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Prepared for:
Tronox LLC
Henderson, Nevada

Phase B Source Area Investigation: Work Plan Tronox LLC Facility Henderson, Nevada

ENSR Corporation
September 2007
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Responsible CEM for this project

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and, to the best of my knowledge, comply with all applicable federal, state and local statutes, regulations and ordinances.

9-24-07

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ABBREVIATIONS AND ACRONYMS

ANOVA	Analysis of Variance
AP	Ammonium Perchlorate
bgs	below ground surface
BMI	Black Mountain Industrial
BRC	Basic Remediation Company
CD	Compact disc
CEM	Certified Environmental Manager
CLP	Contract Laboratory Program
CSM	Conceptual Site Model
DOT	Department of Transportation
DQIs	Data Quality Indicators
DQLs	Data Quality Limits
EAs	Evaluation Areas
EC	electrical conductivity
EDD	electronic data deliverable
EP	Extraction Procedure
EPA	United States Environmental Protection Agency
FID	flame-ionization detector
GC/MS	Gas Chromatography/Mass Spectrometry
GWTP	Groundwater treatment process
HASP	Health and Safety Plan
HSA	hollow stem auger
ICP	inductively coupled plasma
IDW	investigation-derived wastes
LOU	Letter of Understanding
MCL	Maximum Contaminant Level
ml	milliliter
MS/MSD	matrix spike/matrix spike duplicate
NDEP	Nevada Division of Environmental Protection
NTUs	nephelometric turbidity units
PDF	Portable Document File
PID	photoionization detector
PRGs	Preliminary Remediation Goals
PVC	Polyvinyl Chloride

ABBREVIATIONS AND ACRONYMS
(continued)

QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	quality control
RPD	relative percent difference
SOPs	standard operating procedures
SRCs	Site-Related Chemicals
TDS	total dissolved solids
TE	Trade Effluent
Tronox	Tronox LLC
VOA	volatile organic analysis
VOCs	volatile organic compounds
%RSD	percent relative standard deviation

EXECUTIVE SUMMARY

This document presents the Work Plan for the Phase B activities of the Source Area Investigation at the Tronox LLC facility (the Site) located within the Black Mountain Industrial (BMI) Complex in Henderson, Nevada. The Site is owned and operated by Tronox LLC (Tronox) headquartered in Oklahoma City, Oklahoma. Tronox was formerly known as Kerr-McGee Chemical LLC. The Phase B activities follow on the recently completed Phase A Source Area Investigation and are intended to further characterize soil and groundwater conditions at the roughly 450-acre site. The Source Area Investigation is being conducted under the regulatory oversight of the Nevada Division of Environmental Protection (NDEP).

This Phase B Work Plan focuses on the further evaluation of potential source areas for those Site-Related Chemicals (SRCs) identified as not adequately characterized in the *Phase A Source Area Investigation Results* report (ENSR 2007b). The scope-of-work for the Phase B Work Plan is designed to gather data for a baseline human health risk assessment. As such, samples of soil, soil gas, and groundwater will be collected and analyzed to support the evaluation of potential routes of exposure (e.g., direct contact pathway, soil to groundwater migration pathway, groundwater migration pathway, and vapor intrusion to indoor air pathway).

To gather data for the baseline risk assessment, the evaluation of exposure to SRCs along the direct soil contact pathway will involve the collection of soil samples from 51 locations across the Site; samples will be collected at depths of 0.5 feet and 10 feet below ground surface (bgs). Of these 51 locations, 33 will consist of direct contact borings only, the remaining 18 locations will be included with the deeper, Source Area Investigation borings. In addition, at select locations, soil samples will be collected at the surface for analysis of asbestos. To evaluate potential source areas of SRCs, soil samples will be collected from 57 locations. At these locations, soil samples will be collected at regular intervals between 0.5 feet bgs to within one to two feet of the water table in order to gather data to evaluate the soil to groundwater migration pathway.

Groundwater samples will be collected from 97 wells (89 existing and 8 new or replacement) to gather data to evaluate the extent of SRCs in groundwater to further delineate the extent of SRCs in groundwater above comparison levels. The Phase A Source Area Investigation identified the presence of Volatile Organic Compounds (VOCs) in subsurface soils and in shallow groundwater beneath the Site. The migration of volatile constituents from soil to groundwater or from groundwater to indoor air is a potential exposure pathway. Therefore, soil gas samples will be collected from 63 locations across the Site to gather data to evaluate the vapor intrusion to indoor air pathway.

This document presents the sampling and analytical plans to gather data for the baseline risk assessment. Field sampling activities will consist of collecting soil, groundwater, and soil gas samples for laboratory analyses. This Work Plan describes the sampling and data-gathering methods to be used, the locations to be sampled, and the analytical methodologies to be employed for the Phase B Source Area Investigation.

Following completion of laboratory analyses, data will be evaluated to verify that soil, soil gas, groundwater, and quality assurance/quality control (QA/QC) samples were collected in compliance with the specifications contained in this Work Plan.

A report will be prepared that presents the results of the Phase B Source Area Investigation. The report will include a description of the field methods employed, analytical methods, analytical results, data evaluation methods, data validation results, and a scale map containing the locations of the soil borings and monitoring wells installed. Typed boring logs and well completion diagrams will be included in the report. The results of laboratory analysis will be presented in tabulated form. The laboratory-certified analytical reports will be provided in Adobe Acrobat Portable Document File (.PDF) electronic form on a compact disc (CD) in an appendix. A Nevada-Certified Environmental Manager will sign the report.

1.0 Introduction

This document presents the Work Plan for the Phase B activities of the Source Area Investigation at the Tronox LLC facility (the Site) located within the Black Mountain Industrial (BMI) Complex in Henderson, Nevada. The Site is owned and operated by Tronox LLC (Tronox) headquartered in Oklahoma City, Oklahoma. Tronox was formerly known as Kerr-McGee Chemical LLC. The Phase B activities follow on the recently completed Phase A Source Area Investigation and are intended to further characterize soil and groundwater conditions at the roughly 450-acre site. The Source Area Investigation is being conducted under the regulatory oversight of the Nevada Division of Environmental Protection (NDEP).

The Phase B Source Area Investigation activities described herein build upon the results of the Phase A Source Area Investigation activities that were performed in November and December 2006, with supplemental groundwater sampling performed in May 2007. The Phase A activities were performed in compliance with the protocols described in the NDEP-approved *Phase A Source Area Investigation Work Plan* (ENSR 2006a) and the *Addendum to the Phase A Source Area Work Plan* (ENSR 2007a).

The Phase B Source Area Investigation Work Plan focuses on the further evaluation of potential source areas for those Site-Related Chemicals (SRCs) identified (Table I2-2, Table I2-3, and Table I2-5) as not adequately characterized in the *Phase A Source Area Investigation Results* report (ENSR 2007b). The scope-of-work for the Phase B Source Area Investigation Work Plan is designed to gather information for human health risk-based decision-making purposes. As such, samples of soil, soil gas, and groundwater will be collected and analyzed to support the evaluation of potential routes of exposure (e.g., direct contact pathway, soil to groundwater pathway, groundwater pathway, and vapor intrusion inhalation pathway).

For the direct contact soil evaluation, the Site has been subdivided into Evaluation Areas (EAs). The EA boundaries have been developed in consultation with Tronox facility staff and the Basic Remediation Company (BRC), and are based on anticipated future uses of parcels within the Site. The Site is currently an industrial facility. The remainder of the Phase B Source Area Investigation (i.e., sampling activities for soil to groundwater pathway, and vapor intrusion pathway evaluation) will be conducted on a site-wide basis. Portions of the Site may be leased or sold in the future; however, deed restrictions may be used to ensure that Site use remains industrial/commercial.

The purpose of this Work Plan is to provide Site-specific guidance by describing the sampling and data-gathering methods to be used, the locations to be sampled, and the analytical methodologies to be employed for the Phase B Source Area Investigation. Additional information, including the Site setting and history, as well as an overall description of Phase B activities and strategies, are discussed in the *Phase A Source Area Investigation Results* report (ENSR 2007b).

Documents of Record

Previously prepared planning documents for the BMI Common Areas in general, and the Tronox site in particular, have been reviewed and approved by the NDEP. These documents shall be considered documents of record and referenced as is appropriate herein to streamline the preparation of the Phase B Work Plan. These documents include the following:

- *Upgradient Investigation Work Plan* (ENSR 2006a) for the Tronox site;
- *Upgradient Investigation Work Plan Addendum* (ENSR 2006b);
- *BRC Field Sampling and Standard Operating Procedures for the BMI Common Areas* (BRC 2006);

- *Phase A Source Area Investigation Work Plan - Tronox LLC Facility, Henderson, Nevada* (ENSR 2006c);

- *Addendum to the Phase A Source Area Investigation Work Plan* (ENSR 2007a)

Other planning information, including a Site-specific Health and Safety Plan (HASP), has been prepared for this Site as an element of the *Phase A Source Area Investigation Work Plan* (ENSR 2006c). Background information including the site description, site location, physical setting, regional and local geology, etc. are described in detail in the *Phase A Source Area Investigation Work Plan* (ENSR 2006c). Rationale for the Phase B sample locations are described in Section 6 of the *Phase A Source Area Investigation Results* report (ENSR 2007b).

