-</u>					
<u> </u>	5	TH-0	0.05	0.0815		
			0.04	0.0408		
	A	0-935/936	h0.0	0.0403		
1						
2	90	Th-230	0.05	0.0596	-	
						•
	!					
omments:						

LDC #: <u>31990 E59</u> SDG #: <u>335308</u>

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	1 of 3
Reviewer:_	MG
2nd reviewer:_	

METHOD: Radiochemistry (Method: See cover

Y N N/A Y N N/A Were field duplicate pairs identified in this SDG?

Were target isotopes detected in the field duplicate pairs?

	Activity (pci/q)	
!sotopes	2	1 3	RPD
T4-228	1.60	1.85	14 (=50)
T4-230	1.78	1.77	()
Tn-232	1.64	1.66	1 ()

	Activity (PCi/q)			
Isotopes	2	3	difference/RPD	
U-233/234	1.83	1.69	8 RPD (< 50)	
U-235/236	0.0963	0.0948	difference 0.0015 (<0.04)	
U-238	1.51	1.31	14 (= 50)	
			,	

	Activity (ocily,	_
Isotop es	6	7	RPD
Th - 228	1.43	1.19	18 (±50)
Tn-230	3.35	2.87	15 ()
Th-232	1.32	1.30	2 (1

	Activity (PC:/g)		·	
lsotopes	6	7	d:fference/RPD	
U-233/234	2.95	2.97	RPD (≤ 50)	
U-235/236	0.159	0.147	d:fferonce 0.012 (≤0.04)	
U-238	2.70	2.52	7 RPD (= 50)	
			`	

Version 1.0 (3/2/2000)

LDC #: <u>11990 £59</u> SDG #: <u>235208</u>

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	2 of 3
Reviewer:	MG
2nd reviewer:	~

METHOD: Radiochemistry (Method: See cover

N N/A

Were field duplicate pairs identified in this SDG?

Were target isotopes detected in the field duplicate pairs?

	Activity (ci/q)	
Isotopes	11	12	RPD
Tn-228	1.77	1.76	l (€ 50)
Tu-230	2.59	2.74	6 ()
Tn-232	1.82	1.60	13 ()

	Activity (P	ci/g)	
Isotop es	(1	12	difference/APD
. U-233/234	2.29	ð.18	5 RPD (≤50)
U-235/236	0.0921	0.0827	difference 0.0094 (±0.04)
U-238	2.15	2.00	RPD 7 (≤ 50)
			·

	Activity (pci/g)	
isotopes	15	16	RPD
Tu-228	1.72	2.21	25 (450)
Tn-230	2.80	2.85	2(1)
Th -232	1.54	1.68	9 ()

	Activity (scily,	·
isotopes .	15	16	difference ARPD
U- 233/234	2.33	2.74	16 (£50)
U-235/236	0.139	0.145	d; fference 0.006 (≤ 0.04)
U-238	2.31	2.45	6 (± 50)
			*

LDC #: <u>31990 € 59</u> SDG #: <u>335308</u> VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:	3 of 3
Reviewer:_	MG
2nd reviewer:	1/

METHOD: Rad	iochemistry (Method: See cover)
	Were field duplicate pairs identified in this SDG? Were target isotopes detected in the field duplicate pairs?

	Activity (PCi/g)	
Isotopes	18	19	RPD
Tn-228	1.68	1.84	9 (±50)
Tu-230	1.48	1.25	17(1)
Tu-232	1.64	1.72	5 (1)

	Activity (PCi/g)		
isotopes	/8	19	difference /RPD
U-233/234	1.15	1.03	RPD (≤ 50)
U-235/236	0.0717	0.105	1: Herence 0.0333 (±0.04)
U-238	1.02	1.06	4 (± 50)
·			·

	Activity ()	
Isotopes			RPD
		·	
·			

	Activity ()	•
Isotopes			RPD
		•	
			`

31990E59 335308 LDC #:

VALIDATION FINDINGS WORKSHEET Level IV Recalculation Worksheet

of / 2nd Reviewer: Page: Reviewer:

METHOD: Radiochemistry (Method: See cover

Percent recoveries (%R) for a laboratory control sample, a matrix spike and a matrix spike duplicate sample were recaluculated using the following formula:

%R = Found x 100 True

Found = activity of each analyte measured in the analysis of the sample. True = activity of each analyte in the source. Where,

A matrix spike and matrix spike duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = $\frac{|S-D|}{(S+D)/2} \times 100$

S = Original sample activity
D = Duplicate sample activity Where,

,					Recalculated	Reported	
Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	XB or BBD	4	Acceptable
	Laboratory control sample					AH OF HPD	(X/N)
527		Th-330	9.33 (PC:/4)	1.32 (PC/4) 8.30 (PC/4)	111	111	>
	Matrix spike sample						
- 0		88e-h	4.64 (PC:/4)	4.64 (PCi/g) 4.93 (PCi/g)	94.	1.46	
	Duplicate RPD		0	•			
22		Tu-333	1.90 (PC:1)	.90 (PC:1) 1.79 (pc:14)	5.96	5.89	
	Chemical recovery		•	-			
)		U-232	4.77337 (dpm)	17337 (dpm) 5.26247 (dpm)	40.7	40.7	

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10,0% of the recalculated results.

LDC #: <u>01490 E 54</u> SDG #: <u>235008</u>

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	of1
Reviewer:_	MG
2nd reviewer:	

METHOD: Radiocher	mistry (Method: See cover	2nd reviewer:
Please see qualification N N/A Have	ons below for all questions answered "N". Not appli results been reported and calculated correctly? esults within the calibrated range of the instruments	cable questions are identified as "N/A".
Analyte results forand verified using the	# 1 Tn - 23 ス following equation:	reported with a positive detect were recalculated
Activity =	Recalculation:	
(cpm - bckgrd cpm) (2.22)(E)(Vol)(CF)	(177.00/1000.)	
E = Efficiency Vol = Volume CF = %R, Self-absorbance,	(2 22) (2 258422) (2 254) (2 2	3643) = 1.4523 pci/g

#	Sample ID	Analyte	Reported Concentration (PC: /4)	Calculated Concentration (PCi/q)	Acceptable (Y/N)
		Tn-228	1.41	1.48	Y
		Tu-230	2.00	2.00	<u> </u>
		Tu-232	1.45	1.45	
		U-233/23H	1.73	1.73	
		U-235/236	0.0606	0.0606	
_		U-238	1.62	1.62	
-					
2	11	Th-228	1.77	1.76	
_		T4-230	2.59	2.59	
		Tu-232	1.82	1.82	
_		U - 233/234	2.29	2.29	-
		U-235/236	0.0921	0.0921	
		U-238	2.15	2.15	
					
					" - " - "
\dashv					

Note:	

Laboratory Data Consultants, Inc. **Data Validation Report**

Tronox LLC Facility, 2009 Phase B Investigation, Project/Site Name:

Henderson, Nevada

Collection Date: August 20 through August 21, 2009

LDC Report Date: December 5, 2009

Matrix: Soil/Water

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 235782

Sample Identification

SA198-10B

SA198-27B

SA175-10B

SA175-28B

SA139-0.5B

SA139-10B

SA139-25B

SA139009-25B

SA139-35B

RSAT5-0.5B

RSAT5-10B

RSAT5-25B

RSTA5-40B

RSAT5-51B

EB082009-SO2

RSAO6-10B

RSAO6-20B

RSAO6-34B

RSAO6-34BMS

RSAO6-34BDUP

Introduction

This data review covers 19 soil samples and one water sample listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Samples EB082109-SO1 (from SDG 235860) and EB082009-SO2 were identified as equipment blanks. No isotopic uranium or isotopic thorium were found in these blanks with the following exceptions:

Equipment Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
EB082009-SO2	8/20/09	Thorium-228 Thorium-232	0.0523 pCi/L 0.0129 pCi/L	RSAT5-0.5B RSAT5-10B RSAT5-25B RSTA5-40B RSAT5-51B
EB082109-SO1	8/21/09	Uranium-235/236	0.00986 pCi/L	RSAO6-10B RSAO6-20B RSAO6-34B

Sample concentrations were compared to concentrations detected in the equipment blanks as required by the QAPP. No sample data was qualified.

Sample FB072909-SO (from SDG 234267), FB080309-SO (from SDG 234414), and FB082809-SO (from SDG 236238) were identified as field blanks. No isotopic uranium or isotopic thorium was found in these blanks with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB072909-SO	7/29/09	Thorium-228	0.0321 pCi/L	SA198-10B SA198-27B SA175-10B SA175-28B RSAO6-10B RSAO6-20B RSAO6-34B
FB082809-SO	8/28/09	Thorium-228 Uranium-235/236	0.0263 pCi/L 0.00837 pCi/L	SA139-0.5B SA139-10B SA139-25B SA139009-25B SA139-35B
FB080309-SO	8/3/09	Uranium-238	0.0126 pCi/L	RSAT5-0.5B RSAT5-10B RSAT5-25B RSTA5-40B RSAT5-51B

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

c. Tracer Recovery

All tracer recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
SA198-10B	Thorium-228	0.0599	0.05	None	Р
C/1100 10B	Uranium-233/234	0.048	0.04	None	
	Uranium-235/236	0.0411	0.04	None	
	Orania 100,200		5.51	T T T T T T T T T T T T T T T T T T T	
SA198-27B	Thorium-228	0.184	0.05	None	Р
	Thorium-230	0.124	0.05	None	
	Thorium-232	0.124	0.10	None	
	Uranium-233/234	0.0485	0.04	None	
	Uranium-235/236	0.0467	0.04	None	
SA175-10B	Thorium-228	0.195	0.05	None	P
OA175-10B	Thorium-230	0.193	0.05	None	[
	Uranium-233/234	0.182	0.04	None	
	Uranium-235/236	0.0503	0.04	None	
	Uranium-238	0.104	0.04	None	
					
SA175-28B	Thorium-228	0.103	0.05	None	P
	Uranium-233/234	0.121	0.04	None	
	Uranium-235/236	0.0936	0.04	None	
	Uranium-238	0.106	0.04	None	ļ
SA139-0.5B	Thorium-228	0.102	0.05	None	Р
	Thorium-230	0.0906	0.05	None	1
	Uranium-233/234	0.0814	0.04	None	
	Uranium-235/236	0.0872	0.04	None	
	Uranium-238	0.0814	0.04	None	
SA139-10B	Thorium-228	0.145	0.05	None	P
0A109-10D	Thorium-230	0.098	0.05	None	
	Uranium-233/234	0.050	0.04	None	1
	574/HGH1 255/25 /	0.000	0.04	I WONG	
SA139-25B	Thorium-230	0.0982	0.05	None	Р
	Uranium-233/234	0.0577	0.04	None	
	Uranium-235/236	0.0515	0.04	None	
	Uranium-238	0.0417	0.04	None	
SA139009-25B	Thorium-228	0.0818	0.05	None	
5. 1. 55 560 EGD	Uranium-233/234	0.0769	0.04	None	'
	Uranium-235/236	0.055	0.04	None	
	Uranium-238	0.0795	0.04	None	
04400.055	TI viv. 222	0.445		1	+
SA139-35B	Thorium-228	0.118	0.05	None	Р
	Thorium-230	0.107	0.05	None	1
	Uranium-233/234	0.0656	0.04	None	
	Uranium-235/236 Uranium-238	0.0463 0.0602	0.04 0.04	None None	
		-			1
RSAT5-0.5B	Thorium-228	0.127	0.05	None	P
	Thorium-230	0.0716	0.05	None	
	Thorium-232	0.143	0.10	None	
	Uranium-235/236	0.0443	0.04 0.04	None	
	Uranium-238	0.046		None	

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	AorP
RSAT5-10B	Thorium-228	0.102	0.05	None	P
	Thorium-230	0.0789	0.05	None	ì
	Uranium-235/236	0.0433	0.04	None	
RSAT5-25B	Thorium-228	0.134	0.05	None	P
	Thorium-230	0.0957	0.05	None	
:	Uranium-233/234	0.0544	0.04	None	
RSTA5-40B	Thorium-228	0.942	0.05	None	P
	Thorium-230	0.0644	0.05	None	
	Uranium-233/234	0.105	0.04	None	
	Uranium-235/236	0.0721	0.04	None	
	Uranium-238	0.0675	0.04	None	
RSAT5-51B	Thorium-228	0.0709	0.05	None	P
	Thorium-230	0.0876	0.05	None	
	Uranium-233/234	0.0622	0.04	None	
	Uranium-235/236	0.0511	0.04	None	
	Uranium-238	0.0414	0.04	None	
RSAO6-10B	Thorium-228	0.158	0.05	None	P
	Thorium-230	0.102	0.05	None	
	Uranium-233/234	0.0682	0.04	None	
	Uranium-235/236	0.0527	0.04	None	
RSAO6-20B	Thorium-228	0.080	0.05	None	P
	Thorium-230	0.0631	0.05	None	ŀ
	Uranium-233/234	0.0675	0.04	None	
	Uranium-235/236	0.0577	0.04	None	
	Uranium-238	0.0818	0.04	None	
RSAO6-34B	Thorium-228	0.0794	0.05	None	Р
	Thorium-230	0.0627	0.05	None	
	Uranium-233/234	0.108	0.04	None	
	Uranium-235/236	0.0721	0.04	None	
	Uranium-238	0.0894	0.04	None	

Sample	isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
EB082009-SO2	Thorium-228	0.0333	0.03	None	Р

The MDA was greater than the PQL as listed above.

VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 235782	All isotopes reported below the PQL.	J (all detects)	Α

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA139-25B and SA139009-25B were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

	Concentrat	ion (pCi/g)	555	D.''		
Analyte	SA139-25B	SA139009-25B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.88	1.97	5 (≤50)	-	-	•
Thorium-230	1.78	1.75	2 (≤50)	-	-	-
Thorium-232	1.78	1.48	18 (≤50)	-	-	-
Uranium-233/234	1.22	1.33	9 (≤50)	-	-	-
Uranium-235/236	0.0559	0.0696	-	0.0137 (≤0.04)	-	-
Uranium-238	1.12	1.06	6 (≤50)	-	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 235782

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
235782	SA198-10B	Thorium-228 Uranium-233/234 Uranium-235/236	None None None	P	Minimum detectable activity (PQL)
235782	SA198-27B	Thorium-228 Thorium-230 Thorium-232 Uranium-233/234 Uranium-235/236	None None None None None	Р	Minimum detectable activity (PQL)
235782	SA175-10B SA139-0.5B SA139-35B RSTA5-40B RSAT5-51B RSAO6-20B RSAO6-34B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None None	P	Minimum detectable activity (PQL)
235782	SA175-28B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
235782	SA139-10B RSAT5-25B	Thorium-228 Thorium-230 Uranium-233/234	None None None	Р	Minimum detectable activity (PQL)
235782	SA139-25B	Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
235782	SA139009-25B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
235782	RSAT5-10B	Thorium-228 Thorium-230 Uranium-235/236	None None None	Р	Minimum detectable activity (PQL)
235782	RSAO6-10B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	None None None None	Р	Minimum detectable activity (PQL)

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
235782	RSAT5-0.5B	Thorium-228 Thorium-230 Thorium-232 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
235782	EB082009-SO2	Thorium-228	None	Р	Minimum detectable activity (PQL)
235782	SA198-10B SA198-27B SA175-10B SA175-28B SA139-0.5B SA139-10B SA139-25B SA139-25B SA139-35B RSAT5-0.5B RSAT5-10B RSAT5-10B RSAT5-10B RSAT5-25B RSTA5-40B RSAT5-51B EB082009-SO2 RSAO6-10B RSAO6-20B RSAO6-34B	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 235782

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Equipment Blank Data Qualification Summary - SDG 235782

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 235782

No Sample Data Qualified in this SDG

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	235782			3	stag	e 2B				Page:of
_abora	tory: <u>GEL Laboratories</u>	LLC								Reviewer: M(-
										2nd Reviewer:
Modifie The sa	ed)	e revi					, ,	·		EML HASL-300, Th-01-RC
	Validation	Area						Comm	ents	
1.	Technical holding times			Α	Sam	pling d	ates: 8 - 20			1rough 8-21-09
lla.	Initial calibration			Α						J
IIb.	Calibration verification	 		Α						
III.	Blanks			Α						
IVa.	Matrix Spike/(Matrix Spike)	Duplica	ates	A	M	s/p	UP		,	
IVa.	Laboratory control samples	i		Α	L	CS,	/LCSD			
V.	Tracer Recovery			Α	_					
VI.	Minimum Detectable Activit	ty (MD/	٨)	SW						
VII.	Sample result verification			N	_					
VIII.	Overall assessment of data	1		_ A	<u> </u>					
IX.	Field duplicates			SW	_	= 7+				
X	Field blanks			SW	EE		<u> </u>			(sdg: 235860)
Note: /alidate	A = Acceptable N = Not provided/applicabl SW = See worksheet d Samples:	e	R = Rin	o compound sate eld blank	s dete	ected B=	D = Duplio TB = Trip EB = Equ FB08780	cate blank ipment blan 9-50	ık (SDG	: 234267) : 236238)
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1 5	SA198-10B S	11	RSAT5-10B		<u>S</u>		PBS		31	
2 5	SA198-27B	12	RSAT5-25B		-	22 2	PBW		32	
3 8	SA175-10B	13	RSTA5-40B		\downarrow	23			33	
4 5	SA175-28B	14	RSAT5-51B		4	24			34	
5 5	SA139-0.5B	15 2	EB082009-S0	D2	W	25	•		35	
	SA139-10B	16	RSAO6-10B		5	26			36	
7 5	SA139-25B	17	RSAO6-20B			27			37	

8	SA139009-25B	18	RSAO6-34B		28	38
9	SA139-35B	19	RSAO6-34BMS	U Th	29	39
10	RSAT5-0.5B	20	RSAO6-34BDUP	u Tn	30	40
Notes	i:	·				
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919	23
*	*
PC	SDG

## VALIDATION FINDINGS WORKSHEET Field Blanks

Page: of 2nd Reviewer: Reviewer: MG

> see cover METHOD: Radiochemistry (Method:_

Were field blanks identified in this SDG? N NA N NA Blank units:

Were target isotopes detected in the field blanks?