2.0 Identification of Data Needs

The purpose of the Phase B Source Area Investigation is to further evaluate site-related chemicals (SRCs) that were identified to be not adequately characterized by the *Phase A Source Area Investigation Results* report (ENSR 2007b).

Phase B investigations at the Site will be undertaken with the objective of collecting sufficient and suitable data necessary to determine potential exposure to selected receptors. As it is likely that future industrial and/or commercial development will occur at the Site, the roughly 450-acre Site has been subdivided into eleven EAs as shown on **Figure I2-1** for purposes of the direct contact pathway evaluation.

In order to develop a direct contact risk-based sampling approach, it is important to determine current and potential future land use and exposure pathways. As shown in **Table I2-1** the planned use for most of the EAs is commercial and light industrial. Some of the EAs are in the process of having buildings decommissioned, and are likely to remain inactive in the near future. The most likely receptors at the Site are industrial workers and construction workers. In order to determine data needs, it is important to understand the exposure pathways for these receptors.

Industrial worker – It is assumed that the outdoor industrial worker could be exposed to SRCs in surface soil (surface–0.5 feet below ground surface (bgs)) through incidental ingestion, dermal contact, and inhalation of volatiles and particulates in ambient air. Because the depth to groundwater is greater than 15 feet bgs, the industrial worker will not contact groundwater during the course of excavation activities.

Construction worker – It is assumed that the construction worker could be exposed to surface and subsurface soil (surface–10 feet bgs) through incidental ingestion, dermal contact, and inhalation of volatiles and particulates in ambient air. Because the depth to groundwater is greater than 15 feet bgs, the construction worker will not contact groundwater during excavation activities.

The evaluation of the EAs will be risk-based, and it is assumed that receptors evaluated for each EA will have consistent potential for exposure to environmental media with the boundaries of each EA. The media for which data are needed to evaluate the direct contact exposure pathway includes:

- Surface soil (surface-0.5 feet bgs)
- Subsurface soil (surface-10 feet bgs), and
- Shallow groundwater (water table) where groundwater may be encountered at or less than 10 feet in depth.

For the purpose of developing the Phase B Source Area Investigation Work Plan, it is assumed that constituents in groundwater in the alluvium beneath the Site reach and discharge to Las Vegas Wash.

This Phase B Source Area Investigation Work Plan is designed to generate data that can be used to evaluate potential exposure pathways resulting from the direct contact with surface and subsurface soils, direct contact with groundwater (via ingestion, dermal contact, and inhalation pathways) both for SRCs already present in groundwater and those that may migrate there from soil, and inhalation of volatile organic compounds (VOCs) that may migrate from groundwater and/or soil to indoor air. The indoor air intrusion pathway will be evaluated on a site-wide basis.

Sampling and analytical plans have been prepared and are discussed in the following subsections. Section 2.1 discusses the sampling and analytical plan to generate soil data that will be used to evaluate potential

exposure resulting from direct contact with SRCs in soil. Section 2.2 focuses on the evaluation of potential source areas across the Site. In this Work Plan, soil samples collected from areas identified in the *Conceptual Site Model* (CSM) report (ENSR 2005) and as identified, the Phase A Source Area Investigation as potential sources of subsurface constituents will be evaluated for SRCs that could potentially migrate to groundwater.

Section 2.3 focuses on the evaluation of SRCs in shallow groundwater beneath the Site. This consists of an evaluation of background groundwater and an evaluation of the extent of potential SRCs in groundwater beneath the site. Suitable locations of wells from which a background groundwater evaluation will also be conducted. After suitable background locations are identified and sampled, groundwater samples will be analyzed to provide a context from which on-site groundwater concentrations can be fully evaluated. This background evaluation will also be included in the Phase B Source Area Investigation.

The migration of volatile organic constituents from on-site subsurface soil or groundwater to indoor air is a potential exposure pathway. Section 2.4 presents a sampling and analysis plan for a site-wide active soil gas survey to gather data that will be used to evaluate the vapor intrusion pathway.

Lastly, Section 2.5 presents a sampling and analysis plan for further evaluation of asbestos in surface soils at the Sites as part of the direct contact pathway evaluation.

2.1 Evaluation of SRCs in Soil for the Direct Contact Pathway

Soil samples will be collected at 51 locations across the Site and analyzed for SRCs that were identified in the *Phase A Source Area Investigation Results* report (ENSR 2007b) as occurring at concentrations exceeding the comparison levels for the direct contact exposure pathway. In general, soil samples for this evaluation will be collected at 0.5 and 10 feet bgs. Based on the receptors identified in Section 2.0, direct contact of soils by industrial or construction workers are not expected at depths deeper than 10 feet bgs. Therefore, characterization for the purposes of evaluating the direct contact pathway for all SRCs, will be limited to soils no deeper than 10 feet bgs. To provide information for ongoing and planned future development of portions of the Site, this evaluation will be conducted on an EA basis to allow for more localized decision making and assessment of risk.

The soil sample locations in each EA and the proposed sample depths are listed in **Tables I2-2**. The proposed boring locations are shown on **Figure I2-2**. The distribution of locations is designed to provide general coverage within each EA, assuming that the receptors have equal probability of contacting different parts of the EA.

The number of samples to be collected from each EA is designed to provide a large enough statistical sample population to allow for completion of the planned risk assessment program.

In addition to the direct contact exposure pathway assessment conducted as a portion of this Phase B Source Area Investigation, BRC is taking the lead for those parcels located within the EAs that are currently for sale. BRC is in the process of conducting equivalent direct contact investigations in the following parcels:

- Parcel A in EA01,
- Parcel B in EA02,
- Parcels C and D in EA03,
- Parcel F in EA07,
- Parcel G in EA10, and
- Parcel H in EA11.

The Parcel boundaries are presented in **Figure I2-1**. The remainder of the EAs are included in this Phase B Source Area Investigation as described above. The results of the BRC investigations will be made available to Tronox for incorporation into the Phase B Source Area Investigation report.

Soil samples will be analyzed for the SRCs by the listed analytical methods as shown on **Table I2-2.**

2.2 Evaluation of Potential Source Areas for SRCs along the Soil to Groundwater Migration Pathway

The *Phase A Source Area Investigation Results* report (ENSR 2007b) identified SRCs in soil that may have the potential to migrate to groundwater at concentrations of concern. Potential source areas for SRCs in soil were identified in the *CSM* report (ENSR 2005). The data from the Phase A report and the CSM report (ENSR 2005) form the basis for the Phase B evaluation of potential source areas for SRCs along the soil to groundwater migration pathway.

For the Phase B Source Area Investigation, soil samples will be collected at 57 boring locations across the site as shown on **Figure I2-3**. The soil boring locations shown on this figure were selected to: 1) evaluate specific Letter of Understanding (LOU) areas identified in the *CSM* Report (ENSR 2005) as potential source areas, and 2) to further evaluate the vertical and/or horizontal extent of SRCs that were identified in the *Phase A Source Area Investigation Results* report (ENSR 2007b).

In general, soil samples for this evaluation will be collected at depths ranging from 0.5 feet bgs to within one to two feet of the water table as shown on **Table I2-3.** Soil samples will be analyzed for the SRCs as shown on **Table I2-3.** The SRCs shown on this table occurred in Phase A samples, in other previous site investigations, and the CSM at concentrations that were greater than their respective comparison level.

2.3 Groundwater Evaluation

To further evaluate groundwater conditions at the Site, groundwater samples will be collected from 97 wells (89 existing and eight new or replacement wells) to evaluate the extent of SRCs in groundwater. Additionally, groundwater samples will also be collected from selected upgradient wells to evaluate background groundwater geochemistry. These issues are discussed in greater detail below.

2.3.1 Background Groundwater

Four monitoring wells (M117, M118, M120, and M121) were installed along the southern boundary of the Site as part of the investigation to assess upgradient soil and groundwater conditions as documented in the *Upgradient Investigation Results* report (ENSR 2006e). To further evaluate upgradient groundwater conditions and to provide a context from which on-site groundwater constituent concentrations can be fully assessed, background groundwater conditions need to be evaluated.

An assessment of background groundwater quality will be undertake to foster a comparison to general water chemistry constituents, metals and radionuclides that have been carried into the Phase B Source Area Investigation. Because of the complex hydrostratigraphy and varied impacts to groundwater in the area of the site, a phased approach will be taken to investigate the groundwater geochemistry in unaffected and up-gradient areas. The phased approach to the investigation will be comprised of the following steps:

1. An assessment of regional groundwater conditions in the area of the BMI Complex as it relates to Phase B general chemistry constituents, metals and radionuclides. And from this assessment identification of unaffected areas of groundwater impacts for related Phase B constituents in both up-gradient and cross-gradient areas in the vicinity of the Site.

2. Determination if existing monitor wells are present in these areas that are completed in the same hydrostratigraphy as monitor wells that will be sampled as part of the Phase B investigation. This step includes the selection and sampling of monitor wells which are present in the unaffected areas in the vicinity of the Site.

3. And if required, selection and sampling of existing groundwater monitor wells or the installation of additional monitor wells in areas far west of the Site, outside the area of regional groundwater impacts, west of the Las Vegas Express Way (Interstate 515).

The steps are sequenced to provide information for identification of background groundwater and identify existing monitor wells that might be used in support of the project. As such, each step builds upon information gathered from previous work, and depending upon the results, may alter some of the scope of work described below. As such, with the conclusion of each step, NDEP will be apprised of the results and approach prior to proceeding.

Step 1 - Assessment of Regional Groundwater Conditions in the BMI Complex

The most recent groundwater quality data for general chemistry constituents, metals and radionuclides that have been carried into the Phase B investigation will be identified in the Tronox database and any other database provided to Tronox for the BMI Complex. Data will be plotted and contoured for all monitor wells that are completed in the Quaternary Alluvium and the upper Muddy Creek Formation. Wells selected for this assessment will be those that area screened in saturated portions of both zones, as in general, most of the wells sampled as part of the Phase B investigation are completed in both the Quaternary Alluvium and the upper Muddy Creek Formation. The intent in selection of these wells is to compare similar hydrostratigraphic conditions, and thus try to approximate similar geochemical environments.

The objective of this evaluation will be to identify unaffected areas as relates to the Phase B general chemistry constituents, metals and radionuclides.

Step 2 - Identification and Sampling of Existing Groundwater Monitor Wells

From Step 1, existing monitor wells will be identified in unaffected areas both up-gradient and cross-gradient of the site. A preliminary evaluation of potential wells that could be considered to evaluate background water quality based on preliminary assessment of regional total dissolved solids (TDS) and uranium data are shown on **Figure I2-4**. Well completion data for these wells from available database information is provided in **Table I2-4**. In some cases further assessment of the well completion and construction information will be required to determine if the well is completed in a similar hydrostratigraphic interval as those on the Site.

Table I2-5 provides a listing of the analytes and analytical methods to be used in the groundwater sampling program for background water quality analysis.

Step 3 - Identification and Sampling of Groundwater Monitor Wells West of the BMI Complex

If no suitable background wells can be identified within the area of the BMI Complex, an additional search for potential monitor wells will be conducted in areas west of the regional plumes, generally west of the Las Vegas Expressway (Interstate 515). "Far west" wells will be identified from a search of available information in State databases and will be located in Sections 3, 4, 9 and 10 of Township 22 South and Range 62 East. The focus of the search will be to identify existing groundwater monitor wells that are completed in the Quaternary alluvium and uppermost Muddy Creek Formation in a manner similar to Site wells. Additionally, information on the groundwater quality will be evaluated for each well to determine if there are local or regional plumes that contain Phase B constituents in these areas.

As a final measure, based on the research to identify existing groundwater monitor wells and regional plumes west of the BMI Complex, additional monitor wells may be installed in Sections 3, 4, 9 and 10 to provide an understanding of background groundwater quality.

2.3.2 Potential Source Areas and Groundwater Migration Pathway Evaluation

The *Phase A Source Area Investigation Results* report (ENSR 2007b) identified SRCs in groundwater that were present at concentrations above comparison levels. The Phase A Source Area Investigation report and the *CSM* report (ENSR 2005) data form the basis for the further evaluation of SRCs in shallow groundwater as part of the Phase B Source Area Investigation.

For the Phase B Source Area Investigation, groundwater samples will be collected at 97 (89 existing and 8 new) locations across the site as shown on **Figure I2-5**. The sample locations shown on this figure were selected to: 1) evaluate specific LOU areas identified in the *CSM* report (ENSR 2005) as potential source areas, and 2) to further evaluate the horizontal extent of SRCs that were identified in the *Phase A Source Area Investigation Results* report (ENSR 2007b). Some existing off-site wells were selected for sampling as part of the evaluation of potential off-site sources of SRCs.

Groundwater samples will be analyzed for the SRCs as shown on **Table I2-6.** The SRCs shown on this table occurred in Phase A samples at concentrations that were greater than the comparison level for that SRC.

2.4 Evaluation of Vapor Intrusion Pathway

The migration of volatile constituents from groundwater to indoor air is a potential exposure pathway for Site receptors. The *Phase A Source Area Investigation Results* report (ENSR 2007b) identified VOCs whose maximum detected concentrations in groundwater were greater than the vapor intrusion comparison level. Based on the *Phase A Source Area Investigation Results* report, it was concluded that the volatile constituents in groundwater have not been adequately characterized to evaluate this pathway.

To evaluate the vapor intrusion to indoor air pathway, soil gas data are recommended over other data, such as groundwater or soil matrix data, because soil gas data represent a direct measurement of the volatile constituents that could migrate into indoor air. Thus, soil gas data are preferred for calculating risk along the vapor intrusion pathway (EPA 2002).

For the Phase B Source Area Investigation, soil gas samples will be collected at 63 locations across the Site as shown on **Figure I2-6**. **Table I2-7** presents a sampling plan to collect and analyze soil gas samples to evaluate the vapor intrusion pathway. The number of soil gas sample locations are designed to provide site-wide coverage based upon the occurrence of VOCs in the Phase A groundwater samples. In addition, soil gas probes will be placed adjacent to occupied buildings on the Site. As shown on **Table I2-7**, most of the soil gas samples will be collected from 10 feet bgs. at buildings where the basement is occupied by Tronox staff on a daily basis (e.g., Unit 3, 5 and 6 Buildings), and the remaining soil gas samples (SG36-20, SG37-20, SG38-20 and SG41-20) will be collected at a depth of approximately 20 feet bgs.

2.5 Asbestos Sampling

In addition to the shallow soil sampling for SRCs discussed in Section 2.1 above, additional surface soil sampling for asbestos is necessary as part of the Phase B Source Area Investigation activity. The asbestos sampling results of the Phase A Source Area Investigation identified the presence of asbestos in the surface soil in certain portions of the Site. To further evaluate the direct contact pathway for asbestos, the Phase B Source Area Investigation will include the collection of surface soil samples (at 0.0 feet bgs.) for analysis for asbestos.

A total of 34 soil samples to be collected in the following EAs: EA05, EA06, EA07, EA08, EA09 and EA10, will be analyzed for asbestos content by method EPA/640/R-97/028. The number of samples to be collected when combined with the Phase A Source Area Investigation results for each of the EAs listed above is designed to provide a large enough statistical sample population to allow for completion of the planned risk assessment program. The locations to be sampled for asbestos are identified in **Tables I2-2** and **I2-3**. The locations of these samples are depicted on **Figures I2-2** and **I2-3**.

3.0 Description of Field Sampling and Analytical Program

Field sampling activities will consist of collecting soil, groundwater, and soil gas samples for laboratory analyses. In places, surface soil samples will be collected for asbestos analysis. Pre-field activities including underground utility clearance by a geophysical surveyor as well as notification of Underground Services Alert will be performed following the same procedures described in the *Phase A Source Area Investigation Work Plan* (ENSR 2006c).

This section describes the methods and procedures that will be used to collect the various samples for the Phase B Source Area Investigation.

3.1 Soil Sampling for Asbestos Analysis

At locations where soil samples for asbestos analysis are proposed, surface soil samples will be collected and sent to an off-site laboratory for asbestos testing. These procedures are described in BRC *SOP-12 - Surface Soil Sampling for Asbestos* (BRC 2006). To analyze soil samples for asbestos using the elutriator method (EPA Method 540 R-97/028) on which BRC *SOP-12* is based, two soil samples will be collected from each location. The first sample is a soil sample for asbestos analysis and the second is for moisture content and silt content determination which is required for the analytical procedure. A brief description of the sampling procedure is summarized below.

3.1.1 Asbestos Samples

A 50-foot-by-50-foot sampling grid will be centered over the proposed boring location. The 50-foot-by-50-foot grid will be further subdivided into quadrants measuring 25 feet on each side. A 12-inch-square plastic template will be placed in a pre-selected random location in each of the four quadrants and a stainless steel hand trowel will be used to carefully scrape the surface soil within each template to a depth of approximately one inch, and transfer the soil into a one-gallon zip-top plastic bag. Soils from all four quadrants will be placed into a single zip-top plastic bag to form a composite soil sample weighing at least one kilogram. Following this, the bag will be sealed, labeled, and prepared for shipment to the laboratory. No special preservation procedures such as placing samples on ice are required.

At boring locations in areas where the ground surface is covered with asphalt or concrete pavement, the sampling grid will be moved to the closest area of unpaved soil and four 25-foot-square quadrants will be established so that the 12-inch-square template can be placed into pre-selected random locations. From there, surface soil will be collected using the same techniques as described above.

3.1.2 Moisture and Grain Size Analyses

In addition to each composite soil sample collected for asbestos analysis, a second surface soil sample will be collected from the center of the 50-foot-by-50-foot grid for determination of moisture and silt content as described in *SOP-12* (BRC 2006). For each sample, a stainless steel hand trowel will be used to carefully scrape the surface soil to a depth of approximately one inch, and transfer the soil into laboratory-supplied wide-mouth glass jars fitted with threaded screw-on lids. Once filled, the jars will be sealed, labeled, and prepared for shipment to the laboratory.