PCi/L Associated sample units: PCi/q

e: 8-30-09

Sampling date:_

EB Field blank type: (circle one) Field Blank / Rinsate (Offier:)

78 6 十1十01 20 Sample Identification Were Associated Samples:_ samples 3 0.00053 Blank Action Limit 0.0523 Blank ID 0.0139 R Tn-232 Analyte 74-238 RL

Associated sample units: Pci/q Blank units: PC: / Associated Associates | Sampling date: 8-21-09

EB BB Field blank type: (circle one) Field Blank / Rinsate (Other.)

> Re or ND Associated Samples: Blank Blank iD Analyte

81191

0-335/336 0.00986  U-335/336 0.00986  Samples with sotope concentrations within five times the associated field blank concentrations are also as a five field blank concentration of the field blank concentrations within five times the associated field blank concentration field		Action	Sample Identification	
6.00986  6.00986  Concentrations within five times the associated field blank concentration are list of the times the associated field blank concentrations within five times the associated field blank concentrations.	105-601	Limit	07	
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isotope concentrations within five times the associated field blank concentration and the concentrations within five times the associated field blank concentration and the concentrations within five times the associated field blank concentration and the concentrations within five times the associated field blank concentration and the concentration and the concentration and the concentrations within five times the associated field blank concentration and the concentration and				
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isotope concentrations within five times the associated field blank concentration are listed.				
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isotope concentrations within five times the associated field blank concentration are list.				
	isotope conce	intrations w	within five times the associated field hank concentration are list of	

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31990F59 235782 SDG #: LDC #:_

# VALIDATION FINDINGS WORKSHEET

Field Blanks

2nd Reviewer: Page: Reviewer:__

> Associated Samples: Were target isotopes detected in the field blanks? Blank units: Pci /L Associated sample units: pci / Sampling date: 7 - 39 - 09 Field blank type: (circle one) Field Blank / Rinsate / Other: Were field blanks identified in this SDG? See cover METHOD: Radiochemistry (Method:_ N N/A N N/A Blank units:

174, 16→18

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Blank	Action	Cmc	0.0003	,									
Blank ID	03-00	UC-10/ plane	Th-238 0.0331 0.0003										T.
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R

500 Sampling date: 8-38-09

Field blank type: (circle one) Field Blank/ Rinsate / Other:

270

RL Tu-338 0.0363 20 U-335/326 0.00837 20 U-335/326 0.00837		Blank	Samble Identification
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LDC #: 21990 F59 SDG #: 335782

# VALIDATION FINDINGS WORKSHEET

Field Blanks

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Reviewer:	2nd Reviewer:

Page: of /

cover METHOD: Radiochemistry (Method: See

Were field blanks identified in this Sura:

No N/A Were target isotopes detected in the field blanks?

Blank units: Pci/L Associated sample units: Pci/g

Sampling date: 8-3-09

Sampling date: 8-3-09

Blank Action Limit

Blank ID

Analyte

FB 08 0309-50

0.0136

U-338

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2 mil

(> RL)

Associated Samples:

Sample Identification

quali were Samples

> Associated sample units: Blank units:

Sampling date:

Field blank type: (circle one) Field Blank / Rinsate / Other:

Associated Samples:_

Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, Sample Identification Blank Action Limit Blank ID Analyte

FBLKASC4.35

0C #: 21990 F59

## **VALIDATION FINDINGS WORKSHEET** Minimum Detectable Activities

Page: 1 of 4

Cover see ETHOD: Radiochemistry (Method:____

ne following sample MDAs are above the RDL:

#	Sample ID	Isotope	QAPP POL RDI (unite)	AAPP POL Late DL		
_		Th- 200	1:00/ 00:1	V 0 0 0 0 0 V	Pillulling A A A A A A A A A A A A A A A A A A A	3   `
		000 1	20.02	10.0274 (pm/k)	LAB DL > WART FOL	None/P
		0-455/334	0.04	0.048		
	*	U-235/236	0.04	11,40.0		
e	2	Th-328	0.05	P81.0		
		Tn-230	0.05	461.0		
		Tu-332	0.10	024		
		U-233/334	0.04	0.0485		
	>	0-335/236	0.04	0.0467		
3	3	Tu- 238	0.05	0.195		
		Th - 330	0.05	0.154		
		U-233/234	PO.04	0.183		
		U - 235/236	PO.04	0.0503		
	>	U - 238	0.04	0.104		
2	3	Th- 338	0.05	0,103		
		U-333/334	NO.04	0.191		
		U-335/236	0.04	0.0936		
	<b>~</b>	U-338	0.04	0.106		
2	5	Th-338	0.05	0.102		
		TH-230	0.05	0.0906		
		U-233/234	PO.04	0.0814		
		0-335/336	p0.04	0.0372		
	~	U-338	♠ h0.0	0.0814	->	
omments:						

21990 F 59 235782 LDC #: SDG #:

# VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

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2nd Reviewer: Reviewer:

Page: 2 of 4

Cover See METHOD: Radiochemistry (Method:____

The following sample MDAs are above the RDL:

#	Sample (D	Andrei	JOY 99 POL	10 947 1		
`	,	Advived	HUL (UNITE)	Mey (units)	Findin	Qualifications
0	9	Tu-228	0.05 (pc	14) 0.145 (pci/c)	Lab DL > GAPP FOL	None / P
		Tu-230	0.05	0.098	-	. 1
	<b>~</b>	U - 333/234	40.0	0:050		
7	7	Th- 230	0.05	0.0983		
		U-233/234	6.04	0.0577		
		U-235/236	0.04	0.0515		
	7	U - 338	b0.04	0.0417		
ω	သ	Th-328	0.05	0.0818		
		_	но о	0.0769		
		U-335/836	ho.o	0.055		
	4	-	40.0d	0.0795		
9	6	71 228	7.0			
		7. 000	0.05	0.118		
		12-930	0.05	0.107		
		U-333/334	0.04	0.0656		
		U-235/236	0.04	0.0463		
	*	U - 338	0.04	0.0602		
0	0)		0.05	10.137		
			0.05	0.0716		
			0.10	0.143		
		U-335/336	0.04	0 0442		
	^		0.04	25000		
				0 0 0	Ď	<b>→</b>
omments:						

LDC #: 31990 F59 SDG #: 335782

## VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 3 of 4 Reviewer:

METHOD: Radiochemistry (Method: See Cover

The following sample MDAs are above the RDL:

			I DAPP POL	-		
*	Sample ID	isotope	RDL (units)	MDA (units)	Finding	Qualifications
=	-	Tu-238	0.05 (PC:/4)	) 0.102 (pci/	Lab DL > GAPP Pal	None / P
		Th-230	0.05 , 0	0.0789		-
	>	0-335/936	o .0ط	0.0433		
7	12	14-338	0.05	0.134		
		Th-230	0.05	0.0957		
	->	U-333/334	0.04	0.0544		
[3	13	TH-338	0.05	0.0942		
I		Tu-230	0.05	0.0644		
		U-333/334	10.01	0.105		
		U-335/33c	PO.04	0.0731		
	7	0-238	6.04	0.0675		
<u> </u>	h1	Th-238	0.05	0.0709		
		T4-330	0.05	0.0876		
Ī		U-333/334	0.04	0.0632		
		U-335/336	h0.0	0.0511		
	<b>&gt;</b>	u - 238	¥0.0	0.0414		
·Σ	15	Th- 338	10.03 (PC:/L	0.0333 (pc: /L)		
				1		
9	9)	Th-238	0.05 (Pci/q	0.158 (pc://		
T		Th - 330	_	0.102		
		~	0.04	0.0683		
	<b>A</b>	0-235/236	0.04	0.0537	7	7
			į			

Comments:

DC #: 21990 F59 DG #: 235782

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page. 4 of 4

2nd Reviewer: Reviewer:

IETHOD: Radiochemistry (Method: SCC Cover

he following sample MDAs are above the RDL:

#	Sample ID	Isotope	OA PP POL RDL (units)	Lab DL MBA (units)	Finding	Ottoble
1.1	7	74-338	0.05 (pci/d)	14	Lah D	None / P
			0.05	0.0631		. I
		_	D. Оц	0.0675		
			p.04	0.0577		
	>	38	6.04	0.0818		
2	8	Tu-338	0.05	0.0794		
		Tu-330	0.05	7690.0		
		U-333/234	PO.04	0.108		
		U - 235 / 236	ро.0	16.0.0		
	>	U-338	0.04 J	0.0894		
						<b>&gt;</b>
omments.						

LDC #: <u>1990F59</u> SDG #: <u>235782</u>

### VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	of
Reviewer:	MG
2nd reviewer:	1~

METHOD: Radiochemistry (Method: See cover )

N N/A

Were field duplicate pairs identified in this SDG?

N N/A Were target isotopes detected in the field duplicate pairs?

	Activity (	pci/g)	
Isotopes	7	8	RPD
Th-228	1.88	1.97	5 (±50)
Tn-230	1.78	1.75	2 (   )
Tu-232	1.78	1.48	18 ( ( )

	Activity ( P	= 1/9)	
Isotop <del>es</del>	7	8	difference/RPD
.U-233/234	1.22	1.33	9 RPD ( = 50)
U-235/236	0.0559	0.0696	difference 0.0137 (50.04)
U-238	1.12	1.06	6 RPD (≤ 50)
			,

Activity ( )		
		RPD
	·	·
	·	
		•
		•

	Activity ( )	·
Isotopes		RPD
	-	

#### Laboratory Data Consultants, Inc. **Data Validation Report**

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: August 21 through August 26, 2009

LDC Report Date: December 4, 2009

Matrix: Soil/Water

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 235860

#### Sample Identification

RSAN6-10B SA185-41B SA185-10BMS RSAN6009-10B **SA185-10BDUP** 

RSAN6-20B

RSAN6-33B **RSAS7-0.5B** 

RSAS7009-0.5B

RSAS7-10B

RSAS7-25B

RSAS7-42B

RSAS4-0.5B

RSAS4-10B

RSAS4-30B

RSAS4-45B

RSAS4009-45B

EB082109-SO1

SA65-10B

SA65-20B

SA65-32.5B

SA185-10B

SA185-25B

#### Introduction

This data review covers 22 soil samples and one water sample listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

#### I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

#### II. Calibration

#### a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

#### b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

#### III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA) with the following exceptions:

Method Blank ID	Isotope	Activity	Associated Samples
PBW (prep blank)	Uranium-238	0.0143 pCi/L	All water samples in SDG 235860

Sample concentrations were compared to concentrations detected in the method blanks as required by the QAPP. No sample data was qualified.

Sample EB082109-SO1 was identified as an equipment blank. No isotopic uranium or isotopic thorium were found in this blank with the following exceptions:

Equipment Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
EB082109-SO1	8/21/09	Uranium-235/236	0.00986 pCi/L	RSAN6-10B RSAN6009-10B RSAN6-20B RSAN6-33B

Sample concentrations were compared to concentrations detected in the equipment blanks as required by the QAPP. No sample data was qualified.

Samples FB072909-SO (from SDG 234267) and F080309-SO (from SDG 234414) were identified as field blanks. No isotopic uranium or isotopic thorium was found in these blanks with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB072909-SO	7/29/09	Thorium-228	0.0321 pCi/L	RSAN6-10B RSAN6-09-10B RSAN6-20B RSAN6-33B SA65-10B SA65-20B SA65-32.5B SA185-10B SA185-25B SA185-41B
FB080309-SO	8/3/09	Uranium-238	0.0126 pCi/L	RSAS7-0.5B RSAS7-0.5B RSAS7-10B RSAS7-25B RSAS7-42B RSAS4-0.5B RSAS4-10B RSAS4-30B RSAS4-45B RSAS4-45B

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

#### IV. Accuracy and Precision Data

#### a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
SA185-10BDUP (RSAN6-10B RSAN6-09-10B RSAN6-20B RSAN6-33B SA65-10B SA65-20B SA65-32.5B SA185-10B SA185-10B SA185-25B SA185-41B)	Uranium-235/236	-	0.0657 pCi/g (≤0.04)	J (all detects) UJ (all non-detects)	A

#### b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

#### c. Tracer Recovery

All tracer recoveries were within validation criteria.

#### V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
RSAN6-10B	Thorium-228 Thorium-230	0.132 0.0733	0.05 0.05	None None	Р
RSAN6009-10B	Thorium-228 Thorium-230 Uranium-233/234	0.130 0.0775 0.0417	0.05 0.05 0.04	None None None	Р
RSAN6-20B	Thorium-228 Thorium-230	0.190 0.0967	0.05 0.05	None None	Р
RSAN6-33B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	0.116 0.0506 0.0632 0.057	0.05 0.05 0.04 0.04	None None None None	P
RSAS7-0.5B	Thorium-228 Thorium-230	0.112 0.0719	0.05 0.05	None None	Р
RSAS7009-0.5B	Thorium-228 Thorium-230	0.120 0.0769	0.05 0.05	None None	Р

Sample	leatono	Lab DL (nCi/a)	POI (" 0'/")	Fi	A == B
Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
RSAS7-10B	Thorium-228	0.173	0.05	None	Р
	Thorium-230	0.0807	0.05	None	
RSAS7-25B	Thorium-228	0.133	0.05	None	Р
	Thorium-230	0.0879	0.05	None	
RSAS7-42B	Thorium-228	0.170	0.05	None	P
	Thorium-230	0.119	0.05	None	
RSAS4-0.5B	Thorium-228	0.138	0.05	None	Р
	Thorium-230	0.0787	0.05	None	
	Thorium-232 Uranium-233/234	0.101 0.0553	0.10 0.04	None	ļ
	0141114111-255/254	0.0555	0.04	None	
RSAS4-10B	Thorium-228	0.154	0.05	None	Р
	Thorium-230	0.108	0.05	None	
RSAS4-30B	Thorium-228	0.144	0.05	None	Р
	Thorium-230 Uranium-235/236	0.0576 0.0418	0.05 0.04	None	
	Oranium-235/236	0.0418	0.04	None	
RSAS4-45B	Thorium-228	0.140	0.05	None	Р
	Thorium-230	0.102	0.05	None	
RSAS4009-45B	Thorium-228	0.130	0.05	None	Р
	Thorium-230	0.0542	0.05	None	
	Uranium-233/234 Uranium-238	0.0454 0.0498	0.04 0.04	None None	
SA65-10B	Thorium-228	0.159	0.05	None	P
	Thorium-230	0.0617	0.05	None	
	Uranium-233/234	0.0462	0.04	None	
SA65-20B	Thorium-228	0.149	0.05	None	Р
	Thorium-230	0.0748	0.05	None	
	Uranium-235/236	0.0413	0.04	None	
SA65-32.5B	Thorium-228	0.151	0.05	None	Р
	Thorium-230	0.182 0.105	0.05	None	
	Thorium-232	0.105	0.10	None	
SA185-10B	Thorium-228	0.151	0.05	None	Р
	Thorium-230	0.0823	0.05	None	
SA185-25B	Thorium-228	0.148	0.05	None	P
	Thorium-230	0.0653	0.05	None	
	Uranium-233/234 Uranium-235/236	0.0462 0.0439	0.04 0.04	None None	
	0141114111-203/200	0.0403	0.04	1,40116	

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
SA185-41B	Thorium-228 Uranium-235/236	0.107 0.0473	0.05 0.04	None None	Р

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
EB082109-SO1	Thorium-228	0.0515	0.03	None	Р

The MDA was greater than the PQL as listed above.

#### VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 235860	All isotopes reported below the PQL.	J (all detects)	А

Raw data were not reviewed for this SDG.

#### VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

#### **VIII. Field Duplicates**

Samples RSAN6-10B and RSAN6009-10B, samples RSAS7-0.5B and RSAS7009-0.5B, and samples RSAS4-45B and RSAS4009-45B were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

	Concentration (pCi/g)		200	D:#			
Analyte	RSAN6-10B RSAN6009-10B		RPD (Limits)	Difference (Limits)	Flags	A or P	
Thorium-228	2.07	1.60	26 (≤50)	-	-	-	
Thorium-230	1.31	1.09	18 (≤50)	-	-	-	
Thorium-232	1.62	1.57	3 (≤50)	-	-	-	
Uranium-233/234	0.941	1.15	20 (≤50)	-	-	-	

Concentration		ition (pCi/g)				
Analyte	RSAN6-10B	RSAN6009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Uranium-235/236	0.0643	0.0639	-	0.004 (≤0.04)	-	-
Uranium-238	1.01	0.977	3 (≤50)	-	-	-

	Concentra	tion (pCi/g)				
Analyte	RSAS7-0.5B	RSAS7009-0.5B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.84	1.97	7 (≤50)	-	-	-
Thorium-230	1.03	1.10	7 (≤50)	-	-	-
Thorium-232	1.66	1.72	4 (≤50)	-	-	-
Uranium-233/234	0.768	0.829	8 (≤50)	-	-	-
Uranium-235/236	0.0486	0.101	-	0.0524 (≤0.04)	J (all detects)	А
Uranium-238	0.804	0.989	21 (≤50)	-	-	-

	Concentration (pCi/g)					
Analyte	RSAS4-45B	RSAS4009-45B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.59	1.21	27 (≤50)	-	-	-
Thorium-230	2.78	2.78	0 (≤50)	-	-	-
Thorium-232	1.15	1.16	1 (≤50)	-	-	-
Uranium-233/234	2.87	2.75	4 (≤50)	-	-	-
Uranium-235/236	0.175	0.142	-	0.033 (≤0.04)	-	
Uranium-238	3.10	2.90	7 (≤50)	-	-	-

### Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 235860

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
235860	RSAN6-10B RSAN6009-10B RSAN6-20B RSAN6-33B SA65-10B SA65-20B SA65-32.5B SA185-10B SA185-25B SA185-41B	Uranium-235/236	J (all detects) UJ (all non-detects)	A	Duplicate sample analysis (Difference) (Id)
235860	RSAN6-10B RSAN6-20B RSAS7-0.5B RSAS7009-0.5B RSAS7-10B RSAS7-25B RSAS7-42B RSAS4-10B RSAS4-45B SA185-10B	Thorium-228 Thorium-230	None None	Р	Minimum detectable activity
235860	RSAN6009-10B SA65-10B	Thorium-228 Thorium-230 Uranium-233/234	None None None	Р	Minimum detectable activity
235860	RSAN6-33B RSAS4009-45B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	None None None None	Р	Minimum detectable activity
235860	RSAS4-0.5B	Thorium-228 Thorium-230 Thorium-232 Uranium-233/234	None None None None	Р	Minimum detectable activity
235860	RSAS4-30B SA65-20B	Thorium-228 Thorium-230 Uranium-235/236	None None None	Р	Minimum detectable activity
235860	SA65-32.5B	Thorium-228 Thorium-230 Thorium-232	None None None	P	Minimum detectable activity
235860	SA185-25B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	None None None None	P	Minimum detectable activity

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
235860	SA185-41B	Thorium-228 Uranium-235/236	None None	Р	Minimum detectable activity
235860	EB082109-SO1	Thorium-228	None	Р	Minimum detectable activity
235860	RSAN6-10B RSAN6-20B RSAN6-20B RSAN6-33B RSAS7-0.5B RSAS7-0.5B RSAS7-10B RSAS7-25B RSAS7-42B RSAS4-0.5B RSAS4-0.5B RSAS4-10B RSAS4-30B RSAS4-30B RSAS4-45B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-5B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSAS4-30B RSA	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)
235860	RSAS7-0.5B RSAS7009-0.5B	Uranium-235/236	J (all detects)	A	Field duplicates (Difference) (fd)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 235860

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Equipment Blank Data Qualification Summary - SDG 235860

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 235860

No Sample Data Qualified in this SDG

### Tronox Northgate Henderson VALIDATION COMPLETENESS WORKSHEET

LDC #:	21990G59	VALIDATION COMPLETENESS WORKSHEE
SDG #:_	235860	Stage 2B
Laborato	ry: GEL Laboratories	LLC

Date: 12-2-09
Page: 1 of 1
Reviewer: MG
2nd Reviewer:

**METHOD:** Isotopic Uranium (DOE EML HASL-300, U-02-RC Modified), Isotopic Thorium (DOE EML HASL-300, Th-01-RC Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Technical holding times	Α	Sampling dates: 8-21-09 through 8-26-09
lla.	Initial calibration	Α	0
IIb.	Calibration verification	Α	
III.	Blanks	SW	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS/DUP
IVa.	Laboratory control samples	A	LCS/LCSD
V.	Tracer Recovery	A	
VI.	Minimum Detectable Activity (MDA)	SW	
VII.	Sample result verification	N	
VIII.	Overall assessment of data	Α	
IX.	Field duplicates	sw	D= 1+2 D=5+6 D= 13+14
L _X	Field blanks	SW	EB= 15 FB= F8072909-50 (SDG: 234267)

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected FB = R = Rinsate

FB = Field blank

B = FB080309-50 (SDG: 234414)

D = Duplicate
TB = Trip blank
EB = Equipment blank

Validated Samples:

1	RSAN6-10B S	11	RSAS4-10B	S	21	SA185-41B S	31
2	RSAN6009-10B	12	RSAS4-30B	1	22	SA185-10BMS	32
3	RSAN6-20B	13	RSAS4-45B		23	SA185-10BDUP	33
4	RSAN6-33B	14	RSAS4009-45B		24	PBS	34
5	RSAS7-0.5B	152	EB082109-SO1	W	₂₅ 2	PBW	35
6	RSAS7009-0.5B	16	SA65-10B	5	26		36
7	RSAS7-10B	17	SA65-20B		27		37
8	RSAS7-25B	18	SA65-32.5B		28		38
9	RSAS7-42B	19	SA185-10B		29		39
10	RSAS4-0.5B	20	SA185-25B	J	30		40

Notes:		

LDC #: 31990659 SDG #: 335860 SDG #:

## VALIDATION FINDINGS WORKSHEET Blanks

Page: __of_ 2nd Reviewer: Reviewer:

METHOD: Radiochemistry (Method: See covery N.N.A. Were blank analyses performed as req

Were blank analyses performed as required? If no, please see qualifications below. Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see qualifications below.

	Units: PC	pci/L		Associated Samples: All water (N.D.)
	Isotope	Blank ID	Blank Action	Sample Identification
		PBW	Level	No sample was and lifted
38	U-338	0.0143		
	Units:			Associated Samples:

Isotope	Blank ID	Associated Samples Blank Action Level
---------	----------	---------------------------------------

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT: If there is activity in the blank above the MDA, sample results within 10x the blank activity will be qualified as not detected "U".

91990659 335860 LDC #:

## VALIDATION FINDINGS WORKSHEET Field Blanks

2nd Reviewer: Page: 1 of 1 ろろ Reviewer:

> See cover METHOD: Radiochemistry (Method:_

Were target isotopes detected in the field blanks? Were field blanks identified in this suggest that were field be blank units:

| N N/A | Were target isotopes detected in the field be blank units: PC1/L | Associated sample units: PC1/L | Associated

EB Field blank type: (circle one) Field Blank / Rinsate / Other

12x) 74-1 quali Sample Identification Associated Samples:_ were mples ढु ۲° Blank Action Limit U- 335/336 0.00986 Blank ID 10 Analyte

Sampling date: 7-39-09 Blank units: PCi/L

Field blank type: (circle one) (Field Blank) Rinsate / Other:

1019 十个 Associated Samples:

no Head		No samples were qualified						
scheditted element		No samples						
								Samples with isotope concentrations within five times the associated field hank concentration are listed in
Blank	Action		0.00032					entrations with
Blank ID	02-000	107-30	0.0321					sotope conce
Analyte			RL TH-238 0.0321 0.00032					Samples with it

21990659 LDC #:_ SDG #:

# VALIDATION FINDINGS WORKSHEET

Page:

2nd Reviewer: Reviewer:__

(> RL)

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Associated Samples:

VALIDATION FINDINGS WORKS			Associated Samp	
	METHOD: Radiochemistry (Method: See cover	Were field blanks identified in this SDG?  N N/A Were target isotopes detected in the field blanks?  Blank units: PC / L Associated sample units: PC / C Sampling date: 8-3-09	Field blank type: (circle one) Field Blank/ Rinsate / Other:	
	y (Method:	l blanks iden et isotopes c Associated s	one) Field Big	
35 860	diochemistr	Were field Were field PC: /L	/pe: (circle o	Analyte Blank ID Diank
SDG #: 335 860	METHOD: Re	N N/A Were field ble N/A Were target Blank units: PC'/L Assembling date: 8-3-09	Field blank t	Anafvte
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Blank ID	F8 08 0309-50	30130	76100	0.0100												
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Associated Samples: Sampling date: Field blank type: (circle one) Field Blank / Rinsate / Other: Blank ID Analyte

Associated sample units:

Blank units:

Sample Identification  Limit  Limit  Limit  Sample Identification  Limit  Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected.		-	T		T		Ī	-	T		T				7		sted,
Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as number of the sample results were qualified as numbers.							$\downarrow$										ot detec
Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were quality.																	lled as n
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Samples with isotope concer	Diank	Action	LIMIT							T						itrations wit	
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21990659 935860 3DG #: _DC #:_

## VALIDATION FINDINGS WORKSHEET **Duplicate Analysis**

Reviewer:___

Page: Lot 2nd Reviewer:__

WETHOD: Radiochemistry (Method: See Cover

Act = sample activity Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A". Was a duplicate sample analyzed the required frequency of 5% in this SDG?  $\frac{Y(N)N/A}{Y(N)N/A}$  Were all duplicate sample duplicate error ratio (DER) < 1.42? DFR=  $\frac{1}{1}$  Act. Act. Was a duplicate sample analyzed the required frequency of 5% in this SDG? Were all duplicate sample duplicate error ratio (DER)  $\leq$  1.42? DER=  $\frac{|Act_1-Act_2|}{2}$  1.72

 $\delta = 1$  sigma error

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

LEVEL IV ONLY: Y N N/A

	T	Ť	Т	Т	Т	一	T	 T	7	T	T	1	T	Ţ	T	T	T	T	
	Qualifications	5/05/A 1d																	
	Associated Samples	me att soit	10 mg 16 mg 1																
by difference		(£ 0.04)	<b>o</b>																
	Isotope	U-335/336 0.0657 1																	
	Matrix	Soil																	
	Duplicate ID	23																	
	*	-																	

Comments:

Vareion 1 0 (3/2/2000)

335860 )C #: )G #:

# VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

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Reviewer: 2nd Reviewer:

ETHOD: Radiochemistry (Method: SCC Cover

ne following sample MDAs are above the RDL:

*	Sample ID	Isotope	QAPP POL RDL (units)	9 1 1	La 6 DL MBA (units)	Finding	Ouelffications
-		Th-338	0.05	pc;/4)	0.132 (PC:14)	Lab D	None/P
	-	Tu-330	0.05	-	0.0733	_	
7	4	Tu-928	0.05		0.130		
		TH-330	0.05		0.0775		
	<b>^</b>	U-233/234	0.0H		7140.0		
		-					
3	3	Th-238	0.05		0.190		
	-	T4-230	0.05		0.0967		
7	7	Th-338	0.05		0.116		
		Th - 230	0.05		0.0506		
		U-233/234	40.0		0.0632		
	•	U - 238	0.04		0.057		
4	\$	Th-338	0.05	Ĺ	0.112		
	7	TH-330	0.05		0.0719		
૭	9	T4-238	0.05	1	021 0		
	-	Th-230	0.05	1	0.0769		
7	7	366-HJ	0.05		0.172		
	7	TH-330	0.05		0.0807		
C							
a	Φ,	Th-338	0.05		0.133		
	->	Tu-230	0.05		0.0879	•	
				1			
mments:	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,						

)C #: 31990G59

# **VALIDATION FINDINGS WORKSHEET** Minimum Detectable Activities

Page: 2 of 3

Reviewer: 2nd Reviewer:

see cover ETHOD: Radiochemistry (Method:___

ne following sample MDAs are above the RDL:

		T	T		T	T	Τ	Τ	T	T	Τ	T		T	Τ	T	T	T	Ī	T	Τ	T			T	T	7
Qualifications	None/P																										7
Finding	Lab D																										7
Lab DL MBA (units)	(pc:/4) 071.0	0.119 10	0.138	0.0787	101.0	0.0553		0.154	0.108		0.144	0.0576	8140.0		0.140	0.102		0.130	6450.0	0.0454	0.0498		0.0515 (PC1/L)	1,2	0.154 (12./4)		10.040g
QAPP POL RDL (units)	0.05 (pc:/4)	0.05	0.05		0.10			0.05	0.05		0.05				50.0	0.05		0.05		0.04	>		0.03 (PC:/L)0.0515	17.5%	0.03	+	Å
isotope	14 - 338	Th-330	TH-238	Th-230	Th-332	U-233/234		8 <i>66</i> - 41	Th-230		Tu-228	TH-230			Tu-328			TH-238	Th - 230	U-333/334			Th- 328	Tt 208		1934	
Sample ID	9	->	0)			<b>/</b>			7		12		_>		13	-		l4			~		15	7			
*	6		9					=			(2				2			14					5	16	<b> </b>		

omments:

DG #: 335860

# VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 3 of 3

Reviewer:_

iistry (Method: SCC cover

ETHOD: Radiochemistry (Method: SEE Cole following sample MDAs are above the RDL:

Qualifications None/P Lab DL > GAPP Par Finding (Pci/g) 0.149 (Pci/g) Late DL MBA (units) 0.0748 0.0413 0.0653 0.0462 0.0823 0.0439 0.0473 0.105 0.182 0.148 0.151 0.151 0.107 QAPP POL RDL (units) 0.05 0.04 90.0 0.05 0.05 0.05 0.04 0.10 0.05 0.04 0.05 0.05 0.04 U-333/334 U-235/236 U-335/336 U-335/336 Tn-230 Tu-230 TH-338 Tn - 230 Tn-330 Th-232 Tr-998 74-338 T4-238 Th-328 sotope Sample ID 90 9 9 5 mments: 20 _ _ 3 9

LDC #: <u>21990G59</u> SDG #: <u>235860</u>

### VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	1 of 2
Reviewer:_	MG
2nd reviewer:	1~

METHOD: Radiochemistry (Method: See Cover

(Y) N N/A (Y) N N/A Were field duplicate pairs identified in this SDG?

Were target isotopes detected in the field duplicate pairs?

	Activity (	pci/q,	
isotopes		2	RPD
Tn-228	2.07	1.60	26 (£50)
T4-230	1.31	1.09	18 ( )
Tu-232	1.62	1.57	3 ( )

	Activity ( P	ci/q )	
!sotopes	l	2	difference / RPD
.0-233/234	0.941	1.15	20 (≤ 50)
U-235/236	0.0643	0.0639	d:fference 0.0004 (±0.04)
U-238	1.01	0.977	RPP 3 (≤ 50)

	Activity (	pci/q,	
Isotopes	5	. 6	RPD
Th-228	1.84	1.97	7 (450)
Tu-230	1.03	1.10	7 (   )
Tu-232	1.66	1.72	4 ( 1)
			-

	Activity (	c./g)	Qual pavent only		
Isotopes	5	6	difference/RPD		
U-233/234	0.768	0.829	8 (50)		
U-235/236	0.0486	0.101	difference 0.0524 (= 0.04) Jda15/A fd		
U-238	0.804	0.989	21 (≤ 50)		
			·		

LDC #: <u>21990G59</u> SDG #: <u>235860</u>

### **VALIDATION FINDINGS WORKSHEET** Field Duplicates

Page:_	2 of 2
Reviewer:	
2nd reviewer:	10

METHOD: Radiochemistry (Method: See C	over
---------------------------------------	------

Were field duplicate pairs identified in this SDG? Were target isotopes detected in the field duplicate pairs?

	Activity (	pci/qj	
Isotopes	13	14	RPD
Tn-228	1.59	1.21	27 (€50)
Tu-230	2.78	2.78	0()
Tu-232	1.15	1.16	1 ( 6 )

	Activity ( f	ci/g,	
Isotopes	13	14	difference APD
· U - 233 /234	2.87	2.75	4 (\$ 50)
U - 235 / 236	0.175	0.142	difference 0.033 (≤0.04)
U-238	3.10	2.90	7 (±50)
·			

	Activity (	)	
Isotopes		·	RPD

	Activity ( )		·
Isotopes	·		RPD

### Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: August 25 through August 27, 2009

LDC Report Date: December 4, 2009

Matrix: Soil

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 2B

**Laboratory:** GEL Laboratories, LLC.

Sample Delivery Group (SDG): 236043

### Sample Identification

RSAN7-0.5B RSAO5-41BDUP

RSAN7-10B

RSAN7-10B

RSAN7-38B

SA113-0.5B

SA113-10B

SA113-30B

SA196-0.5B

SA196-10B

SA196-29B

SA200-10B

SA200-20B

SA200-31B

SA200009B-31B

RSAT3-40B

RSAT3-53B

**RSAO5-10B** 

RSAO5-25B

**RSAO5-41B** 

RSAO5-41BMS

### Introduction

This data review covers 21 soil samples listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

### I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

### II. Calibration

### a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

### b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

### III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Samples FB072909-SO (from SDG 234267) and F080309-SO (from SDG 234414) were identified as field blanks. No isotopic uranium or isotopic thorium was found in these blanks with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB072909-SO	7/29/09	Thorium-228	0.0321 pCi/L	RSAN7-0.5B RSAN7-10B RSAN7-25B RSAN7-38B SA113-0.5B SA113-10B SA113-30B SA196-0.5B SA196-10B SA196-29B SA200-10B SA200-20B SA200-31B SA20009B-31B RSAO5-10B RSAO5-41B
FB080309-SO	8/3/09	Uranium-238	0.0126 pCi/L	RSAT3-40B RSAT3-53B

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

### IV. Accuracy and Precision Data

### a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
RSAO5-41BDUP (RSAN7-0.5B RSAN7-10B RSAN7-25B RSAN7-38B SA113-0.5B SA113-10B SA113-30B SA196-0.5B SA196-0.5B SA196-10B SA196-29B SA200-10B SA200-20B SA200-31B SA200-31B SA200-31B SA200-31B RSAO5-10B RSAO5-41B)	Thorium-228	20.3 (≤20)	-	J (all detects) UJ (all non-detects)	Α

### b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

### c. Tracer Recovery

All tracer recoveries were within validation criteria.

### V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
RSAN7-0.5B	Thorium-228	0.140	0.05	None	P
110/111/-0.55	Thorium-230	0.0785	0.05	None	
RSAN7-10B	Thorium-228	0.147	0.05	None	Р
	Thorium-230	0.088	0.05	None	
	Uranium-233/234	0.0427	0.04	None	
RSAN7-25B	Thorium-228	0.150	0.05	None	Р
	Thorium-230	0.0769	0.05	None	
RSAN7-38B	Thorium-228	0.109	0.05	None	Р
SA113-0.5B	Thorium-228	0.115	0.05	None	P
. –	Thorium-230	0.0744	0.05	None	'
SA113-10B	Thorium-228	0.120	0.05	None	P
	Thorium-230	0.0779	0.05	None	
	Uranium-233/234 Uranium-235/236	0.0601 0.0402	0.04	None	
	Oranium-235/236	0.0402	0.04	None	
SA113-30B	Thorium-228	0.136	0.05	None	Р
	Thorium-230	0.0603	0.05	None	İ
	Uranium-233/234 Uranium-238	0.0455	0.04	None	į
	Oranium-236	0.0455	0.04	None	
SA196-0.5B	Thorium-228	0.106	0.05	None	Р
	Uranium-233/234	0.060	0.04	None	
SA196-10B	Thorium-228	0.090	0.05	None	P
3A190-10D	Thorium-230	0.0938	0.05	None	-
	Uranium-233/234	0.0457	0.04	None	
				1	<del> </del>
SA196-29B	Thorium-228 Thorium-230	0.103	0.05	None None	P
	Uranium-233/234	0.0876 0.0706	0.05 0.04	None	
	Uranium-235/236	0.0473	0.04	None	
	Uranium-238	0.0613	0.04	None	
SA200-10B	Thorium-228	0.176	0.05	None	P
0,1200 100	Thorium-230	0.0971	0.05	None	'
SA200-20B	Thorium-228	0.171	0.05	None	Р
UM200-20D	Thorium-230	0.0807	0.05	None	'
	Uranium-233/234	0.066	0.04	None	
	Uranium-235/236	0.0508	0.04	None	
	Uranium-238	0.0411	0.04	None	1

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
SA200-31B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	0.191 0.0655 0.0506 0.0416	0.05 0.05 0.04 0.04	None None None None	Р
SA200009B-31B	Thorium-228 Thorium-230 Uranium-233/234	0.102 0.0586 0.0429	0.05 0.05 0.04	None None None	Р
RSAT3-40B	Thorium-228 Thorium-230 Uranium-233/234	0.106 0.0899 0.0466	0.05 0.05 0.04	None None None	Р
RSAT3-53B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	0.107 0.0694 0.0491 0.0439	0.05 0.05 0.04 0.04	None None None None	Р
RSAO5-10B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	0.154 0.0724 0.066 0.0409 0.0497	0.05 0.05 0.04 0.04 0.04	None None None None None	P
RSAO5-25B	Thorium-228 Thorium-230 Uranium-233/234	0.119 0.0794 0.0479	0.05 0.05 0.04	None None None	Р
RSA05-41B	Thorium-228 Thorium-230 Uranium-235/236	0.131 0.0922 0.0409	0.05 0.05 0.04	None None None	Р

The MDA was greater than the PQL as listed above.

### VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 236043	All isotopes reported below the PQL.	J (all detects)	Α

Raw data were not reviewed for this SDG.

### VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

### VIII. Field Duplicates

Samples SA200-31B and SA200009B-31B were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

	Concentra	tion (pCi/g)					
Analyte	SA200-31B	SA200009B-31B	RPD (Limits)	Difference (Limits)	Flags	A or P	
Thorium-228	2.32	2.34	1 (≤50)	-	-	-	
Thorium-230	4.41	4.60	4 (≤50)	-	-	-	
Thorium-232	1.99	1.83	8 (≤50)	-	-	-	
Uranium-233/234	3.72	4.25	13 (≤50)	-	-	-	
Uranium-235/236	0.195	0.203	-	0.008 (≤0.04)	-	-	
Uranium-238	3.94	4.03	2 (≤50)	-	-	-	

### Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 236043

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
236043	RSAN7-0.5B RSAN7-10B RSAN7-25B RSAN7-38B SA113-0.5B SA113-10B SA113-30B SA196-0.5B SA196-10B SA196-10B SA200-10B SA200-20B SA200-31B SA20009B-31B RSAO5-10B RSAO5-41B	Thorium-228	J (all detects) UJ (all non-detects)	A	Duplicate sample analysis (RPD) (Id)
236043	SA113-0.5B RSAN7-25B RSAN7-0.5B SA200-10B	Thorium-228 Thorium-230	None None	Р	Minimum detectable activity
236043	RSAN7-10B SA196-10B SA200009B-31B RSAT3-40B RSAO5-25B	Thorium-228 Thorium-230 Uranium-233/234	None None None	Р	Minimum detectable activity
236043	RSAN7-38B	Thorium-228	None	Р	Minimum detectable activity
236043	SA113-10B SA200-31B RSAT3-53B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	None None None None	Р	Minimum detectable activity
236043	SA113-30B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	None None None None	Р	Minimum detectable activity
236043	SA196-0.5B	Thorium-228 Uranium-233/234	None None	Р	Minimum detectable activity
236043	SA196-29B SA200-20B RSAO5-10B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None None	Р	Minimum detectable activity

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
236043	RSA05-41B	Thorium-228 Thorium-230 Uranium-235/236	None None None	Р	Minimum detectable activity
236043	RSAN7-0.5B RSAN7-10B RSAN7-25B RSAN7-38B SA113-0.5B SA113-10B SA113-30B SA196-0.5B SA196-10B SA196-29B SA200-10B SA200-20B SA200-31B SA200-31B SA200-31B SA200-31B SA200-31B RSAT3-40B RSAT3-53B RSAT3-53B RSAO5-10B RSAO5-25B RSAO5-41B	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 236043

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 236043

No Sample Data Qualified in this SDG

### **Tronox Northgate Henderson**

LDC #:	21990H59	VALIDATION COMPLETENESS WORKSHEET
SDG #:	236043	Stage 2B
Laborator	y: GEL Laborator	es LLC

Date: 12-2-09 Page: | of | Reviewer: MG 2nd Reviewer:_

METHOD: Isotopic Uranium (DOE EML HASL-300, U-02-RC Modified), Isotopic Thorium (DOE EML HASL-300, Th-01-RC Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 8-25-09 through 8-27-09
lla.	Initial calibration	A	δ
IIb.	Calibration verification	À	
III.	Blanks	Α	9n H
Va.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS /MSD DUP
IVa.	Laboratory control samples	Α	LCS
V.	Tracer Recovery	A	
VI.	Minimum Detectable Activity (MDA)	SW	
/II.	Sample result verification	N	
/III.	Overall assessment of data	A	
łX.	Field duplicates	SW	D= 13 +14
х	Field blanks	SW	FB = FB072909-50 (SDG: 234267) FB = FB080309-50 (SDG: 234414)

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

FB080309-50 D = Duplicate

TB = Trip blank

FB = Field blank EB = Equipment blank

Validated Samples:

all soil

	411 307					
1	RSAN7-0.5B	11	SA200-10B	21	RSAO5-41BDUP U TA	31
2	RSAN7-10B	12	SA200-20B	22	PBS	32
3	RSAN7-25B	13	SA200-31B	23		33
4	RSAN7-38B	14	SA200009B-31B	24		34
5	SA113-0.5B	15	RSAT3-40B	25		35
6	SA113-10B	16	RSAT3-53B	26		36
7	SA113-30B	17	RSAO5-10B	27		37
8	SA196-0.5B	18	RSAO5-25B	28		38
9	SA196-10B	19	RSAO5-41B	29		39
10	SA196-29B	20	RSAO5-41BMS U Th	30		40

FWHM > 100 ke V and tracer peak centroid > 50 keV from expected Manual integration was performed for this sample and the resulting tracer within limit for Uranium isotopes. No Qual.

31990HS9 LDC #:

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Page:	Reviewer:	2nd Reviewer:

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17-19 工个一 VALIDATION FINDINGS WORKSHEET Associated Samples:_ Field Blanks Were target isotopes detected in the field blanks? Blank units: Pci /L Associated sample units: pci /g Sampling date: 7-39-09 Field blank type: (circle one) Field Blank / Rinsate / Other: Were field blanks identified in this SDG? See cover METHOD: Radiochemistry (Method:_ SDG #: 736043 ON N/A ON N/A Blank units:

										-	
								•			
	•	1 0:0.1	מכני לממונגוב ס								
	Sample identification	0.00	2 y 2								
	Sample id	0/0 5									
		No sam									
Blank	Action		60000	0.0003					<del></del>		
Blank iD		<b>- B</b> 07 a909 - S0	1000	14-668 0.034 0.0003							
Analyte		FB 07	7. 120	200-W							

7

Associated sample units: PC: /4 Blank units: PCi/L

Sampling date: 8-3-09 Field blank type: (circle one) Field Blank) Rinsate / Other:

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31990H59 336043 _DC #:__ 3DG #:

### VALIDATION FINDINGS WORKSHEET **Duplicate Analysis**

2nd Reviewer:___ Page: Reviewer:

WETHOD: Radiochemistry (Method: See Cover

Dease see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N/A

Was a duplicate sample analyzed the required frequency of 5% in this SDG? Were all duplicate sample duplicate error ratio (DER)  $\leq$  1.42? DER=  $\frac{|Act_1-Act_2|}{2|\delta_1^2|}$  Act = sample activity  $2|\delta_1^2+\delta_2^2|^{1/2}$ 

 $\delta = 1$  sigma error

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. LEVEL IV ONLY:
Y N N/A W

Qualifications	J/UJ/A 19										
Associated Samples	1714, 17-19										
RPD DER (Limits)	20.3 (± 30)										
Isotope	Th-338										
Matrix	1,05										
Duplicate ID	16										
*	-										

Comments:

DUP 35 DOC

)C#: 21990459

# VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 1 of 3 Reviewer: 2nd Reviewer:

ETHOD: Radiochemistry (Method: SEE Cover

ie following sample MDAs are above the RDL:

#	Sample ID	Isotope	AAPP POL RDL (units)	L Lab DL MBA (units)	Finding	Qualifications
-		Th. 338	(pc.)	KI .	Lab Di	None/P
	•	Th - 230	0.05	0 0.0785 1 0	l	
7	8	Tn-238	0.05	0.147		
		Tu-230	0.05	0.0888		
	->	U-233 /234	0.04	D.0427		
3	3	Tr-338	0.05	0.150		
	-	Tn-330	0.05	0.0769		
7	7	74-338	0.05	6.109		
,						
4	5	Th-238	0.05	0.115		
	•	Ти -930	0.05	0.0744		
٩	9	Th-238	0.05	0.120		
		T4-330	0.05	0.0779		
		U-233/234	0.04	0.06.01		
	->	U - 335/336	0.04	0.0402		
-	7	Th-328	0.05	0.136		
		Tu-330	0.05	0.0603		
		U-233/234	bo.0	0.0455		
	*	U-238	0.04	0.0455		
,	d					
ω	B	3	0.05	0.106		
	7	U-333/334	0.04	0.060	->	
omments:						

DC #: 21990H59

# VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 2 of 3 Reviewer: Mc

AETHOD: Radiochemistry (Method: See Cover

he following sample MDAs are above the RDL:

*	Sample (D	Isotope	AAPP POL RDL (unite)	Late DL MBA (units)	Findina	Custantone
6	Ь	Th-338	(pc:/4)	<b> </b>	Lab Di	None / P
		Th -330	0.05	0.0938		
	<b>\</b>	U-933/934	PO.04	0.0457		
0	(0)	Th-328	0.05	0.103		
		Th -330	0.05	9.0876		
		U-333/334	0.04	0.0706		
		U-335/336	h0.0	0.0473		
		U-238	0.04	0.0613		
=	-	Th-338	0.05	0.176		
	<b>→</b>	Tu-230	0.05	1760.0		
3	(2	14-338	0.05	0.171		
		Th-130	50.0	0.0807		
		4-333/33H	0.04	0.066		
		0-335/236	0.04	0.0508		
	*	0-938	40.0	0.0411		
5	13	Th-338	0.05	0.191		
		Tn -330	0.05	0.0655		
		U-333/234	6.04	0.0506		
	/	U- 335/336	0.04	0.0416		
5	14	Th-238	0.05	0.103		
		Ти-930	0.05	0.0586		
	->	U-233/334	0.04	0.0439		,
						<b>X</b>
omments						

31990H59 236043 DG #: DC #:

# VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

R

Page: 3 of 3

IETHOD: Radiochemistry (Method: SCE Cover

he following sample MDAs are above the RDL:

*	Sample ID	Isotope	QAPP POL RDL (unite)	Late DL MBA (units)	Finding	Continue
15	اک	Th-338	0.05 (pc:/4	) 0.106 (PC:/4)	Lah D	None / P
		Th-930	0.05 10	0.0899		J.
	->	U-333/33H	0.04	0.0466		
9	91	Tu-338	0.05	0.107		
		Th- 330	0.05	0.0694		
		U-333/334	6.04	0.0491		
	->	U - 335 / 936	6.04	0.0439		
_		14-938	0.05	0.154		
		Th-230	0.05	10.073H		
		U-333/334	0.04	0.066		
		U-335/336	0.04	0.0409		
	>	U - 338	0.04	0.0497		
9	ය)	Th-338	0.05	0.119		
		Th-330	50.0	0.0794		
	<b>→&gt;</b>	U-333/334	h0.0	0.0479		
6	61	Th-238	0.05	0.131		
		Tu-330	0.05	0.0922		
		0 - 335/336	0.04	0.0409	>	-
omments:						

LDC #: <u>11990H59</u> SDG #: <u>736043</u>

### VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page:_	1_0	of
Reviewer:	M	G
2nd reviewer:		

METHOD: Rad	iochemistry (Method: See cover
⊗n n/a ⊗n n/a	Were field duplicate pairs identified in this SDG? Were target isotopes detected in the field duplicate pairs?

	Activity (	pci/q)	
Isotopes	13	14	RPD
T4-228	2.32	2.34	(£50)
Tu-230	4.41	4.60	4()
Tu-232	1.99	1.83	8 ( )

	Activity ( P	ci/g)	
Isotopes	13	14	difference / RPD
U-233/234	3.72	4.25	13 (± 50)
U-235/236	0.195	0.203	d:fference 0.008 (≤ 0.04)
U - 938	3.94	4.03	2 (±50)

	Activity ( )	
sotopes		RPD

Activity ( )	
	RPD
-	
	Activity ( )

### Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: September 23 through October 5, 2009

LDC Report Date: December 16, 2009

Matrix: Soil

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 2B

**Laboratory:** GEL Laboratories, LLC.

Sample Delivery Group (SDG): 237785

### Sample Identification

SA148-10BSPLP

SA148-35BSPLP

RSAR3-0.5BSPLP

RSAR3-35BSPLP

RSAQ4-10BSPLP

RSAQ4-32BSPLP

SA148-10BSPLPMS

SA148-10BSPLPDUP

SA148-35BSPLPMS

SA148-35BSPLPDUP

Samples in this SDG underwent SPLP extraction

### Introduction

This data review covers 10 soil samples listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- Data are qualified as estimated, with a high bias likely to occur. False positives or false J+ negatives are unlikely to have been reported.
- Data are qualified as estimated, with a low bias likely to occur. False positives or false Jnegatives are unlikely to have been reported.
- Data are qualified as estimated; it is not possible to assess the direction of the potential J bias. False positives or false negatives are unlikely to have been reported.
- Indicates the compound or analyte was analyzed for but not detected at or above the U stated limit.
- Data are qualified as rejected. There is a significant potential for the reporting of false R negatives or false positives.
- Indicates the compound or analyte was analyzed for but not detected. The sample UJ detection limit is an estimated value.
- The analytical result may be a false positive totally attributable to blank contamination. В This qualifier is applicable to radiochemistry analysis only.
- The analytical result may be biased high and partially attributable to blank contamination. JB This qualifier is applicable to radiochemistry analysis only.
- The analytical result is an estimated maximum possible concentration (EMPC). JK
- The analytical result is not used for reporting because a more accurate and precise result Χ is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- Indicates the finding is based upon technical validation criteria. Α
- Indicates the finding is related to a protocol/contractual deviation. Р
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

### I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

### II. Calibration

### a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

### b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

### III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA) with the following exceptions:

Method Blank ID	Isotope	Activity	Associated Samples
SPLP PB (prep blank)	Thorium-228	0.0266 pCi/L	All samples in SDG 237785

Sample concentrations were compared to concentrations detected in the method blanks as required by the QAPP. No sample data was qualified.

No field blanks were identified in this SDG.

### IV. Accuracy and Precision Data

### a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
SA148-10BSPLPDUP (All samples in SDG 237785)	Uranium-233/234	-	0.0339 pCi/L (≤0.03)	J (all detects) UJ (all non-detects)	А

### b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

### c. Tracer Recovery

All tracer recoveries were within validation criteria.