3.2 Subsurface Soil Sampling

Soil samples will be collected using the methods described in the NDEP-approved *Phase A Source Area Investigation Work Plan* (ENSR 2006c) and the *BRC Field Sampling and Standard Operating Procedures Manual* (BRC, 2006). Sampling methodology is briefly described below.

Soil samples will be collected using a variety of methods consisting of one or more of the following: sonic drilling, hollow-stem auger (HSA) drilling, or Geoprobe™ drilling. During drilling activities, soil samples will be screened for organic vapors using a photo-ionization detector (11.8 electron volt [eV] lamp) and a flame-ionization detector (FID) using the procedures described in BRC *SOP-39 – Photoionization Detector (PID) Screening Procedure* (BRC 2006) and the *Phase A Source Area Investigation Work Plan* (ENSR 2006c). Soil borings will be logged in the field using the procedures as described in BRC *SOP-14 – Field* Documentation (BRC 2006), *SOP-17 – Soil Logging* (BRC 2006), and the *Phase A Source Area Investigation Work Plan* (ENSR 2006c).

Soil samples will be collected following the procedures described in BRC *SOP-7 – Soil Sampling* (BRC 2006). If a sonic drill rig or HSA drill rig is employed, a split-spoon sampler fitted with brass liners will be used to collect soil samples for laboratory analyses using the procedures described in BRC *SOP-23 – Split Spoon Sampling* (BRC 2006). If a Geoprobe™ drill rig is used, soil samples will be collected using a Macro-corer™ sampler fitted with acetate liners.

Soil samples designated for VOC analyses will be taken from the brass sleeve (or acetate liner) and placed into containers prescribed under U.S. Environmental Protection Agency (EPA) Method 5035. These containers would consist of either EnCore™ capsules or laboratory-supplied 40-milliliter (ml) volatile organic analysis (VOA) vials filled with pre-measured amounts of preservatives. If EnCore™ capsules are used, the samples will be collected using the procedures outlined in BRC *SOP-18 - Soil Sampling for VOCs Using EnCore™ Samplers in Compliance with USEPA Method 5035* (BRC 2006). If laboratory-supplied VOA vials are used, the samples will be collected using the procedures described in the *Phase A Source Area Investigation Work Plan* (ENSR 2006c).

Sample containers will be sealed, labeled, and placed on ice inside an ice chest and shipped to the laboratory under chain-of-custody protocol using the procedures described in BRC *SOP-06 – Sample Management and Shipping* (BRC 2006).

Each borehole will be abandoned once the target depth has been reached and the necessary samples are obtained. The boreholes will be abandoned by backfilling with a bentonite/neat cement grout using the procedures described in BRC *SOP-19 – Borehole Abandonment* (BRC 2006).

Soil cuttings (including unused soil cores) will be temporarily stored in U.S. Department of Transportation-approved steel 55-gallon drums (DOT drums) while awaiting receipt of the final laboratory results. Each drum will be managed according to the procedures described in BRC SOP-34 – *Investigative Derived Waste (IDW) Management* (BRC 2006).

Equipment cleaning or decontamination procedures will be followed using the procedures described in BRC *SOP-31 – Drilling Equipment Decontamination* (BRC 2006) and the *Phase A Source Area Investigation Work Plan* (ENSR 2006c).

3.3 Groundwater Monitoring

Groundwater monitoring will involve the installation of eight monitoring wells (seven new wells and one replacement well) and groundwater sampling of approximately 97 wells (including the 8 new wells). New monitoring wells will be placed in areas on the Site where SRCs were detected in groundwater grab samples from open boreholes during the Phase A Source Area Investigation. At other locations, new wells will be installed on the Site to further assess the extent of SRCs identified in groundwater from the Phase A Source Area Investigation.

3.3.1 Monitoring Well Installation and Well Development

Eight monitoring wells will be installed on the Site as part of the Phase B activities (seven new wells and one replacement well). Four out of the eight wells (M122, M123, M124, and M125) will be installed at the locations shown on **Figure I2-4.** These locations are adjacent to Phase A borings SA08, SA09, SA10, and SA14. (During the Phase A Source Area Investigation, groundwater grab samples were collected from the open boreholes at these four locations).

A fifth well (M111R) will be installed as a replacement for well M111, which was inadvertently damaged during Tronox decommissioning activities prior to the start of the Phase A field activities in 2006. (Because M111 was damaged, a groundwater grab sample [GWSA08] was collected from the open borehole SA08 for the Phase A Source Area Investigation). The remainder of the new wells (M126, M127, M128, and M129) will be installed at the locations shown on **Figure I2-4** along the western perimeter of the Site**.**

Monitoring wells will be installed according to the procedures described in BRC *SOP-2 – Groundwater Monitoring Well Design and Installation* (BRC 2006). Briefly, monitoring wells will be installed as follows:

Monitoring wells will be constructed of 2-inch diameter Schedule 40 polyvinyl chloride (PVC) blank casing and screen (0.020-inch slot size). The filter pack will consist of Lonestar # 3 sand or an appropriate size similar to the formation material across from the screened interval of the saturated zone. The screened interval will be 10 to 20 feet long, depending on Site-specific conditions. The screen length and depth placement will be selected by the field geologist, pending the lithologic interpretation of the soil core. Specific details regarding the design of the filter pack and well screen is described in BRC *SOP-20 – Filter Pack and Well Screen Slot-Size Determination* (BRC 2006).

To protect the well head, a steel protective casing will be cemented in-place around the well. The well casing and steel protective casing will extend at least one foot above the ground surface. A cement pad will be placed on the ground surface, around the steel protective casing. If the well is completed flush with the ground surface, a flush-mount well box with traffic-rated steel lid will be cemented around the well casing. Flush mounted well boxes will be used in traffic areas.

Each monitoring well will be developed to remove sediments from the well and to improve the hydraulic communication between the well and the aquifer formation. Well development will be performed according to the procedures described in BRC *SOP-3 – Groundwater Monitoring Well Development* (BRC 2006).

The water generated from well development activities will be placed in the GW-11 Pond on the Tronox plant where the water will pass through the on-site perchlorate removal groundwater treatment system. Materials and or equipment that come in contact with soil or groundwater will be decontaminated before use, between each well, and after the sampling event is complete.

3.3.2 Groundwater Sampling

Groundwater samples will be collected using the procedures described in BRC *SOP-5 – Water Sampling and Field Measurements* (BRC 2006*).* After water levels are measured, each well will be purged using micropurge (i.e., low-flow) methods. A stainless steel bladder pump will be used to purge each well. Water levels will be monitored during purging to ensure that the water level does not vary more than 3.6 inches (0.3 feet). Water quality parameters (e.g., pH, temperature, conductivity, dissolved oxygen, oxidation-reduction potential, etc.) will be measured and recorded on field data sheets using a water quality meter fitted with a flow-through cell. Turbidity will be measured in the field using a stand alone instrument (nephelometer). Once the parameters have stabilized as described in BRC *SOP-5* (BRC 2006), water samples will be collected. Groundwater parameter field measurements will be recorded on a field data sheet for each well.

Groundwater samples designated for metals and radionuclide analyses will be filtered in the field if turbidity levels of 10 nephelometric turbidity units (NTUs) or lower are not achieved as described in BRC *SOP-05* (BRC

2006). The purge rate of the bladder pump will be used to control the turbidity of the water sample. If turbidity levels less than 10 nephelometric cannot be attained even though the other water quality parameters have stabilized, the groundwater sample for metals and radionuclides analyses will be filtered in the field. To filter groundwater samples, an electric peristaltic pump will be used to transfer the water sample through a disposable water filter designed to remove particulate matter as small as 0.45 micrometers.

Groundwater sampling equipment will be cleaned after each well using the procedures described in BRC *SOP-5* (BRC 2006). At the end of each day's sampling, purged groundwater as well as equipment decon water will be placed into the GW-11 Pond on the Tronox plant where the water will pass through the on-site perchlorate removal groundwater treatment system. Further details regarding the groundwater sampling procedures are described in the *SOP-5* (BRC 2006).

3.4 Soil Vapor Sampling

Several volatile organic constituents were detected in groundwater samples collected across the Site during the Phase A Source Area Investigation. These constituents may potentially off-gas from the groundwater and collect in the overlying unsaturated soil in a vapor-phase. To evaluate the vapor intrusion pathway, an active soil gas survey will be performed to assess shallow soil across the Site for the presence of VOCs.

Soil gas samples will be collected using the methods described in BRC *SOP-37 – Active Soil Gas Investigation* (BRC 2006). Soil gas samples will be collected into Summa™ canisters using low-flow purge and sampling techniques. The filled Summa™ canisters will be sent to an off-site laboratory for analysis of VOCs using EPA Method TO-15. A list of the TO-15 analytes to be tested is included in Appendix B.