### V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
SA148-10BSPLP	Thorium-228 Uranium-235/236 Uranium-238	0.0376 0.0363 0.0424	0.03 0.03 0.03	None None None	Р
SA148-35BSPLP	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	0.0364 0.0323 0.0346 0.036	0.03 0.03 0.03 0.03	None None None None	Р
RSAR3-0.5BSPLP	Thorium-228 Uranium-233/234	0.042 0.0444	0.03 0.03	None None	Р
RSAR3-35BSPLP	Thorium-228 Uranium-233/234 Uranium-238	0.0398 0.0345 0.0345	0.03 0.03 0.03	None None None	P
RSAQ4-10BSPLP	Thorium-228 Uranium-238	0.0438 0.0319	0.03 0.03	None None	Р
RSAQ4-32BSPLP	Thorium-228 Uranium-233/234	0.0347 0.0318	0.03 0.03	None None	Р

The MDA was greater than the PQL as listed above.

### VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 237785	All isotopes reported below the PQL.	J (all detects)	А

Raw data were not reviewed for this SDG.

### VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

### VIII. Field Duplicates

No field duplicates were identified in this SDG.

### *Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 237785

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
*237785	SA148-10BSPLP SA148-35BSPLP RSAR3-0.5BSPLP RSAR3-35BSPLP RSAQ4-10BSPLP RSAQ4-32BSPLP	Uranium-233/234	J (all detects) UJ (all non-detects)	A	Duplicate sample analysis (Difference) (ld)
237785	SA148-10BSPLP	Thorium-228 Uranium-235/236 Uranium-238	None None None	Р	Minimum detectable activity (PQL)
237785	SA148-35BSPLP	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
237785	RSAR3-0.5BSPLP RSAQ4-32BSPLP	Thorium-228 Uranium-233/234	None None	Р	Minimum detectable activity (PQL)
237785	RSAR3-35BSPLP	Thorium-228 Uranium-233/234 Uranium-238	None None None	Р	Minimum detectable activity (PQL)
237785	RSAQ4-10BSPLP	Thorium-228 Uranium-238	None None	Р	Minimum detectable activity (PQL)
237785	SA148-10BSPLP SA148-35BSPLP RSAR3-0.5BSPLP RSAR3-35BSPLP RSAQ4-10BSPLP RSAQ4-32BSPLP	All isotopes reported below the PQL.	J (all detects)	А	Sample result verification (PQL) (sp)

^{*}Corrected code for Duplicate qualification

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 237785

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary -SDG 237785

No Sample Data Qualified in this SDG

### **Tronox Northgate Henderson**

LDC #:	21990159	_ VALIDATION COMPLETENESS WORKSHEET	
SDG #:	237785	Stage 2B	
Laborator	y: GEL Laboratorie	es LLC	Re
			0 D

Date: 12-2-09 viewer: MG 2nd Reviewer:

METHOD: Isotopic Uranium (DOE EML HASL-300, U-02-RC Modified), Isotopic Thorium (DOE EML HASL-300, Th-01-RC Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments					
l.	Technical holding times	L A	Sampling dates: 9-23-09 through 10-5-09					
IIa.	Initial calibration	Α						
Hb.	Calibration verification	A						
III.	Blanks	SW						
IVa.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS/DUP					
IVa.	Laboratory control samples	Α	LCS					
V.	Tracer Recovery	Α						
VI.	Minimum Detectable Activity (MDA)	SW						
VII.	Sample result verification	N						
VIII.	Overall assessment of data	Α						
IX.	Field duplicates	7						
X	Field blanks	7						

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

D = Duplicate

TB = Trip blank

FB = Field blank EB = Equipment blank

Validated Samples:

	211 July				 	
1	SA148-10BSPLP	11	PBS	21	31	
2	SA148-35BSPLP	12	PB SPLP	22	 32	
3	RSAR3-0.5BSPLP	13		23	 33	
4	RSAR3-35BSPLP	14		24	34	
5	RSAQ4-10BSPLP	15		25	35	
6	RSAQ4-32BSPLP	16		26	36	
7	SA148-10BSPLPMS	17		27	37	
8	SA148-10BSPLPDUP	18		28	38	
9	SA148-35BSPLPMS	19		29	39	
10	SA148-35BSPLPDUP	20		30	40	

Notes:	Fluid	<b>2</b> (	West	

91990IS SDG A

Reviewer: MG Page: 1 of nd Reviewer:

SDG #: 737785	VALIDATION FINDINGS WORKSHEET  Reviewer: MG  Reviewer: 1 of the state
METHOD: Radiochemistry (Method: See Cove	required? If no, please see qualifications below.
PCi/L Units: PCi/L	Associated Samples: Q II (ND or > RL)

									_
									_
	ed	,							-
	qualifiled-					-			
Sample Identification	were						Sample Identification		
Sample for	No samples						Sample Id		
	No SX								-
									-
						amples:	·		-
						Associated Samples:			
Blank Action	Level					,	Blank Action	Level	
Blank ID	PBSPLP	9960.0					Blank ID		
Isotope		14-338				Units:	ísotope		
	i de i	2	 i	 	 	٦Ļ			 =

Sample Identification					
Blank Action	Level				
Blank ID					
isotope					

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT: If there is activity in the blank above the MDA, sample results within 10x the blank activity will be qualified as not detected "U".

DC #: 31990I 59 3DG #: 337785

### VALIDATION FINDINGS WORKSHEET **Duplicate Analysis**

Page: Reviewer:_

2nd Reviewer:

see cover **METHOD:** Radiochemistry (Method:_

Act = sample activity  $\delta = 1$  sigma error Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".  $\frac{V}{N}$  N/A. Was a duplicate sample analyzed the required frequency of 5% in this SDG?  $\frac{V}{N}$  Were all duplicate sample duplicate error ratio (DER)  $\leq$  1.42? DER =  $\frac{|\Delta c_{12}|^2}{|\Delta c_{12}|^2}$  Act = sar  $\frac{V}{N}$  N/A.

LEVEL IV ONLY:
Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Duplicate ID	Matrix	Isotope	by difference DER (Limits)	Associated Samples	Qualifications
	8	SPLP	1	0.0339 PC:/ (£0.03)		5/05/A 1d
1_						
<u></u>						
_						
,						
S 2	Comments:					

1C#: 31990 I 59 JG #: 337785

VALIDATION FINDINGS WORKSHEET

Minimum Detectable Activities

Page: of Reviewer: 2nd Reviewer:

> see cover ie following sample MDAs are above the RDL: ETHOD: Radiochemistry (Method:___

*	Sample ID	l#otop•	AAPP POL RDL (unite)	100 (g	LAG DL- MBA (units)	Finding	Qualifications
-		Tu-228	0.03	\(\frac{1}{r}\)	0.0376 (Pc: /L)	Lab Di	None/P
		0 - 935/936	-		0.0363		
		U-338			0.042H		
7	4	Tu-338			0.0364		
		U-333/33H			0.0323		
		U-235/236			6.0346		
	->	U-238			0.036		
3	3	Tr-338			0.043		
	->	U-333/334			0.0444		
2	7	Th - 338			0.0398		
		1-233/334			0.0345		
	->	0 - 339			5450.0		
2	5	Tn-338			0.0438		
	7	0-238			0.0319		
و	9	Tu-228			0.0347		
	7	U-233/334	->		A 8180.0	7	>
omments:							

### Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: September 23 through October 5, 2009

LDC Report Date: December 5, 2009

Matrix: Soil

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 2B

**Laboratory:** GEL Laboratories, LLC.

Sample Delivery Group (SDG): 237795

### Sample Identification

SA148-10BSPLP

SA148-35BSPLP

RSAR3-0.5BSPLP

RSAR3-35BSPLP

RSAQ4-10BSPLP

RSAQ4-32BSPLP

SA148-10BSPLPMS

SA148-10BSPLPDUP

SA148-35BSPLPMS

SA148-35BSPLPDUP

### Introduction

This data review covers 10 soil samples listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

### I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

### II. Calibration

### a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

### b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

### III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

No field blanks were identified in this SDG.

### IV. Accuracy and Precision Data

### a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

### b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

### c. Tracer Recovery

All tracer recoveries were within validation criteria.

### V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
SA148-10BSPLP	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	0.0321 0.0554 0.0324 0.0379	0.03 0.03 0.03 0.03	None None None None	Р
SA148-35BSPLP	Thorium-228 Uranium-238	0.038 0.0339	0.03 0.03	None None	Р
RSAR3-0.5BSPLP	Thorium-228 Uranium-233/234 Uranium-238	0.0365 0.0472 0.0373	0.03 0.03 0.03	None None None	Р
RSAR3-35BSPLP	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	0.0356 0.0399 0.0328 0.0399	0.03 0.03 0.03 0.03	None None None None	Р
RSAQ4-10BSPLP	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	0.042 0.0427 0.047 0.0354	0.03 0.03 0.03 0.03	None None None None	Р
RSAQ4-32BSPLP	Thorium-228	0.0341	0.03	None	Р

The MDA was greater than the PQL as listed above.

### VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 237795	All isotopes reported below the PQL.	J (all detects)	А

Raw data were not reviewed for this SDG.

### VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

### VIII. Field Duplicates

No field duplicates were identified in this SDG.

## Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 237795

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
237795	SA148-10BSPLP RSAR3-35BSPLP RSAQ4-10BSPLP	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
237795	SA148-35BSPLP	Thorium-228 Uranium-238	None None	Р	Minimum detectable activity (PQL)
237795	RSAR3-0.5BSPLP	Thorium-228 Uranium-233/234 Uranium-238	None None None	Р	Minimum detectable activity (PQL)
237795	RSAQ4-32BSPLP	Thorium-228	None	Р	Minimum detectable activity (PQL)
237795	SA148-10BSPLP SA148-35BSPLP RSAR3-0.5BSPLP RSAR3-35BSPLP RSAQ4-10BSPLP RSAQ4-32BSPLP	All isotopes reported below the PQL.	J (all detects)	А	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 237795

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 237795

No Sample Data Qualified in this SDG

## Tronox Northgate Henderson

LDC #: 21990J59	VALIDATION COMPLETENESS WORKSHEET	Date: 12-3-09
SDG #: 237795	Stage 2B	Page:of
Laboratory: <u>GEL Laboratories</u>	LLC	Reviewer: MG
		2nd Reviewer:

METHOD: Isotopic Uranium (DOE EML HASL-300, U-02-RC Modified), Isotopic Thorium (DOE EML HASL-300, Th-01-RC Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Technical holding times	Α	Sampling dates: 9-23-09 through 10-5-09
IIa.	Initial calibration	Α	J J
IIb.	Calibration verification	<u> </u>	
111.	Blanks	A	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/DUP
IVa.	Laboratory control samples	A	LCS
V.	Tracer Recovery	Α	
VI.	Minimum Detectable Activity (MDA)	5W	
VII.	Sample result verification	N	
VIII.	Overall assessment of data	A	
IX.	Field duplicates	1	
X	Field blanks	N	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

EB = Equipment blank

Validated Samples:

	all soil				 	
1	SA148-10BSPLP	11	PBS	21	31	
2	SA148-35BSPLP	12	PB SPLP	22	32	
3	RSAR3-0.5BSPLP	13		23	33	
4	RSAR3-35BSPLP	14		24	34	
5	RSAQ4-10BSPLP	15		25	35	
6	RSAQ4-32BSPLP	16		26	 36	
7	SA148-10BSPLPMS	17		27	37	
8	SA148-10BSPLPDUP	18		28	38	
9	SA148-35BSPLPMS	19		29	39	
10	SA148-35BSPLPDUP	20		30	40	

Notes:	Fluid	3	(Reagent	Water	<u> </u>
			0		

01990559 337795 LDC #:_ SDG #:

Page: 1 of 1

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities See METHOD: Radiochemistry (Method:__

COVEV

The following sample MDAs are above the RDL:

*	Sample ID	Isotope	RDL (units)	RDL (units) MAA (units)	1 1 2 2	
		Tu-238	1 0 0 C	( ) ( C C C ( ) ( )		<u>5</u> ∥`
			(2.5)	4/0.0501 (Pull)	Lab DL > GAFF FOL	None/P
		0-333/334		0.0554		
		7-235/236		p.0334		
	<b>&gt;</b>	U-238		0.0379		
•	•					
4	6	266- NI		0.038		
	-	0-238		0.0339		
3	3	Th-238		0.0365		
		U-233/234		0.0472		
	->	U-338		0.0373		
7	h	Th-338		0.0356		
		0-333/334		0.0399		
		U-335/336		0.0398		
	<b>&gt;</b>	U-238		0.0399		
٧	2	Tt 220				
		1100/ 200 -11		0.043		
		0-033/034		0.0497		
		0-335/336		0.047		
	•	0-338		0.0354		
و	9	14-938	<b>→</b>	0.0341	>	-
Comments:	ió					

### **LDC Report#** 21990K59

# Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

**Collection Date:** 

September 24 through October 7, 2009

**LDC Report Date:** 

January 5, 2010

Matrix:

Water

Parameters:

Isotopic Uranium & Isotopic Thorium

Validation Level:

Stage 2B

Laboratory:

GEL Laboratories, LLC.

Sample Delivery Group (SDG): 237885

### Sample Identification

M-89B

FiltB092509-A2

M-2AB

M-2009AB

M-76B

M-76009B

PB100209-A2

MC-94B

M-89BMS

M-89BDUP

### Introduction

This data review covers 10 water samples listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

### I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

### II. Calibration

### a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

### b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

### III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Samples FB0060409 (from SDG 230340) and FB080409-SO (from SDG 233776) were identified as field blanks. No isotopic uranium or isotopic thorium was found in these blanks.

Sample FiltB092509-A2 was identified as a filter blank. No isotopic uranium or isotopic thorium were found in this blank with the following exceptions:

Filter Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FiltB092509-A2	9/25/09	Thorium-230	0.0112 pCi/L	No associated samples in this SDG

Sample PB100209-A2 was identified as a pump blank. No isotopic uranium or isotopic thorium were found in this blank.

### IV. Accuracy and Precision Data

### a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

### b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

### c. Tracer Recovery

All tracer recoveries were within validation criteria.

### V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
M-89B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	0.0402 0.0356 0.036 0.0318	0.03 0.03 0.03 0.03	None None None None	Р
FiltB092509-A2	Thorium-228	0.0355	0.03	None	Р
M-2AB	Thorium-228 Thorium-230 Thorium-232 Uranium-233/234 Uranium-235/236 Uranium-238	0.0488 0.0307 0.0307 0.231 0.160 0.129	0.03 0.03 0.03 0.03 0.03 0.03	None None None None None	Р
M-2009AB	Thorium-228 Thorium-230 Uranium-233/234	0.0533 0.0343 0.0336	0.03 0.03 0.03	None None None	Р
M-76B	Thorium-228 Thorium-232	0.0406 0.0327	0.03 0.03	None None	Р
M-76009B	Thorium-228 Thorium-230	0.0563 0.0331	0.03 0.03	None None	Р
PB100209-A2	Thorium-228 Uranium-238	0.0415 0.0326	0.03 0.03	None None	Р
MC-94B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	0.0386 0.126 0.156 0.146	0.03 0.03 0.03 0.03	None None None None	Р

The MDA was greater than the PQL as listed above.

### VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P	
All samples in SDG 237885	All isotopes reported below the PQL.	J (all detects)	A	

Raw data were not reviewed for this SDG.

### VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

### *VIII. Field Duplicates

Samples M-2AB and M-2009AB and samples M-76B and M-76009B were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

	Concentration (pCi/L)		RPD	Difference		
Analyte	M-2AB	M-2009AB	(Limits)	(Limits)	Flags	A or P
Thorium-228	0.0722	0.0921	-	0.0199 (≤0.03)	-	_
Thorium-232	0.0055U	0.0279	-	0.02235 (≤0.03)	-	-
Uranium-233/234	11.2	11.4	2 (≤30)	-	-	-
Uranium-235/236	0.462	0.406	13 (≤30)	-	-	-
Uranium-238	7.39	7.46	1 (≤30)	-	-	_

	Concentra	tion (pCi/L)	200	Difference		
Analyte	M-76B	M-76009B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	0.0431	-0.00434U	-	0.04744 (≤0.03)	J (all detects) UJ (all non-detects)	A

	Concentrat	ion (pCi/L)	555	Difference		
Analyte	M-76B	M-76009B	RPD (Limits)	(Limits)	Flags	A or P
Thorium-230	0.0146U	0.0617	-	0.0471 (≤0.03)	J (all detects) UJ (all non-detects)	A
*Thorium-232	-0.00487U	0.0444	-	0.04927 (≤0.03)	J (all detects) UJ (all non-detects)	А
Uranium-233/234	4.52	4.97	9 (≤30)	-	-	-
Uranium-235/236	0.125	0.161	-	0.036 (≤0.03)	J (all detects)	А
Uranium-238	3.10	3.24	4 (≤30)	-	•	-

^{*}Corrected difference value for Thorium-232 in table above

### Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 237885

		1			
SDG	Sample	Isotope	Flag	A or P	Reason (Code)
237885	M-89B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	None None None None	Р	Minimum detectable activity (PQL)
237885	FiltB092509-A2	Thorium-228	None	Р	Minimum detectable activity (PQL)
237885	M-2AB	Thorium-228 Thorium-230 Thorium-232 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None None	P	Minimum detectable activity (PQL)
237885	M-2009AB	Thorium-228 Thorium-230 Uranium-233/234	None None None	Р	Minimum detectable activity (PQL)
237885	M-76B	Thorium-228 Thorium-232	None None	Р	Minimum detectable activity (PQL)
237885	M-76009B	Thorium-228 Thorium-230	None None	Р	Minimum detectable activity (PQL)
237885	PB100209-A2	Thorium-228 Uranium-238	None None	Р	Minimum detectable activity (PQL)
237885	MC-94B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
237885	M-89B FitB092509-A2 M-2AB M-2009AB M-76B M-76009B PB100209-A2 MC-94B	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)
237885	M-76B M-76009B	Thorium-228 Thorium-230 Thorium-232	J (all detects) UJ (all non-detects)	A	Field duplicates (Difference) (fd)

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
237885	M-76B M-76009B	Uranium-235/236	J (all detects)	A	Field duplicates (Difference) (fd)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 237885

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 237885

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Filter Blank Data Qualification Summary - SDG 237885

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Pump Blank Data Qualification Summary - SDG 237885

No Sample Data Qualified in this SDG

## Tronox Northgate Henderson

		Tronox trogato frontacioon	
LDC #:	21990K59	VALIDATION COMPLETENESS WORKSHEET	Date: 19-3-09
SDG #:	237885	Stage 2B	Page: 1_of_1_
Laborator	y: GEL Laboratories I	LC	Reviewer: MG
			2nd Reviewer:

METHOD: Isotopic Uranium (DOE EML HASL-300, U-02-RC Modified), Isotopic Thorium (DOE EML HASL-300, Th-01-RC Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
<u>l.</u>	Technical holding times	A	Sampling dates: 9-24-09 through 10-7-09
lla.	Initial calibration	Α	
IIb.	Calibration verification	Α	
III.	Blanks	Α	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	Α	MS/DUP
iVa.	Laboratory control samples	Α	LCS
V.	Tracer Recovery	Α	
VI.	Minimum Detectable Activity (MDA)	SW	
VII.	Sample result verification	N	
VIII.	Overall assessment of data	Α	
IX.	Field duplicates	SW	D= 3+4. D= 5+6
X	Field blanks	SW	Filter blank = 2 Pump blank = * 7

Note:

A = Acceptable

¥ = ND = No compounds detected

FB= * FB060409 D = Duplicate

N = Not provided/applicable SW = See worksheet

R = Rinsate FB = Field blank

TB = Trip blank
EB = Equipment blank FB= * F8080409-GW (SDG: 233776)

Validated Samples: all water

1	M-89B	11	PBW	21	31
2_	FiltB092509-A2	12		22	32
3	M-2AB	13		23	33
4	M-2009AB	14		24	34
5	M-76B	15		25	35
6	M-76009B	16		26	36
7	PB100209-A2	17		27	37
8	MC-94B	18		28	38
9	M-89BMS U Th	19		29	39
10	M-89BDUP U Th	20		30	40

lotes:	
	_

LDC #: 31990 K59 237885

# VALIDATION FINDINGS WORKSHEET

Field Blanks

Page: 1 of 2nd Reviewer: Reviewer:

METHOD: Radiochemistry (Method: See Cover

(V) N/A Were field blanks identified in this SDG?

(V) N/A Were target isotopes detected in the field blanks?

Blank units: Pc i / L Associated sample units: Pc i / L Sampling date: 9-35-09

Field blank type: (circle one) Field Blank / Rinsate / Other) Filter Blank Associated Samples:

None

Analyte	Blank ID	Blank	Sample Identification
	8	Limit	No samples where others of
Tu-330 0.0113	0.0113		
Blank units:		Associated s	Associated sample units:
Sampling date:	9:		
Field blank ty	rpe: (circle o	ne) Field Bla	Field blank type: (circle one) Field Blank / Rinsate / Other:
4			

Analyte	Blank ID	Blank	Samia Idanifilasian
		Action	
		Limit	
Samples with	isotope cond	entrations w	Samples with isotope concentrations within five times the accordance for the first concentrations within the first first concentrations within the first concentrations within the first concentrations within the first concentrations within the first concentration of the first concentration o
֓֞֝֞֜֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓	ì		med masociated lield biglik concentration are listed above, these sample results were qualified as not detected,

DC #: 31990K59

# **VALIDATION FINDINGS WORKSHEET**

of 20

Page:

Reviewer: 2nd Reviewer:

Minimum Detectable Activities

ne following sample MDAs are above the RDL:

ETHOD: Radiochemistry (Method:___

see cover

*	Sample ID	lsotope	AAPP POL RDL (units)	QAPP POL LAG DL RDL (units) MBA (units)	Finding	Qualifications
-		Tu-228	0.03 (PC:/L)	0.0402 (PCI/L)	Lab D	None / P
	_	Th -230		0.0356		
		456/886-D		0.036		
	~	U-235/236		0.0318		
3	۲	Tu-228		0.0355		
3	3	Th-338		0.0488		
		Tu-230		0.0307		
		Th -232		0.0307		
		U-233/234		0.231		
		U - 335/236		0.160		
	<u> </u>	0-938		60.19		
2	7	Th-338		0.0533		
		Th - 330		0.0343		
		U-333/334		0.0336		
5	\$	Tu-338		90400		
		Th - 232		0.0327		
9	9	Th-238		0.0563		
		Th-330		0.0331		
-	_	TH-938		0.0415		
	7	U-338	<b>^</b>	0.0336	~	•
mments:						

DC#: 31990K59 JG #: 237885

**VALIDATION FINDINGS WORKSHEET** 

Minimum Detectable Activities

Page: 2 of 2 Reviewer: 2nd Reviewer:

> re following sample MDAs are above the RDL: ETHOD: Radiochemistry (Method:____

see cover

*	Sample ID		AAPP POL RDL (unite)	A PP POL LA 6 DL RDL (units)	Finding	Qualifications
သ	80	38	0.03 (PC:/L	0.0386 (PCi/L	Lab D	None/P
		_		0.136		
		336		0.156		
			<b>→</b>	0.146	7	,
omments:						

LDC #: <u>21990 K59</u> SDG #: 237885

### VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:	ot
Reviewer:	MG
2nd reviewer:	$-4\Delta$

METHOD: Radiochemistry	(Method:	see	cover

Y) N N/A

Were field duplicate pairs identified in this SDG? Were target isotopes detected in the field duplicate pairs?

	Activity ( P	c:/L)	
Isotopes	3	4	d: fferage / RPD
Tu-230	0.0722	0.0931	0.0199 (£0.03)
Tu-232	0.00555 U	0.0279	d:fference 0.02235 (±0.03)
U-233/234	11.2	11.4	2 ( < 30)
U-235/236	0.462	0.406	13 (± 30)
U-238	7.39	7.46	(£30)

	Activity ( PCi/L ) by differ		by difference
isotop <del>es</del>	5	6	Qual parentonly
T4-228	0.0431	-0.00434 U	0.04744 (±0.03) J/UJ/A
Tu-230	0.0146 U	0.0617	0.0471 ( )
Tu-232	-0.00487 U	0.0444	0.04997 ( ) )
			•
		·	

	Activity (	pc:/u )	Qual parentonly
Isotopes	5	. 6	difference / RPD
U-233/234	4.52	4.97	9 RPD ( < 30)
U-235/236	0.125	0.161	d:fference 0.036 (±0.03) Jdets/A fd
U-238	3.10	3.24	4 (≤ 30)
			-

	Activity ( )	
isotop <del>es</del>		RPD
		444
	-	407
		4984
		41

# Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: October 5 through October 6, 2009

LDC Report Date: December 5, 2009

Matrix: Soil/Water

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 2B

**Laboratory:** GEL Laboratories, LLC.

Sample Delivery Group (SDG): 238405

### Sample Identification

RSAQ4-0.5B SA111-25BDUP

RSAQ4-10B

RSAQ4-25B

RSAQ4-32B

SA214-0.5B

SA214-15B

SA214-30B

SA214-43B

SA111-1.5B

SA111-10B

SA111-25B

SA111-39B

EB100509-SO1A4

SA103-0.5B

SA103-10B

SA103009-10B

SA103-25B

SA103-35B

EB100609-SO1A4

SA111-25BMS

### Introduction

This data review covers 19 soil samples and 2 water samples listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

### I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

### II. Calibration

### a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

### b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

### III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Samples EB100509-SO1A4 and EB100609-SO1A4 were identified as equipment blanks. No isotopic uranium or isotopic thorium were found in these blanks with the following exceptions:

Equipment Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
EB100509-SO1A4	10/5/09	Thorium-232	0.0055 pCi/L	RSAQ4-0.5B RSAQ4-10B RSAQ4-25B RSAQ4-32B SA214-0.5B SA214-15B SA214-30B SA214-43B SA111-1.5B SA111-1.5B SA111-10B SA111-25B SA111-39B

Sample concentrations were compared to concentrations detected in the equipment blanks as required by the QAPP. No sample data was qualified.

Sample FB080309-SO (from SDG 234414) was identified as a field blank. No isotopic uranium or isotopic thorium was found in this blank with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB080309-SO	8/3/09	Uranium-238	0.0126 pCi/L	All soil samples in SDG 238405

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

### IV. Accuracy and Precision Data

### a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
SA111-25BDUP (All soil samples in SDG 238405)	Uranium-235/236	68.0 (≤20)	-	J (all detects) UJ (all non-detects)	А

### b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

### c. Tracer Recovery

All tracer recoveries were within validation criteria.

### V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
RSAQ4-0.5B	Thorium-228	0.119	0.05	None	Р
	Thorium-230	0.0756	0.05	None	
	Uranium-233/234	0.0525	0.04	None	
	Uranium-235/236	0.0649	0.04	None	

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
RSAQ4-10B	Thorium-228	0.114	0.05	None	Р
NOAQ+10D				l .	'
	Thorium-230	0.0597	0.05	None	
	Uranium-233/234	0.075	0.04	None	
	Uranium-238	0.0908	0.04	None	
RSAQ4-25B	Thorium-228	0.0946	0.05	None	P
	Thorium-230	0,0611	0.05	None	1 '
	Uranium-233/234	0,068	0.04	None	· I
	Uranium-238	0.068	0.04	None	
	Oranium-200	0.000	0.04	None	
RSAQ4-32B	Thorium-228	0.140	0.05	None	Р
	Thorium-230	0.0984	0.05	None	
	Uranium-233/234	0.0831	0.04	None	
		1	5.5 .	110110	
SA214-0.5B	Thorium-228	0.117	0.05	None	Р
	Thorium-230	0.0512	0.05	None	
	Uranium-233/234	0.0925	0.04	None	
	Uranium-235/236	0.089	0.04	None	1
	Uranium-238	0.072	0.04	None	
	Craimain 200	5.5, 2	5.5 .		
SA214-15B	Thorium-228	0.162	0.05	None	Р
	Thorium-230	0.0951	0.05	None	
	Uranium-233/234	0.0874	0.04	None	
	Uranium-238	0.068	0.04	None	
04044.000	The serious coo	0.404	0.05	NI	<del>                                     </del>
SA214-30B	Thorium-228	0.181	0.05	None	P
	Thorium-230	0.0977	0.05	None	1
	Uranium-233/234	0.0637	0.04	None	
	Uranium-235/236	0.0629	0.04	None	
SA214-43B	Thorium-228	0.109	0.05	None	P
3A214-13D	Thorium-230	0.0808	0.05	None	'
	•				1
	Uranium-233/234	0.116	0.04	None	İ
	Uranium-235/236	0.0864	0.04	None	
	Uranium-238	0.0847	0.04	None	
SA111-1.5B	Thorium-228	0.0933	0.05	None	P
	Thorium-230	0.0774	0.05	None	
	Uranium-233/234	0.0791	0.04	None	
	Uranium-235/236	0.0878	0.04	None	
	S. a	0.3070	3.01	1.10110	
SA111-10B	Thorium-228	0.110	0.05	None	Р
	Thorium-230	0.0533	0.05	None	
	Uranium-238	0.0507	0.04	None	
01444.055	The street con	0.1	0.55		
SA111-25B	Thorium-228	0.147	0.05	None	Р
	Thorium-230	0.0798	0.05	None	
	Uranium-233/234	0.0903	0.04	None	
	Uranium-238	0.0703	0.04	None	

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
SA111-39B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	0.112 0.0791 0.127 0.0818 0.0662	0.05 0.05 0.04 0.04 0.04	None None None None None	Р
SA103-0.5B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	0.119 0.0599 0.0747 0.0639 0.0747	0.05 0.05 0.04 0.04 0.04	None None None None None	P
SA103-10B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	0.111 0.0967 0.0919 0.0743	0.05 0.04 0.04 0.04	None None None None	Р
SA103009-10B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	0.114 0.0806 0.0856 0.0658	0.05 0.05 0.04 0.04	None None None None	Р
SA103-25B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	0.100 0.0518 0.0748 0.064	0.05 0.05 0.04 0.04	None None None None	Р
SA103-35B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	0.117 0.0557 0.0689 0.0698	0.05 0.04 0.04 0.04	None None None None	Р

Sample	Isotope	Lab DL (pCi/L)	PQL (pCl/L)	Flag	A or P
EB100509-SO1A4	Thorium-228	0.0309	0.03	None	Р

The MDA was greater than the PQL as listed above.

### VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 238405	All isotopes reported below the PQL.	J (all detects)	Α

Raw data were not reviewed for this SDG.

### VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

### **VIII. Field Duplicates**

Samples SA103-10B and SA103009-10B were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

	Concentrat	ion (pCi/g)		<b></b>		
Analyte	SA103-10B	SA103009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.73	1.57	10 (≤50)	-	-	-
Thorium-230	1.08	1.03	5 (≤50)	-	-	-
Thorium-232	1.26	1.43	13 (≤50)	-	-	-
Uranium-233/234	1.16	1.15	1 (≤50)	-	-	-
Uranium-235/236	0.0581U	0.0859	-	0.0278 (≤0.04)	-	-
Uranium-238	0.947	1.07	12 (≤50)	-	-	-

### Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 238405

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
RSAQ4-10B RSAQ4-25B RSAQ4-32B SA214-0.5B SA214-15B SA214-30B SA214-43B SA111-1.5B SA111-10B SA111-25B SA111-39B SA103-0.5B SA103-0.5B SA103-10B SA103-25B SA103-35B		Uranium-235/236	J (all detects) UJ (all non-detects)	A	Duplicate sample analysis (RPD) (ld)
238405	RSAQ4-0.5B SA214-30B SA111-1.5B SA103009-10B SA103-25B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	None None None None	Р	Minimum detectable activity (PQL)
238405	RSAQ4-10B RSAQ4-25B SA214-15B SA111-25B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
238405	RSAQ4-32B	Thorium-228 Thorium-230 Uranium-233/234	None None None	Р	Minimum detectable activity (PQL)
238405	SA214-0.5B SA214-43B SA111-39B SA103-0.5B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None None	Р	Minimum detectable activity (PQL)
238405	SA111-10B	Thorium-228 Thorium-230 Uranium-238	None None None	Р	Minimum detectable activity (PQL)
238405	SA103-10B SA103-35B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None	P	Minimum detectable activity (PQL)
238405	EB100509-SO1A4	Thorium-228	None	Р	Minimum detectable activity (PQL)

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
238405	RSAQ4-0.5B RSAQ4-10B RSAQ4-25B RSAQ4-32B SA214-0.5B SA214-15B SA214-30B SA214-43B SA111-10B SA111-10B SA111-25B SA111-39B EB100509-SO1A4 SA103-0.5B SA103-10B SA103-25B SA103-35B EB100609-SO1A4	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 238405

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Equipment Blank Data Qualification Summary - SDG 238405

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 238405

No Sample Data Qualified in this SDG

## **Tronox Northgate Henderson**

_DC #:	21990L59	VALIDATION COMPLETENESS WORKSHEET	Date: 12-3-09
SDG #:_	238405	Stage 2B	Page: I of I
_aborato	ry: GEL Laboratories	LLC	Reviewer: MG
			2nd Reviewer: 1

METHOD: Isotopic Uranium (DOE EML HASL-300, U-02-RC Modified), Isotopic Thorium (DOE EML HASL-300, Th-01-RC Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments				
1.	Technical holding times	Α	Sampling dates: 10-5-09 + hrough 10-6-09				
lla.	Initial calibration	Α					
IIb.	Calibration verification	A					
111.	Blanks	Α					
IVa.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS/DUP				
IVa.	Laboratory control samples	A	MS/DUP LCS/LCSD				
V.	Tracer Recovery	Α					
VI.	Minimum Detectable Activity (MDA)	SW					
VII.	Sample result verification	N					
VIII.	Overall assessment of data	Α					
IX.	Field duplicates	SW	D = 15+16				
х	Field blanks	SW	EB= 13 *19				

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

FB= * = ND = No compounds detected

FB080309-S0 D = Duplicate TB = Trip blank

R = Rinsate FB = Field blank EB = Equipment blank

### Validated Samples:

1	RSAQ4-0.5B S	11	SA111-25B S	21	SA111-25BDUP	31
2	RSAQ4-10B	12	SA111-39B	22 1	PBS	32
3	RSAQ4-25B	13 2	EB100509-SO1A4 W	23 2	PB W	33
4	RSAQ4-32B	14	SA103-0.5B S	24		34
5	SA214-0.5B	15	SA103-10B	25		35
6	SA214-15B	16	SA103009-10B	26		36
7	SA214-30B	17	SA103-25B	27		37
8	SA214-43B	18	SA103-35B	28		38
9	SA111-1.5B	19 2	EB100609-SO1A4 W	29		39
10	SA111-10B	20	SA111-25BMS 4 Th S	30		40

recounted negative result 3x error. PB was NO QUAL

LDC #: 319901 59 SDG #: 38405

# VALIDATION FINDINGS WORKSHEET

Field Blanks

Page:   of	Reviewer: MG	2nd Reviewer:

Were target isotopes detected in the field blanks?  $P^{C_1/L}$  Associated sample units:  $P^{C_1/c}$  is: 8-3-09Field blank type: (circle one) Field Blank/ Rinsate / Other: Were field blanks identified in this SDG? cover METHOD: Radiochemistry (Method: 566 Sampling date:_ N N/A N N/A Blank units:

Associated Samples: GII Soil ( > RI)		Sample Identification	No somoto	Same of the same o						
Field blank type: (circle one) Field Blank / Rinsate / Other:										
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rpe: (circle o	Blank ID		FB CF 0309-50	0.0136						
Field blank ty	Analyte		F 8 0 8	< RL 0-338	J					
				18 ×	!				 	لتحد

Sampling date: 10 - 5 - 09
Field blank type: (circle one) Field Blank / Rinsate / Other.) Associated sample units: PCI Blank units: PCi/L

Associated Samples: EB

( Y RL)

Tu-333 0.0055  Tu-333 0.0055	The 333 0.0055  The 333 0.0055  The 333 0.0055  Samples with isotope concentrations within that those the concentrations within that those the concentrations within that those the concentrations within that the concentrations within that the concentrations within that the concentrations within the concentrations within that the concentrations within the concentrations within the concentrations within the concentrations within the concentrations within the concentrations within the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentrations with the concentration of the concentrations with the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the concentration of the con	Th-339 0.0055  Th-339 more multiple identitions with isotope concentrations within five times the associated field blank concentration are listed obtain. Its		Analyte	Blank ID	Blank	Committee Lander - 1
13 Unit No samples were qualified — Tu-333 0.0055	Th-333 0.0055  Th-333 0.0055  Samples with solope concentrations within the times the concentrations within the times the concentrations within the times the concentrations with solope  Th-33 0.0055  Th-33 0.0055  Samples with sotope concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations within five times the associated field blank concentration are listed of the concentrations with a concentration and the concentrations with a concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the concentration and the concentration are listed of the co				Action	Cample Identification	
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31990159 238405 .DC #: ,DG #:_

# **VALIDATION FINDINGS WORKSHEET**

**Duplicate Analysis** 

0	2	3
Page:	Reviewer:_	2nd Reviewer:

Sec **AETHOD:** Radiochemistry (Method:

Corer

Was a duplicate sample analyzed the required frequency of 5% in this SDG? Were all duplicate sample duplicate error ratio (DER)  $\leq 1.42$ ? DER=  $\frac{|Act_1-Act_2|}{2|\delta_1^2+\delta_2^2|^{1/2}}$  Act = sample activity  $\delta=1$  sigma error  $2|\delta_1^2+\delta_2^2|^{1/2}$ Nease see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A". Was a duplicate sample analyzed the required frequency of 5% in this SDG?