Once the soil gas samples are collected, the sample tubing will be removed from the ground and the borehole will be abandoned as described in *SOP-37* (BRC 2006).

3.5 Site Surveying

Sample locations including soil borings, soil gas sample points, and new monitoring wells will be surveyed as described in BRC *SOP-10 – Surveying* (BRC 2006). In general, locations will be surveyed to an accuracy of 0.01-foot vertical and 0.1-foot horizontal relative to Nevada Coordinate System Datum (North American Vertical Datum 1983 and North American Datum 1983, Nevada East Plane) by a licensed land surveyor.

3.6 Management of Investigation-Derived Wastes

Soil cuttings (including unused cores) and other solid or liquid wastes including decontamination fluids, well development water, and purged groundwater) will be temporarily stored in DOT-approved 55-gallon drums or roll-off boxes, as appropriate. Each container will be marked with water-proof labels and water-proof markers. Each container will receive a unique identification number and will be cataloged for waste containment documentation purposes. The IDW will be disposed of in an appropriated manner (including off-site disposal at a licensed treatment or disposal facility) based on the results of the analyses of the laboratory analyses.

It is anticipated that groundwater and decontamination liquids will be placed in the GW-11 pond and treated on-site by the Tronox groundwater treatment systems. These systems consist of a granular activated carbon filtration system after which the water passes through the on-site chromium removal system and the perchlorate removal system.

3.7 Analytical Testing Program

The Phase B samples (soil, groundwater, and soil gas) will be analyzed using the EPA Methods shown on **Tables I2-2** through I**2-6**. Sample containers, analytical methods, and holding times for the various analytes are listed on **Table I3-1.** This table lists the data quality limits (DQLs) for each soil and groundwater SRC.

The DQLs for soil are industry-based Preliminary Remediation Goals (PRGs) established by the EPA (EPA 2004). The laboratories have been instructed to achieve 0.1 of the DQLs where possible using the standard laboratory procedures. It should be noted that achieving these limits is dependant on the sample matrix and the concentrations of other constituents that may be present. The laboratories selected are Nevada Certified laboratories for most of the methods identified. Some methods may not have been certified by Nevada. Correspondence will be continued with the State through the Phase B Source Area Investigation process regarding the certification process and the status of certification regarding the methods proposed in this Work Plan.

The DQLs for water are drinking water maximum contaminant levels (MCLs) or tap water PRGs (EPA 2004).

3.8 Field Quality Assurance/Quality Control Requirements

An integral part of the Phase B Source Area Investigation Work Plan is the quality assurance/quality control (QA/QC) program to ensure the reliability and compatibility of all data generated during this assessment. The following subsections describe the QA/QC program that will be implemented as part of the Phase B activities at the Site.

These requirements are described in detail in the *Quality Assurance Project Plan (QAPP)* (ENSR 2006d).

3.8.1 Field QA/QC Samples

Field QA/QC procedures will be followed to ensure viability and integrity of sample analytical data. The field investigative team will be responsible for submitting QA/QC samples to the laboratory. QA/QC samples include field duplicates, trip blanks, equipment decontamination blanks, and field blanks.

3.8.1.1 Field Duplicate Samples

One field duplicate will be collected for every 10 samples submitted for analysis. The duplicate sample will be tested for the same suite of analytical parameters as the corresponding original sample. For duplicate groundwater samples, two sets of sample containers will be filled and both submitted for analysis. For duplicate soil gas samples, two Summa™ canisters will be filled simultaneously and both submitted for analysis.

3.8.1.2 Trip Blank Samples

Trip blanks are provided by the laboratory. One pair of VOA trip blanks will be included in each cooler that contains samples for VOC analyses. One trip blank per day will be analyzed for the same VOCs scheduled for analysis. The trip blanks for water samples will consist of laboratory reagent water shipped to and from the sample Site in the same type of sample containers and with the same preservative as the collected samples. Trip blanks will not be opened or exposed to the atmosphere in the field.

3.8.1.3 Equipment Decontamination Blank Samples

Equipment decontamination blanks will consist of distilled water rinsed through sampling devices. This will include the soil sampling equipment and groundwater sampling equipment used in the investigation. A minimum of one equipment blank per day of sampling will be collected and analyzed for the same set of parameters as the samples collected that day (except for cations, pH, and electrical conductivity, for which an equipment blank will not be collected). If a non-dedicated groundwater pump is used, a pump decontamination blank (pump blank sample) will be obtained for each pump used before and after use for the groundwater sampling event.

3.8.1.4 Field Blank Samples

Field blank samples consisting of the decontamination source water will be analyzed for the full suite of analyses (except for asbestos). Equipment rinsate blanks will be collected each day from water used as the final rinse of decontaminated sampling equipment.

3.9 Laboratory QA/QC Procedures

Laboratory quality control (QC) measures will be taken to confirm the integrity of the laboratory data generated during the source area investigation program. The procedures used to assess laboratory data quality are described in this section and the associated QAPP (ENSR 2006d).

Method blanks will be analyzed daily to assess the effect of the laboratory environment on the analytical results. Method blanks will be performed for each parameter analyzed.

Each sample to be analyzed for organic parameters will contain surrogate spike compounds. The surrogate recoveries will be used to determine if the analytical instruments are operating within limits. Surrogate recoveries will be compared to control limits established and updated by the laboratory based on its historical operation.

Matrix spike and matrix spike duplicate (MS/MSD) samples will be analyzed at a frequency of approximately five percent of the project samples submitted. MS/MSD results will be evaluated to determine whether the sample matrix is interfering with the laboratory analysis and provide a measure of the accuracy and precision for the associated analytical data. MS/MSD recoveries and precision will be compared to control limits established and updated by the laboratory based on its historical operation.

A full Contract Laboratory Program (CLP) laboratory QC data package will be included with the analytical results. This QC data will include method blanks, surrogate spike recoveries (for organic parameters only), matrix spike recoveries, sample duplicate or matrix spike duplicates results, all initial and continuing calibration data, all gas chromatography/mass spectrometry (GC/MS) tuning data, all instrument raw data including chromatograms and mass spectra, all inductively coupled plasma (ICP) serial dilutions and interference check sample results, all standards and sample preparation worksheets, and a case narrative describing all QA/QC non-conformances and corrective action. Radiochemical analyses reports will include calibration control charts and background results for all detectors associated with all radiochemical results. All results will be reported including estimated values between the detection and reporting limits.

Prior to submitting analytical results to Tronox/ENSR, the supervising chemist will check the entire data package so that the data are acceptable. These checks include:

- Project requirements for precision, accuracy, and detection limits;
- Analytical procedure blanks, duplicates, matrix spike recoveries, and other method required QC results; as well as internal quality checks such as anion-cation balance, measured vs. calculated total dissolved solids (TDS), and the TDS to electrical conductivity (EC) ratio; and
- Instrument standardization and response factors.

If the data are acceptable, a written report will be generated and reviewed by the senior chemist before submission to Tronox/ENSR.

3.9.1 Data Quality Indicators (DQI)

Specific quality assurance objectives for measurement are defined by precision, accuracy, representativeness, comparability, and completeness. Specific requirements for quality assurance will be based on standard laboratory methods, QAPP requirements, and data validation guidelines. Definitions of precision, accuracy,

comparability, and completeness as they pertain to analytical data are briefly described below and more thoroughly described in the project QAPP (ENSR 2006d). If data do not meet data quality objectives, action will be taken to address the issues and resolve them as appropriate.

Precision is the degree of mutual agreement characteristic of independent measurements as the result of repeated application of the process under specified conditions. It is concerned with the "closeness of results," that is, the reproducibility of measurements under a given set of conditions. Precision will be evaluated using duplicate samples and expressed as relative percent difference (RPD) or percent relative standard deviation (%RSD). These quantities are defined as follows:

$$\%RPD = (A1 - A2)/(A1 + A2)/2 \ X100$$

where A1 and A2 are the reported concentrations for each duplicate sample.

The objectives for field duplicate precision RPDs are 30% RPD for aqueous samples and 50% RPD for solid samples. The objectives for laboratory duplicate precision will be based on requirements within the appropriate EPA methods or laboratory SOPs.

Accuracy is the degree of agreement of a measured value with the true or expected value of the quantity of concern. Accuracy measures the bias in a measurement system. Accuracy will be evaluated using percent recovery data from spiked samples and laboratory control samples. Percent recovery is defined as:

$$\% \text{ Recovery} = (R / S) \ X \ 100$$

where:

S = spiked concentration.

R = reported concentration.

Percent recovery acceptance criteria used to evaluate the results will be analyte and laboratory specific and based on laboratory statistical control limits.

Completeness is the percentage of measurements made that are judged to be valid measurements. Completeness can be quantitatively assessed simply by calculation of the percentage of valid data obtained. Field completeness is a measure of the amount of valid samples obtained during all sampling for the project. The field completeness objective is greater than 90 percent. Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The laboratory completeness objective is greater than 95 percent.

Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population parameter, variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is mostly concerned with the proper design of the sampling program (i.e., that the number and locations of samples are sufficient for the purposes of the investigation). Measures can be taken to achieve a high degree of representativeness. Such measures will include but are not necessarily limited to the following:

- Obtaining samples over a range of environmental conditions. In the case of groundwater sampling, this would include (a) the systematic collection of samples over time to account for temporal variations and (b) an adequate number of, and appropriately located, sampling locations to account for spatial variations.

- Use of previously collected site-specific data to guide the selection of appropriate sampling locations and chemical parameters.

- Use of appropriate sample collection procedures.

Details of the sampling program design and sample collection procedures are presented in Sections 2 and 3.

Comparability is a qualitative expression of the measure of confidence that two or more data sets may contribute to a common analysis. Comparability of data within the investigation will be controlled by using standard EPA methods for sampling and analysis, reporting data, and data validation.

4.0 Data Evaluation and Reporting

4.1 Data Review

Data will be evaluated to verify that soil, soil gas, groundwater, and QA/QC samples were collected in compliance with the specifications contained in the Work Plan. The laboratory-certified analytical reports will be reviewed to determine if samples were analyzed within holding times and that laboratory QA/QC samples, such as MS/MSD were within the laboratory-specific acceptable ranges. Deviations, if any, will be identified. One hundred percent of the laboratory data will be reviewed and 10 percent of the laboratory packages will be undergo comprehensive data validation as described by NDEP guidance (NDEP 2006). For this reason, the laboratories have been requested to provide CLP-like data packages. If some of the validation packages indicate problems, a larger percentage may be validated. As appropriate, the following statistical tests may be applied to the data: T-test, Gehan Modification of the Wilcox Rank Sum, Analysis of Variance (ANOVA), Krusall-Wallis, Quantile Test, Slipage Test, and box and whisker plots.

4.2 Reporting of Results

A report will be prepared that presents the results of the Phase B Source Area Investigation – Phase B for soil, groundwater and soil gas sampling. The report will include a description of the field methods employed, analytical methods, analytical results, data evaluation methods, data validation results, and a scale map containing the locations of the soil borings and monitoring wells installed. Typed boring logs and well completion diagrams will be included in the report. The results of laboratory analysis will be presented in tabulated form. The laboratory-certified analytical reports will be provided in Adobe Acrobat (.PDF) electronic form on a CD in an appendix. A Nevada-Certified Environmental Manager will sign the report.

The soil data will be used to characterize the on-site soil chemistry within the alluvium and underlying Muddy Creek formation from 0.5 feet to a maximum depth of just above the water table (roughly 50 feet bgs. maximum). The groundwater data will be used to assess on-site conditions and identify SRCs that are present in the water table beneath the Site. The soil gas data will be used to assess whether on-site VOC conditions represent an indoor air intrusion risk to site occupants. These soil and groundwater data will be compared to available on-site and off-site data.

4.3 Assessment of Adequate Characterization for SRC Parameters

Consistent with the *EPA Risk Assessment Guidance for Superfund, Volume 1* (EPA 1989) and *EPA Guidance for Data Useability in Risk Assessment (Part A)* (EPA 1992), each of the SRC parameters investigated during Phase B will be evaluated to assess the adequacy of its characterization. A particular SRC parameter may be determined to be adequately characterized by applying a combination of the following evaluation steps:

- Apply appropriate statistical tools to verify the comparability of the parameter with other data populations;
- Determine if parameter detections are less than one tenth (0.10x) the available EPA Industrial PRG values or MCLs;
- Determine whether the data indicate that the parameter is either absent or is rare in frequency;
- Compare the parameter detections with the upgradient data, and assess whether background or upgradient conditions are exceeded; and,

- Determine whether the probability of a parameter occurring at a specific location or depth is remote due to the lack of evidence of historical uses and or occurrence.

These review steps, and others as needed, will be applied to the SRC data to assess whether characterization is adequate. Once a SRC parameter is established to be adequately characterized it will be recommended for exclusion from future characterization activities.

4.4 Assessment of Inadequate Characterization for SRC Parameters

Consistent with the *EPA Risk Assessment Guidance for Superfund, Volume 1* (EPA 1989) and *EPA Guidance for Data Useability in Risk Assessment (Part A)* (EPA 1992), a particular SRC parameter may be determined to be inadequately characterized when applying a combination of the following evaluation steps:

- Apply appropriate statistical tools to verify the comparability of the parameter with other data populations;

- Determine if the parameter detections exceed one tenth (0.10x) of the available EPA Industrial PRG values or MCLs;

- Determine if the parameter is present and occurs with significant frequency;

- Determine if the parameter detections are comparable to, and significantly exceed the background or upgradient data;

- Determine whether the probability of a parameter occurring at a specific location or depth is remote due to the evidence of historical uses and or occurrence.

Once a SRC parameter is established to be inadequately characterized it will be recommended for inclusion in future characterization activity (fcs).

4.5 Additional Investigation

For parameters found to be inadequately characterized, if any, additional investigative work may be needed. The supplemental activities to the Phase B Source Area Investigation may be needed to collect the data necessary to characterize the nature and extent of those SRC parameters that are inadequately characterized.

The scope of any supplemental activities will be dependent upon the combined results of the Phase A and Phase B Source Area Investigations, and the identified data gaps. If supplemental investigation activities become necessary, a work plan outlining additional recommended characterization work will be developed for NDEP review and approval.

5.0 Project Management Plan

This work is being conducted as part of the Environmental Conditions Assessment under agreements with the NDEP. The NDEP project manager is Mr. Brian Rakvica.

The Tronox project manager is Susan Crowley. Ms. Crowley is a Nevada-Certified Environmental Manager (CEM # 1428, expiring March 8, 2009) and is the person who serves as the point of contact for regulatory and environmental issues pertinent to the Site. She is located at the Tronox Henderson Facility. Her telephone number is (702) 651-2234. Ms. Crowley manages the subcontractors that will be performing the tasks described in this Work Plan. Ms. Crowley will be supported by Tronox hydrogeologist Mr. Tom Reed.

ENSR Corporation is Tronox's environmental consultant. Mr. David Gerry (Senior Program Manager), Keith Bailey (Engineer), Dr. Lisa Bradley (Senior Toxicologist), Michael Flack (Senior Hydrogeologist), Brian Ho, CEM (Field Manager), Elizabeth Perry (Geostatistician), and Robert Kennedy (Senior Chemist and Quality Assurance Officer), and ENSR Staff Geologists will be assisting with this project as needed. Ms. Elizabeth Martinez will be responsible for QA/QC of documents.

At present, the laboratory contractor has not been selected for this project; however, the selected laboratory will be certified by the State of Nevada as an environmental testing laboratory. The laboratory may subcontract some of the soil and groundwater analysis to other specialty laboratories and those subcontract laboratories will also be certified with the State of Nevada as environmental testing laboratories. Laboratory data will be provided to Tronox in hard copy format as well as Tronox-specific EQuIS™ electronic data deliverable (EDD) format. The laboratory will provide sample receipt notification upon receipt of samples at the laboratory. Specific information regarding the laboratories will be provided via letter following contract award.

The implementation of this Work Plan is the shared responsibility of the ENSR Senior Program Manager, the Field Manager, the Quality Assurance Officer, the field and office personnel, and the contractor personnel. The Senior Program Manager's responsibilities include:

- Providing the field personnel with a copy of the Work Plan;
- Notifying the laboratory regarding site-specific data quality requirements;
- Checking chain-of-custody and field logs to verify sample collection; and
- Taking corrective action, if necessary.

The responsibilities of the Quality Assurance Officer and Senior Hydrogeologist include:

- Reviewing the field and laboratory data to determine if the data quality objectives were met;
- Preparing a summary of QA/QC data; and
- Conducting audits and implementing corrective action, as necessary.

The responsibilities of the Field Manager include:

- Noting Work Plan progress and corrective actions taken on daily field logs;
- Collecting and compiling the daily field logs from field personnel and providing them to the Senior Program Manager within two days; and
- Keeping the Tronox Project Manager advised of project status daily.

The responsibilities of the office and field personnel include:

- Reviewing and implementing the Work Plan and QAPP;
- Field calibration of measurement and test equipment, as needed;
- Maintaining required documentation of activities;
- Collecting, labeling, handling, storing, shipping, and filling out chain-of-custody (COC) forms for environmental samples collected;
- Maintaining control of samples until they are appropriately released; and
- Notifying the Project Manager if there are deviations from or problems with implementing the Work Plan or with quality assurance procedures.

The responsibilities of the QA/QC of documents team include:

- Review of reports for formatting, spelling, grammar, and references.

The responsibilities of the laboratory subcontractor include:

- Provide appropriate sample containers, preservatives, and coolers to the Site;
- Advise the Project Manager of delays experienced in analyzing the samples;
- Advise the Project Manager upon receipt of samples if there are questions regarding the analysis requested or if there are quality or sample integrity issues that need to be addressed;
- Perform the requested analyses under SW-846 (EPA 1982) and/or state-approved protocols; and
- Conduct the required instrument calibration and QA/QC protocols specified in the laboratory's internal quality assurance plans.

The responsibilities of the drilling subcontractor include:

- Provide appropriate drilling equipment and trained personnel as specified in the subcontract agreements

6.0 References

BRC, 2006, Basic Remediation Company (BRC) Field Sampling and Standard Operating Procedures Manual for the BMI Common Areas, May, 2006.

ENSR, 1997, Phase II Environmental Conditions Assessment located at Kerr-McGee Chemical Corporation, Henderson Nevada, August 7, 1997.

ENSR, 2005, Conceptual Site Model, Kerr-McGee Facility, Henderson, Nevada, February 28, 2005.

ENSR, 2006a, Upgradient Investigation Work Plan, Tronox LLC Facility, Henderson, Nevada, February.

ENSR, 2006b, Upgradient Investigation Work Plan Addendum, February.

ENSR, 2006c, Phase A Source Area Investigation Work Plan, Tronox LLC Facility, Henderson, Nevada, September.

ENSR, 2006d, Quality Assurance Project Plan, September, 2006.

ENSR, 2006e, Upgradient Investigation Results report, October.

ENSR, 2007a, Addendum to the Phase A Source Area Work Plan, April

ENSR, 2007b, Phase A Source Area Investigation Results report, September.

Environmental Protection Agency (EPA), 1982, Test Methods for Evaluating Solid Waste – Physical/Chemical Methods, SW-846, 2nd Edition.

EPA, 1989, EPA Risk Assessment Guidance for Superfund, Volume 1.

EPA, 1992, EPA Guidance for Data Useability in Risk Assessment (Part A).

EPA, 2002, OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), EPA 530-D-02-004. November 2002.

EPA, 2004, Region 9 Preliminary Remediation Goals, October.

NDEP, 2006, NDEP Guidance on Data Validation, BMI Plant Sites and Common Areas Projects, Henderson, Nevada

TABLES

Table I2-1
Phase B Sampling Rationale for Source Area Investigation
Phase B Source Area Investigation Results
Tronox Facility - Henderson, Nevada

Constituent	LOU #	Section in CSM Document	Table Number	Description	Proposed Phase B Sampling	Figure Number	Boring ID
Ammonia							
	16 & 17	4.1.1	7	**AP Ponds** AP-1, AP-2, AP-3 are three of five synthetically lined surface impoundments that were part of the ammonium perchlorate (AP) manufacturing process.	One deep soil boring has been proposed adjacent to AP-1 to address this potential source area.	6-7	SA64
	18	4.1.1	7	**AP-4 Pond** AP Ponds Soils from adjacent to the drum crushing area (LOU 31) were transported to AP-4 for recovery of the residual perchlorate.	One deep soil boring has been proposed to address this potential source area.	6-7	SA63
	19	4.1.1	7	**AP-5 Pond** AP-5 is one of five synthetically lined surface impoundments were part of the AP manufacturing process.	One deep soil boring has been proposed to address this potential source area.	6-7	SA72
	30	4.1.2		**Ammonium Perchlorate Area - Pad 35** "L" shaped concrete pad south of building known as Old D-1. Area used for the accumulation of drummed common trash potentially contaminated with perchlorate and other industrial wastes, such as cooling tower sludge and iron oxide sludge.	Phase A soil borings, SA15, SA16, and SA19 are in this area. Two additional deep soil borings have been proposed west of this area to address this potential source area.	6-7	SA74
	31	4.1.3		**Drum Crushing and Recycling Area** The drum crushing area (serving the ammonium perchlorate production) consisted of a drum crusher located on a concrete pad located just east of the old D-1 building. Drums destined for disposal were emptied and rinsed prior to delivery to this area. Soils adjacent to the drum crushing area were transported to the AP-4 pond for recovery of the residual perchlorate.			
	32	4.1.4		**Groundwater Remediation System** The groundwater remediation includes a line of groundwater interceptor wells, the groundwater treatment process (GWTP), the groundwater barrier wall, two recharge trenches, and the GW-11 pond. The GWTP is located to the east of new D-1 building on a 60 foot by 20 foot concrete pad with containment curbing. In the early 1990s portions of the recharge trenches became plugged and required modifications. During this time treated water occasionally would emerge from the trenches' water elevation test wells and impact surface soils. This water contained iron oxide, which colored the affected area red.			
	52	4.1.7		**AP Plant Area Screening Building, Dryer Building, and Associated Sump** Wash-down water, on rare occasions, would overflow. Soil (didn't say from where) exhibiting white stains was collected and recycled for perchlorate recovery.	Two deep soil borings have been proposed to address this potential source area; one adjacent to the building, one to the west for delineation.	6-7	SA65
	53	4.1.8		**AP Plant Area Tank Farm** Tank farm contained a number of vertical open-top and closed-top tanks used for process solution storage. Secondary containment and sump, contained reported spills.	One deep soil boring has been proposed to address this potential source area.	6-7	SA60
	54	4.8.25		**AP Plant Area Change House/Laboratory and Septic Tank** Laboratory operations included rinsing laboratory equipment, preparing standards, analyzing inorganic samples, preparing analytical solutions, and preparing dilute titrants. Hazardous solutions were collected and shipped to an appropriate disposal facility. Rinse water from the laboratory entered the septic system until August 1992 when the use of the septic system was discontinued. The change house showers, restrooms, and laboratory sinks now discharge to a pump station, which transfers the water to the City of Henderson sanitary drains. Based on this use, this is not considered to be a significant source area.	No deep soil borings have been proposed.		
	55	4.1.9	32	**Area Affected by July 1990 Fire** Fire occurred on the ammonia perchlorate drum storage pad area. Soil around fire area was impacted with ammonium perchlorate, which was washed off the concrete pad by the fire suppression water. Impacted soil was collected and returned to the ammonia perchlorate process to recover residual perchlorate.	No deep soil borings have been proposed.		
	56	4.1.10		**Plant Area Old Building D-1 Wash-down** Ammonia perchlorate dust fell on old D-1 building floor. Dust was swept up and washed down monthly. Wash-down water contained dissolved ammonia perchlorate and drained onto the asphalt pad surrounding the building. Some of the wash water drained onto the soil adjacent to the asphalt .	No deep soil borings have been proposed.		

Table I2-1
Phase B Sampling Rationale for Source Area Investigation
Phase B Source Area Investigation Results
Tronox Facility - Henderson, Nevada

Constituent	LOU #	Section in CSM Document	Table Number	Description	Proposed Phase B Sampling	Figure Number	Boring ID
	57 & 58	4.1.11		**AP Plant Area New Building D-1 Wash-down and AP Plant Transfer lines to Sodium Chlorate Process** Transfer lines lead to the AP Plant surface impoundments and the AP Plant. The transfer lines occasionally released process solution to the ground.	One deep soil boring has been proposed east of New Building D-1 address this potential source area. One deep soil borings has been proposed in the western portion of the AP Plant Transfer Lines to address this potential source area.	6-7	SA70 SA74
					Two deep soil borings have been proposed to bound the eastern and western extent of this potinetial source area (LOU 57 and 58).	6-7	SA66 SA75
Arsenic							
	1	4.8.1	26	**Trade Effluent Settling Ponds** The TE ponds were operated as unlined storage impoundments for acid waste neutralized with caustic liquor. Soil samples analyzed in 1997 show that arsenic range from 3.2 mg/kg to 18.3 mg/kg. Two soil samples (SB1-5 and SB1-7) exceeded 6.29 mg/kg (95th percentile of background for Phase A report).	No deep soil borings have been proposed.		
	4	4.7.1		**Hardesty Chemical Site** Hardesty leased the property in the vicinity o f Unit 2 (as well as elsewhere in the BMI Complex). Products listed for proposed production included muriatic acid, synthetic hydrochloric acid, monochlorobenzene, paradicyhlorobenzene, orthodichlorobenzene, DDT, and soda arsenite solution.	One deep soil boring has been proposed to address this potential source area.	6-8	SA84
	5	4.8.4	28	**On-Site Portion of Beta Ditch Including the Small Diversion Ditch** The Beta Ditch could have carried a wide variety of chemicals throughout its history. Three soil samples were above the detection limit at concentrations of 13 mg/kg, 24 mg/kg, and 83 mg/kg. All exceeded 6.29 mg/kg (95th percentile of background for Phase A report).	Two deep soil borings have been proposed to address this potential source area.	6-8	SA67 SA71
	62	4.8.28	33	**State Industries Inc. Site, Including Impoundments and Catch Basin** State Industries leased portions of the Kerr-McGee property for the manufacture and storage of hot water heaters and operated two surface impoundments. Soil samples analyzed in 1996 show that arsenic was concentrations ranging from 6.7 mg/kg to 110 mg/kg. Two soil samples exceeded 6.29 mg/kg (95th percentile of background for Phase A report).	One deep soil boring has been proposed to address this potential source area.	6-8	SA28
	35	4.8.19	31	**Truck Emptying Area** The truck emptying area was used for the unloading of inorganic materials. The soil samples from the truck emptying area show arsenic concentrations ranging from 3.9 mg/kg to 24.5 mg/kg.	Based on the Phase A results for arsenic above background at SA09, two deep soil borings have been proposed to address this area and downgradient of this area.	6-8	SA56 SA57 SA68
Barium							
	1	4.8.1	26	**Trade Effluent (TE) Settling Ponds** The TE ponds were operated as unlined storage impoundments for acid waste neutralized with caustic liquor. Soil samples analyzed in 1997 show that barium concentrations range from 72.3 mg/kg to 812 mg/kg. One sample (SB1-7) exceeded 464 mg/kg (95th percentile of background for Ph A report).	No deep soil borings have been proposed.		
	35	4.8.19	31	**Truck Emptying Area** The truck emptying area was used for the unloading of inorganic materials. The soil samples from the truck emptying area show barium concentrations ranging from 161 mg/kg to 1450 mg/kg.	No deep soil borings have been proposed.		
Beta-BHC							
	5	4.8.4	28	**On-Site Portion of Beta Ditch Including the Small Diversion Ditch** The Beta Ditch could have carried a wide variety of chemicals throughout its history. This ditch was investigated during the 1996 Phase II ECI. Beta-BHC was detected in one soil sample at 1.4J mg/kg near the western boundary of the Tronox Facility. Montrose, to the west, manufactured Beta-BHC and it is still stored on site.	Four deep soil borings have been proposed along the western property boundary to address this potential source area.	6-18	SA56 SA57 SA67 SA68
	4	4.7.1	20	**Hardesty Chemical Site** NDEP has anecdotal Information that Beta-BHC may have been produced or used at this facility.	One deep soil boring has been proposed to address this potential source area.	6-18	SA84
Boron							
	20	4.6.1		**Pond C-1 and Associated Piping** Pond used to evaporate non-hazardous process water. Analytical data from this area is for pH, EC, total Cr, Mn, and ClO4. This pond is lined.	Two deep soil borings have been proposed to address this potential source area.	6-9	SA62 SA71