YAN N/A Were all duplicate sample duplicate error ratio (DER)  $\leq 1.42$ ? DER = 1000 1.42 1.42 1.42 1.42 1.42 1.42 1.42 1.42 1.42 1.42 1.42 1.42 1.42 1.42 1.42

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. EVEL IV ONLY:

Qualifications	5/05/A 14										
Associated Samples	a11 soil										
R PD <b>DER</b> (Limits)	(oe =) 0.89										
Isotope	0-335/336										
Matrix	50.1										
Duplicate ID	16										
*	-										

Comments:_

LDC #: 31990L59 SDG #: 338405

# VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 1 of 4

see cover METHOD: Radiochemistry (Method:___

The following sample MDAs are above the RDL:

*	ol dames.		WAPP POL	Lab DL		
	CI Aldinas	edojosi	RDL (units)	m Ver	Finding	Qualifications
	_	T4-338	0.05 (PC:/4	(pc:/4)	Lab DL > GAPP POL	None / P
		Th-230	0.05	0.0756		.1
		U-333/234	0.04	0.0535		
	<b>→</b>	U- 335/336	0.04	0.0649		
2	ď	Th - 328	0.05	0.114		
		Th-330	0.05	0.0597		
		U-333/334	0.04	0.075		
	^	U - 338	0.04	0.0408		
3	3	Tn-338	0.05	0.0946		
		Tn-330	0.05	0.0611		
		U-333/334	0.04	0.068		
	>	U - 338	0,0u	0.069		
ェ	h	Tu-238	0.05	01110		
		71, - 320	0.00	0000		
		000	0.02	0.0484		
	•	U-333/334	0.04	0.0831		
ļ						
ک	٨	Th-338	0.05	0.117		
		T4-230	50.05	0.0512		
		U-333/234	0.04	2660.0		
		U - 335/336	pc.04	0.089		
	<b>→</b>	U-238	0.04	0.072		
9	9	Th-338	0.05	0.162		
		TH-330	50.0	0.0951		
	>	U-733/934	0.04	0.0874		
Comments:	<b>→</b>	U- 338	bo.0	0.068		
			,	•	7	7

91990159 SDG #: 338405 LDC #:_

# VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 2 of 4 Reviewer:

METHOD: Radiochemistry (Method: SPE Cover

The following sample MDAs are above the RDL:

	OL Late DL MBA (units)	A PP POL LA 6 DL RDL (units) MBA (units)
		(PC:/4
_	0.0977	0.05 1 0.0977 1
. 1	0.0637	
	0.0639	
-	601.0	
l.— i	0.0808	
	911.0	
	6.0864	
	2480·0	
_		
	0.0933	
<b> </b>	PTT0.0	
<u> </u>	0.0791	
Ш	0.0878	
Н	0.110	0.05
	0.0533	
	0.0507	
-		
$\dagger$	741.0	741.0 20.0
$\vdash$	0.0798	
$\vdash$	0.0903	
1	0.0703	<b>→</b>
- [		
•		

Comments:

LDC #: 31990L59 SDG #: 338405

## VALIDATION FINDINGS WORKSHEET

Minimum Detectable Activities

Page: 3 of 4 Reviewer:

The following sample MDAs are above the RDL:

METHOD: Radiochemistry (Method: SCC Cover

*	Sample ID	Isotope	QAPP POL RDL (units)	Late DL MBA (units)	Finding	Qualifications
3	7	Th-338	0.05 (pc:/4)	2	Lab Di	None/P
		Th-230	0.05 1	_		J
		U-233/234	6.04	161.0		
		0-335/236	Ø.04	8180.0		
	>	U -338	1 40.0	0.0662		
			İ	_		
(3	3	T4-338	0.03 (pci/L	0.0309 (PC:/L)		
ΣĮ	14	Tu-238	0.05 (pci/g	(pc:/4) 0.119 (pc:/4)		
		Th -330				
		n - 333 /334	0.04	0.0747		
		0 - 335/336	P0.04	0.0639		
	<b>&gt;</b>	ს -	6.04	7470.0		
~	اج	Th-338	0.05	0.111		
		U-333/334	PO.04	0.0967		
		0 - 335/236	ho.o	0.0919		
	<b>-&gt;</b>	U - 338	40.0	0.0743		
و	91	Tr-338	0.05	0.114		
		Tu-230	0.05	0.0806		
		hee/eee-0	6.04	0.0856		
	-2	0 - 235/336	6.04	0.0658		
	[7	Th-238	0.05	0.100		
		Th -730	0.05	0.0518		
		- 933/	po.04	0.0748		
	Ą	U - 235/336	0.04	0.064 W	7	-
						,

Comments:

LDC #: 31990L59 SDG #: 338405

## VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 4 of 4

Reviewer:

METHOD: Radiochemistry (Method: See Cover

The following sample MDAs are above the RDL:

#	Sample ID	Isotope	AAPP POL RDL (units)	- La b DL MBA (units)	Finding	Outlies
18	81	Th - 338	0.05 (pc:/4	) 0.117 (pc:4)	Lab D	None / P
		U-333/334	40.0d	0.0557		
		U-335/236	p. 04	6.0689		
	*	U - 338	0.04	0.0698		
Comments:						

LDC #: 21990 L59 SDG #: 238405

### **VALIDATION FINDINGS WORKSHEET** Field Duplicates

Page:_	
Reviewer:	MG
2nd reviewer:	

METHOD: Radiochemistry	(Mathod:	see	cover	1
ME I HOD. Hadiocheimsuy	(INIELLIOU			

N N/A

Were field duplicate pairs identified in this SDG? Were target isotopes detected in the field duplicate pairs?

	Activity (	PCi/q)	
isotopes .	15	16	RPD
Tu-228	1.73	1.57	10 (450)
Tu-230	1.08	1.03	5 (   )
Tu-232	1.26	1.43	13 ( 🗸 )
			<u> </u>

	Activity ( P	ci/q )	
, Isotop <del>es</del>	15	16	difference APD
. U - 233/234	1.16	1.15	1 RPD (≤50)
U - 235/236	0.0581 U	0.0859	difference 0.0278 (≤0.04)
U-238	0.947	1.07	12 (≤ 50)
			,

	Activity (	)	
sotopes			RPD
			-

	Activity (	) .	
Isotopes	·		RPD
		•	
			·

### Laboratory Data Consultants, Inc. **Data Validation Report**

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

**Collection Date:** October 6 through October 7, 2009

LDC Report Date: December 8, 2009

Matrix: Soil

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 4

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 238477

### Sample Identification

SA138-0.5B RSAR5-40BDUP

SA138-10B

SA138009-10B

SA138-30B

SA138-45B

RSAR5-0.5B

RSAR5-10B

RSAR5-25B

RSAR5-40B

**RSAS5-0.5B** 

RSAS5-10B

RSAS5-25B RSAS5-36B

RSAS5009-36B

RSAP5-0.5B

RSAP5-10B

RSAP5009-10B

RSAP5-25B

RSAP5-39B

RSAR5-40BMS

### Introduction

This data review covers 21 soil samples listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

### I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

### II. Calibration

### a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

### b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

### III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample EB100609-SO1A4 (from SDG 238405) was identified as an equipment blank. No isotopic uranium or isotopic thorium were found in this blank.

Sample FB080309-SO (from SDG 234414) was identified as a field blank. No isotopic uranium or isotopic thorium was found in this blank with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB080309-SO	8/3/09	Uranium-238	0.0126 pCi/L	All samples in SDG 238477

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

### IV. Accuracy and Precision Data

### a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
RSAR5-40BDUP (All samples in SDG 238477)	Thorium-232	26.5 (≤20)	-	J (all detects) UJ (all non-detects)	А

### b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

### c. Tracer Recovery

All tracer recoveries were within validation criteria.

### V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
SA138-0.5B	Thorium-228 Thorium-230	0.0931 0.0521	0.05 0.05	None None	Р
SA138-10B	Thorium-228 Thorium-230	0.105 0.978	0.05 0.05	None None	Р
SA138009-10B	Thorium-228 Thorium-230 Uranium-233/234	0.0843 0.0827 0.0535	0.05 0.05 0.04	None None None	Р
SA138-30B	Thorium-228 Thorium-230 Uranium-235/236 Uranium-238	0.115 0.0636 0.0697 0.0564	0.05 0.05 0.04 0.04	None None None None	Р
SA138-45B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	0.128 0.0743 0.0621 0.0415 0.0537	0.05 0.05 0.04 0.04 0.04	None None None None	Р
RSAR5-0.5B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	0.102 0.0723 0.0604 0.0523	0.05 0.05 0.04 0.04	None None None None	Р

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
RSAR5-10B	Thorium-228	0.139	0.05	None	P
	Thorium-230	0.143	0.05	None	'
	Uranium-233/234	0.0574	0.04	None	
	Uranium-235/236	0.0507	0.04	None	
	Uranium-238			None	
	Oranium-236	0.0574	0.04	None	
RSAR5-25B	Thorium-228	0.128	0.05	None	Р
	Thorium-230	0.0708	0.05	None	
	Uranium-233/234	0.115	0.04	None	
	Uranium-238	0.0886	0.04	None	
	-		· · · · · · · · · · · · · · · · · · ·		
RSAR5-40B	Thorium-228	0.0989	0.05	None	Р
	Thorium-230	0.114	0.05	None	
	Uranium-233/234	0.068	0.04	None	
	Uranium-235/236	0.0526	0.04	None	
	Uranium-238	0.0546	0.04	None	
RSAS5-0.5B	Thorium-228	0.119	0.05	None	Р
NOA00-0.0D	Uranium-238	0.119	0.05	None	
	Oranium-236	0.0416	0.04	None	
RSAS5-10B	Thorium-228	0.0641	0.05	None	Р
	Uranium-235/236	0.0495	0.04	None	
RSAS5-25B	Uranium-233/234	0.0526	0.04	None	Р
	Uranium-238	0.0473	0.04	None	
RSAS5-36B	Thorium-228	0.0673	0.05	None	P
NOAGGGGG					[
	Thorium-230	0.066	0.05	None	
	Uranium-233/234	0,052	0.04	None	
RSAS5009-36B	Thorium-228	0.114	0.05	None	Р
	Thorium-230	0,121	0.05	None	
	Thorium-232	0.116	0.10	None	
	Uranium-233/234	0.0486	0.04	None	
	Uranium-235/236	0.0468	0.04	None	
RSAP5-0.5B	Thorium-228	0.0534	0.05	None	P
	Thorium-230	0.0524	0.05	None	
	Uranium-233/234	0.0893	0.04	None	
	Uranium-235/236	0.0894	0.04	None	
	Uranium-238	0.0776	0.04	None	
DOADE 402	The siture 200	0.5544	0.05	N	
RSAP5-10B	Thorium-230	0.0541	0.05	None	P
	Uranium-235/236	0.0563	0.04	None	
RSAP5009-10B	Thorium-228	0.0642	0.05	None	Р
	Thorium-230	0.0504	0.05	None	'
	Uranium-233/234	0.0863	0.04	None	
	Uranium-235/236	0.0686	0.04	None	
	Uranium-238	į	0.04	None	
	UtatilUtti-230	0.0799	U.U4	I None	1

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
RSAP5-25B	Thorium-228	0.0963	0.05	None	Р
	Thorium-230	0.088	0.05	None	
	Uranium-233/234	0.0516	0.04	None	1
	Uranium-235/236	0.0526	0.04	None	]
	Uranium-238	0.0516	0.04	None	
RSAP5-39B	Thorium-228	0.0646	0.05	None	Р
	Thorium-230	0.0506	0.05	None	
	Uranium-233/234	0.0725	0.04	None	
	Uranium-235/236	0.0628	0.04	None	
	Uranium-238	0.0546	0.04	None	

The MDA was greater than the PQL as listed above.

### VI. Sample Result Verification and Project Quantitation Limit

All sample result verifications were acceptable.

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 238477	All isotopes reported below the PQL.	J (all detects)	А

### VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

### **VIII. Field Duplicates**

Samples SA138-10B and SA138009-10B, samples RSAS5-36B and RSAS5009-36B, and samples RSAP5-10B and RSAP5009-10B were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

	Concentra	tion (pCi/g)				
Analyte	SA138-10B	SA138009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.51	2.01	28 (≤50)	-	-	-
Thorium-230	1.12	1.62	36 (≤50)	-	-	-
Thorium-232	1.36	1.45	6 (≤50)	-	-	-

	Concentra	tion (pCi/g)				
Analyte	SA138-10B	SA138009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Uranium-233/234	1.26	1.20	5 (≤50)	-	-	-
Uranium-235/236	0.0802	0.0897	-	0.0095 (≤0.04)	-	-
Uranium-238	1.06	1.22	14 (≤50)	-	-	-

	Concentrat	ion (pCi/g)				
Analyte	RSAS5-36B	RSAS5009-36B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.04	1.08	4 (≤50)	-	-	-
Thorium-230	2.25	1.78	23 (≤50)	-	-	-
Thorium-232	0.868	0.993	13 (≤50)	-	-	-
Uranium-233/234	2.13	2.05	4 (≤50)	-	-	-
Uranium-235/236	0.101	0.142	<del>-</del>	0.041 (≤0.04)	J (all detects)	А
Uranium-238	1.86	2.08	11 (≤50)	-	-	-

	Concentrat	tion (pCi/g)		<b>.</b>		
Analyte	RSAP5-10B	RSAP5009-10B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.58	1.49	6 (≤50)	-	-	-
Thorium-230	0.898	0.928	3 (≤50)	-	-	-
Thorium-232	1.49	1.39	7 (≤50)	-	-	-
Uranium-233/234	1.00	0.853	16 (≤50)	-	-	-
Uranium-235/236	0.0882	0.0558U	-	0.0324 (≤0.04)	-	-
Uranium-238	0.946	0.920	3 (≤50)	-	-	-

### Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 238477

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
238477	SA138-0.5B SA138-10B SA138009-10B SA138-30B SA138-45B RSAR5-0.5B RSAR5-10B RSAR5-25B RSAR5-40B RSAS5-0.5B RSAS5-10B RSAS5-25B RSAS5-36B RSAS5-36B RSAS5-36B RSAS5-36B RSAS5-0.5B RSAS5-0.5B RSAS5-0.5B RSAS5-0.5B RSAS5-0.5B RSASS-0.5B RSASS-0.5B RSASS-0.5B RSASS-0.5B RSASS-0.5B RSASS-0.5B RSASS-0.5B RSASS-0.5B RSASS-0.5B	Thorium-232	J (all detects) UJ (all non-detects)	A	Duplicate sample analysis (RPD) (Id)
238477	SA138-0.5B SA138-10B	Thorium-228 Thorium-230	None None	Р	Minimum detectable activity (PQL)
238477	SA138009-10B RSAS5-36B	Thorium-228 Thorium-230 Uranium-233/234	None None None	Р	Minimum detectable activity (PQL)
238477	SA138-30B	Thorium-228 Thorium-230 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
238477	SA138-45B RSAR5-10B RSAR5-40B RSAP5-0.5B RSAP5009-10B RSAP5-25B RSAP5-39B	Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-235/236 Uranium-238 RSAP5-25B		Р	Minimum detectable activity (PQL)
238477	RSAR5-0.5B RSAR5-25B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
238477	RSAS5-0.5B	Thorium-228 Uranium-238	None None	P	Minimum detectable activity (PQL)
238477	RSAS5-10B	Thorium-228 Uranium-235/236	None None	Р	Minimum detectable activity (PQL)

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
238477	RSAS5-25B	Uranium-233/234 Uranium-238	None None	Р	Minimum detectable activity (PQL)
238477	RSAS5009-36B	Thorium-228 Thorium-230 Thorium-232 Uranium-233/234 Uranium-235/236	None None None None None	Р	Minimum detectable activity (PQL)
238477	RSAP5-10B	Thorium-230 Uranium-235/236	None None	Р	Minimum detectable activity (PQL)
238477	SA138-0.5B SA138-10B SA138009-10B SA138-30B SA138-45B RSAR5-0.5B RSAR5-10B RSAR5-25B RSAR5-40B RSAS5-0.5B RSAS5-10B RSAS5-25B RSAS5-36B RSAS5-36B RSAS5-36B RSAS5-0.5B RSAS5-0.5B RSAS5-0.5B RSAS5-0.5B RSAS5-0.5B RSAS5-10B RSASS-0.5B RSASS-0.5B RSASS-0.5B RSASS-0.5B RSASS-0.5B RSASS-0.5B RSASS-0.5B RSASS-0.5B	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)
238477	RSAS5-36B RSAS5009-36B	Uranium-235/236	J (all detects)	A	Field duplicates (Difference) (fd)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 238477

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Equipment Blank Data Qualification Summary - SDG 238477

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 238477

No Sample Data Qualified in this SDG

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							- 4		Page: <u>/ of /</u>
Labor	atory: GEL Laboratories	LLC	<del></del>			O)	14		Reviewer: MG
							•		2nd Reviewer:
Modifi The s	ed)	e revi		,					EML HASL-300, Th-01-RC
	Validation	Area					Comi	nents	
1,	Technical holding times		•	Α	Samp	lina d		thro	ugh 10-7-09
lla.	Initial calibration			A		<u>.</u>		, 0, 0	7
IIb.	Calibration verification			Α					
III.	Blanks			A					
IVa.				SW	M	5/	DUP		
IVa.				Α	L	c S			
V.				Α					
VI.	Minimum Detectable Activit	y (MDA	۹)	SW					
VII.	Sample result verification		'	AN					
VIII.	Overall assessment of data			Α	<u> </u>				
IX.	Field duplicates			5W			+3, D= 13+14		
Lx_	Field blanks	<del>;</del>		SW	E				4 (SDG: 238405)
Note: Validat	A = Acceptable N = Not provided/applicable SW = See worksheet ed Samples:		<b>¥ =</b> ND = No R = Rins FB = Fi€		s detec	⊬ B	B = FB 080309 - D = Duplicate TB = Trip blank EB = Equipment bla		( SDG: 234414)
T I	all soil	1	T			<del></del>	l u th	<del></del>	
1	SA138-0.5B	11	RSAS5-10B			21	RSAR5-40BDUP	31	
	SA138-10B	12	RSAS5-25B			22	PBS	32	
3	SA138009-10B	13	RSAS5-36B			23		33	
4	SA138-30B	14	RSAS5009-36	6B		24		34	
5	SA138-45B	15	RSAP5-0.5B			25		35	
ll	RSAR5-0.5B	16	RSAP5-10B			26		36	
	RSAR5-10B	17	RSAP5009-10	)B		27		37	
8	RSAR5-25B	18	RSAP5-25B			28		38	

Notes:		 	
		<del></del>	

RSAR5-40BMS

RSAP5-39B

y Th

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19

RSAR5-40B

RSAS5-0.5B

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	Page:_	<u>1_of_2</u>
	Reviewer:_	MG
2nd	Reviewer:	12

### Method:Radiochemistry(EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
L Technical holding times				
All technical holding times were met.	/			
II, Calibration				
Were all instruments and detectors calibration as required?	V			
Were NIST traceable standards used for all calibrations?	. /			
Was the check source identified by activity and radionuclide?	/			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	/			
III. Blanks				Г
Were blank analyses performed as required?	<b>/</b>			
Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see the Blanks validation completeness worksheet.		/		
IV. Matrix spikes and Duplicates				
Were a matrix spike (MS) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	/			
Were the MS percent recoveries (%R) within the QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	/			
Was a duplicate sample anaylzed at the required frequency of 5% in this SDG?	1			
Were all duplicate sample duplicate error rations (DER) ≤1.42?.				
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	<b>V</b>			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	/			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?	<u> </u>			
Were tracer/carrier recoveries within the QC limits?	<u> </u>			
VII. Regional Guality Assurance and Guality Control				
Were performance evaluation (PE) samples performed?		/		
Were the performance evaluation (PE) samples within the acceptance limits?			<b>✓</b>	
VIII, Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?				
Were the Minimum Detectable Activities (MDA) < RL?		/		

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### **VALIDATION FINDINGS CHECKLIST**

Page: 2 of 2 Reviewer: MG 2nd Reviewer: _____

Validation Area	Yes	No	NA	Findings/Comments
IX Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			
X Field duplicates				
Field duplicate pairs were identified in this SDG.	/			ı
Target analytes were detected in the field duplicates.	/			
XI. Field blanks				
Field blanks were identified in this SDG.	/			
Target analytes were detected in the field blanks.				

LDC #: 31990 M59 238477 SDG #:

### VALIDATION FINDINGS WORKSHEET Field Blanks

Page:	Reviewer:	2nd Reviewer:

COVER 566 **METHOD:** Radiochemistry (Method:_

Were field blanks identmed in this control blanks?

Were target isotopes detected in the field blanks?

Blank units: PC:/L Associated sample units: PC:/c
Sampling date: 8-3-09
Sampling date: 4:-1- --- Field Blank/ Rinsate / Other:

ع ا ( م ه د) Fied quali Sample Identification Associated Samples: Were amples 9 Blank Action Limit FB 08 0309-50 0.0136 Blank ID Analyte U- 338

18 ×

Associated sample units: Blank units:

Sampling date;

Field blank type: (circle one) Field Blank / Rinsate / Other:

Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected."U". Sample Identification Associated Samples: Blank Action Limit Blank ID Analyte

31990M59 738477 "= "TDC #: SDG #:

### VALIDATION FINDINGS WORKSHEET **Duplicate Analysis**

2nd Reviewer: Page:__ Reviewer:_

METHOD: Radiochemistry (Method:_

see cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Act = sample activity  $\delta = 1$  sigma error Was a duplicate sample analyzed the required frequency of 5% in this SDG? Were all duplicate sample duplicate error ratio (DER)  $\leq$  1.42? DER=  $\frac{|Act_1-Act_2|}{2}$  Were all duplicate sample duplicate error ratio (DER) Y W N/A

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. LEVEL IV ONLY:

				RPD		•
*	Duplicate ID	Matrix	Isotope	ĐER (Limits)	Associated Samples	Qualifications
_	100	Soil	T4-332	36.5 (4 30)	911	J/U5/4 1d
<u></u>						
<u> </u>						
<u> </u>						
Con	Comments:					

LDC #: 21990 M 59 SDG #: 338477

## VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 1 of 4
Reviewer: MC
2nd Reviewer:

METHOD: Radiochemistry (Method: SCC Cover

The following sample MDAs are above the RDL:

			OA PP PO	L		
*	Sample ID	Isotope	.ᆁ	MBA (units)	Finding	Qualifications
-		T4-228	0.05 (pc:/k)	4) 0.0931 (PCi/	Lak D	Along / D
	7	Tu-230	0.05	0.0521		<b>\</b>
7	2	Tu-338	0.05	0.105		
	7	Tu-330	0.05	0.0978		
,						
~	2	TH-328	0.05	0.0843		
		T4-230	0.05	0.0837		
		U-333/234	0.04	0.0535		
7	7	Th-338	0.05	0.115		
		Tu-230	0.05	0.0636		
		0-335/336	h0.0	0.0697		
	~	0-238	PO.04	0.0564		
,						
3	5	Th- 328	0.05	0.128		
		Tu-230	0.05	0.0743		
		V-233/234	0.04	0.0631		
		U-935/236	0.04	0.0415		
	->	U-338	p0.0	0.0537		
1						
9	9	Bee-n]	0.05	0.102		
		Th-230	0.05	0.0723		
		N-933/934	0.04	40.00.0		
	-	U-238	9 HC.0	0.0533		

Comments:

LDC #: 21990 M 59 SDG #: 238477

## VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 2 of 4

Reviewer: 2nd Reviewer:

METHOD: Radiochemistry (Method: SCE Cover

The following sample MDAs are above the RDL:

			AAPP POL	LAG DL		
*	Sample iD	isotope	RDL (units)	MDA (units)	Finding	Qualifications
7	7	T4-238	0.05 (Pci/	() 0.139 (PCib)	Lah D	None / P
		Th-230	0.05	0,143		J
		U-233/234	0.04	0.0574		
		U-335/236	ì	0.0507		
	->	U-938	h0.0	0.0574		
0						
a	22	Tu-228	0.05	0.128		
		Th -330	0.05	0.0708		
		U-233/234	0.0H	0.115		
	Ò	V-238	0.0d	0.0886		
6	6	3ec-41	0.05	0.0989		
		Tu-230	0.05	0.114		
		U-333/234	h0.0	0.068		
		0-335/936	0.04	0.0536		
	>	U-238	0.0ч	9,0546		
1						
9	10	Bee-11	0.05	0.119		
	7	0-938	0.0y	0.0416		
+		Th-338	0.05	0.064		
1	->	U-335/336	6.04	0.0495		
19						
76	7	n-933/934	0.04	0.0526		
		U-338	0.04 V	0.0473 ↓	>	
<b>—————</b>						

Comments:

JC #: 21990 M59

# VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 3 of 4
Reviewer: MC
2nd Reviewer:

ETHOD: Radiochemistry (Method: SCC Cover

ne following sample MDAs are above the RDL:

#	Sample ID	edotosi	AAPP POL RDI (unite)	AAPP POL LA6 DL BDL BDL BDL	100	
(3	13	80	0.05 (pc://	10.0673 (pc. L)	10 L D	N A A P
			0.05	0.066	2	<b>√</b> I
	٠,	7	0.04	0.052		
3	١٦	366- nl	0.05	0.114		
		T4-230	50.0	161.0		
		Tu-332	0.10	0.116		
		U-333/234	40.0	9850.0		
		U-235/236	0.04	0.0468		
7	15	Tu-338	0.05	0.0534		
		Th-230	0.05	450.0		
		N-333/334	po.04	0.0893		
		0-935/936	h0.04	P 6 80.0		
	<b>&gt;</b>	U-338	0.04	0.0776		
9	و	Th-230	0.05	0.0541		
	<b>→</b>	U-335/336	po.04	0.0563		
	7	14-938	0.05	0.0642		
		Th-230	0.05	0.050y		
		0-333/234	40.04	0.0863		
		U-235/336	0.04	0.0686		
	Å	0-938	↑ ho.o	0.0799 V	->	
ymments:						

DC #: 31990 M 59

# VALIDATION FINDINGS WORKSHEET MInimum Detectable Activities

Page; 4 of 4
Reviewer: MG
2nd Reviewer:

IETHOD: Radiochemistry (Method: SCC Cover

he following sample MDAs are above the RDL:

*	Sample ID	Isotope	AAPP POL RDL (units)	Late DL MBA (units)	Finding	Qualifications
(8	8)	Tu-338	0.05 (pc:/4)	. ~	Lab Di	None/P
		Th-330	0.05	0.088		J
		U-233/234	0.04	0.0516		
		1-335/336	0.04	9650.0		
	<b>&gt;</b>	U-238	0.04	0.0516		
ē	61	Tu-328	0.05	9,00.0		
		T4-230		0.0506		
		U-333/334		0.0735		
		0-235/236		0.0638		
	*	J-938	->	0.0546	<b>→</b>	3
mments:						

LDC #: 21990 M59 SDG #: 238477

### **VALIDATION FINDINGS WORKSHEET** Field Duplicates

Reviewer:___ 2nd reviewer:_

	•		600	A- A-	
	Radiochemistry	/A A - Alla	366	COVEN	
ME (HUD:	Radiocnemistry	imethod:		- ' 0.	
141		( · · · · · · · · · · · · · · · · · · ·			

Were field duplicate pairs identified in this SDG? Were target isotopes detected in the field duplicate pairs?

	Activity (	pci/g,	
Isotopes	2	3	RPD
Th-228	1.51	2.01	28 (±50)
Tu-230	1.12	1.62	36 ( )
Tu-232	1.36	1.45	6 (1)

	Activity ( PC	19,	
Isotopes	2	3	difference/APD
· U-233/234	1.26	1.20	5 (450)
U-235/236	0.0802	0.0897	d:fference 0.0095 (£0.04)
U-238	1.06	1.22	14 (±50)
			,

	Activity (	pcily,	
isotopes	13	14	RPD
Tu-228	1.04	1.08	4 (≤ 50)
Tu-130	2.25	1.78	23 (   )
Tu-232	0.868	0.993	13 (1)

	Activity ( PC: /q)		Qual parent only
Isotopes	13	14	difference / RPD
U-233/234	2.13	2.05	4 (£ 50)
U-235/236	0.101	0.142	0.041 (50.04) Jdets/A fd
U-238	1.86	J.08	RPO [[ ( £50)

LDC #: 21990 M59 SDG #: 238477

### VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 2 of 2
Reviewer: MG

2nd reviewer: V

	•		cas	000.0	
METHOD: RE	adiochemistry	(Method:	200	cover	١
METITOR	adiooniciniou y	(11.00.00			_

(Y) N N/A

Were field duplicate pairs identified in this SDG?

Were target isotopes detected in the field duplicate pairs?

	Activity ( PC; /q )		
isotopes	16	(7	RPD
Tu-228	1.58	1.49	6 (450)
Tu-230	0.898	0.928	3 (   )
Tn-232	1.49	1.39	7 (1)
			·

		ci/g,	
isotopes	16	17	difference/RPD
. U-233/234	1.00	0.853	16 ( ± 50)
U-235/236	0.0882	0.0558 U	difference 0.0324 (≤0.04)
U-238	0.946	0.920	3 (£50)
·			,
		·	

	Activity (	)	
isotopes			RPD
		·	
			•

	Activity (	·	·
laotopes			RPD
	•		
			3-

LDC #: 31990 M 59 238477 SDG #:

### VALIDATION FINDINGS WORKSHEET **Level IV Recalculation Worksheet**

Page: ___of__ Reviewer: 2nd Reviewer:

10/00 See

METHOD: Radiochemistry (Method:_

Percent recoveries (%R) for a laboratory control sample, a matrix spike and a matrix spike duplicate sample were recaluculated using the following formula:

%R = Found x 100 True

Where, Found = activity of each analyte <u>measured</u> in the analysis of the sample.

True = activity of each analyte in the source.

A matrix spike and matrix spike duplicate relative percent difference (RPD) was recalculated using the following formula:

iple activity imple activity

D = Duplicate sample
(S+D)/2

					Recalculated	Reported	
Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	%R or RPD	%R or RPD	Acceptable (Y/N)
	Laboratory control sample						
527		U-338	5.13 (Pci/4)	13 (PCi/g) 4.94 (PCi/g)	104	104	Y
	Matrix spike sample						
90		Th-330	8.64 (Pci/g)	8.64 (Pci, 4) 8.49 (pci,4)	102	102	
	Duplicate RPD						
9 (		U-333/334 3.7	2.75 (PC:/4)	15 (PCi/q) 3.05 (PCi/q)	10.3	10.5	
	Chemical recovery	Ac- 227					
		for Th - isotoper	4.08010 (dpm) 3.89353 (dpm)	3.89353 (d pm)	105	105	<del>-</del> >

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #:_	21990M59
SDG #:	238 477

CF = %R. Self-absorbance, abundance, ect.

### **VALIDATION FINDINGS WORKSHEET Sample Calculation Verification**

Page:	1 of 1
Reviewer:_	MG
2nd reviewer:	<b>У</b>

METHOD: Radioche	emistry (Method: See Cover )	2nd reviewer:
Please see qualifica  Y N N/A Hav  Y N N/A Are	tions below for all questions answered "N". Not a re results been reported and calculated correctly results within the calibrated range of the instrum	applicable questions are identified as "N/A". rents?
	世 1, Tu- J32 ne following equation:	reported with a positive detect were recalculated
Activity =	Recalculation:	
(cpm - bckgrd cpm) (2.22)(E)(Vol)(CF)	(201.00/1000.)	- 1 3600 pCi/
E = Efficiency Vol = Volume	(2.22) (0.250454) (0.252g) (	1.04792)

#	Sample ID	Analyte	Reported Concentration	Calculated Concentration (PC:/g)	Acceptable (Y/N)
		Tu-228	1.33	1.30	Y
		Tu-230	1.14	1.14	
_		Tu-232	1.37	1.37	
		U-233/234	0,951	0.951	
		U-235/236	0.0446	0.0446	
		U-238	1.05	1.05	
2	13	T		1.72	
4		Tu-228 Tu-230	1.56	1.53	
		Tu-232	1.44	1.44	
		U-233/234	1.74	1.74	
		U-235/236	0.0878	0.0878	
		U-238	1.29	1.29	

Note:	
	•