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Constituent	LOU #	Section in CSM Document	Table Number	Description	Proposed Phase B Sampling	Figure Number	Boring ID
	21	4.3.2	13	**Pond Mn-1 and Associated Piping** Boron from the production process is transferred in the washing solution. Sulfuric acid washes metallic boron. Currently washing solution gets pumped to Mn-1 pond as boron sulfate (insoluble). Historically this pond has received washing solution. This pond is lined.	Two deep soil borings have been proposed to address this potential source area.	6-9	SA59 SA61
				Building North of Units 4 and 5 Original production areas for elemental boron, boron trichlorate, and boron triflouride were in the area northeast of the crane bay and northeast of Unit 5 in the dirt area. In the early 1990's production was move to its current location north of Unit 4. Raw products used in production include metallic boron, boron oxide, magnesium metals, boron carbide. Boron is not used in aqueous form. Boron is transferred in washing solution generated by the boron production process. Sulfuric acid washes metallic boron. Currently washing solution gets pumped to Mn-1 pond as boron sulfate (insoluble). Historically both C-1 and Mn-1 ponds received washing solution. Storm sewers, sanitary sewers, and acid drain systems may be a source for some subsurface contamination.	Three deep soil borings have been proposed in the area upgradient, at, and downgradient of Unit 5 to address the original production location as potential source area. Phase A soil samples SA06 and SA07 also address this area.	6-9	SA33 SA36 SA37
Carbon Tetrachloride							
				Potential sources identified off-site along the western site boundary.	Seven deep soil borings have been proposed along the western property boundary to characterize the potential for an off-site source area, as well as the truck emptying area.	6-23	SA48 SA49 SA55 SA56 SA57 SA67 SA68
Chlorobenzene							
	5	4.8.4	28	**On-Site Portion of Beta Ditch Including the Small Diversion Ditch** The Beta Ditch could have carried a wide variety of chemicals throughout its history. Chlorobenzene was detected in one soil sample along the west end of the Beta Ditch at a concentration of 2,200 mg/kg (comparison level for chlorobenzene is 0.07 mg/kg).	Phase A soil samples, SA14, SA16, and SA17 have adequately characterized this area.		
				Potential sources identified off-site along the western site boundary.	Seven deep soil borings have been proposed along the western property boundary to characterize the potential for an off-site source area as well as the truck emptying area.	6-24	SA48 SA49 SA55 SA56 SA57 SA67 SA68
Chloroform							
	62	4.8.28	33	**State Industries Inc. Site, Including Impoundments and Catch Basin** State Industries leased the property for the manufacture and storage of hot water heaters. Two surface impoundments were operated and analysis of sludge samples indicated that the material was non-hazardous based on EP Toxicity tests.	One deep soil boring has been proposed in this area.	6-25	SA28
				Unit 4 Although there is no record of uses of chloroform at the site, there is a groundwater plume that appears to emanate from this area.	Four deep soil borings are proposed in this area. Two deep soil borings are proposed just north of Chemstar.	6-25	SA30 SA31 SA32 SA39 SA34 SA51
				Vicinity of SA11 Chloroform concentrations greater that the direct contact comparison level of 0.047 mg/kg.	Three Deep soil borings are proposed in this area.	6-25	SA45 SA50 SA53
	35	4.8.19	31	**Truck Emptying Area** The truck emptying area was used for the unloading of inorganic materials. Chloroform concentrations are elevated in deep soils in this area. The source could be this area or an area off-site.	Four deep soil borings are proposed in this area.	6-25	SA48 SA49 SA55 SA56
				Western Property Boundary Groundwater concentrations are elevated in this area. The source could be off-site.	Three deep soil borings are proposed in this area along the western property boundary.	6-25	SA57 SA67 SA68

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Chromium (hexavalent)							
total	1	4.8.1	26	**Trade Effluent (TE) Settling Ponds** The TE ponds were operated as unlined storage impoundments for acid waste neutralized with caustic liquor. Soil samples analyzed in 1997 show that chromium was detected at concentration of 14.3 mg/kg to 43.5 mg/kg at depths between 1 foot and 10 feet. Phase A background level for total chromium is 14.5 mg/kg for alluvium (95th percentile of background for Phase A report).	Two deep soil boring have been proposed on the west and east of this area to address this potential source area.	6-10	SA77 SA78
total	2	4.8.2	27	**Open Area due South of Trade Effluent Settling Ponds** Analytical results of soil samples collected from the TE ponds indicate that total Cr concentrations in soil samples range from 5.70 to 43 mg/kg. 95th percentile of background is 14.5 mg/kg.	Phase A soil sampling at SA18 has adequately characterized this area. No deep soil borings have been proposed.		
	5	4.8.4	28	**On-Site Portion of Beta Ditch Including the Small Diversion Ditch** The Beta Ditch could have carried a wide variety of chemicals throughout its history. This ditch was investigated during the 1996 Phase II ECA. As, Cr, and Pb, were elevated relative to the 95th percentile of background.	Phase A soil sampling at SA14, SA16, and SA17 has adequately characterized this area. No deep soil borings have been proposed.		
total	7	4.4.1	8	**Old P-2 Pond and Associated Conveyance Facilities** Ponds used to collect and concentrate dilute sodium chlorate solutions as apart of the sodium chlorate production process. Ponds were lined with single-layer synthetic liners. Total chromium was detected in at concentrations ranging from 23.5 mg/kg to 1,560 mg/kg.	Phase A soil sampling at SA11 has adequately characterized this area.		
total	8	4.4.1	8	**Old P-3 Pond and Associated Conveyance Facilities** Ponds used to collect and concentrate dilute sodium chlorate solutions as apart of the sodium chlorate production process. Ponds were lined with single-layer synthetic liners. Total chromium was detected above 14.5 mg/kg (95th percentile of background for Phase A report) in pond during Phase II ECA.			
total	9	4.4.2	9	**New P-2 Pond and Associated Piping** It is assumed that this pond received the same dilute sodium chlorate solutions from the sodium chlorate production process as the Old P-2 Pond. Pond has been lined since initial construction.			
	11	4.4.3		**Sodium Chlorate Filter Cake Drying Pad Area** Area used to dry particulate material removed from the sodium chlorate process. When pad structure was demolished "discolored soil was removed and disposed of with the concrete." Material removed was disposed of as hazardous waste due to total chromium content of the upper surface; however, there is no record of confirmation samples for this area.	Phase A soil sampling at SA04 has adequately characterized this area. No deep soil borings have been proposed.		
total	13 & 14	4.2.5	10 & 11	**Ponds S-1 and P-1** S-1 and P-1 ponds were single-lined surface impoundments used by the sodium chlorate process. During closure of the ponds, approximately two feet of soil from beneath the floor of each pond was removed and soils sampled and analyzed to confirm adequate soil removal. Soil samples were analyzed by Extraction Procedure (EP) Toxicity methods and revealed concentrations of total soluble chromium between <0.02 mg/l and 0.11 mg/l. NDEP has indicated that no further action was required for LOU #13 and #14.	This area has been remediated and NDEP has indicated that no further action is required.		
?	15	4.4.6	12	**Platinum Drying Unit** In this area, a sodium perchlorate process byproduct which contained recoverable amount of platinum was worked and platinum was recovered. Pad sampled for metals using TCLP. Metals results were below the method detection limit with the exception of chromium samples. Area was demolished, waste transported as hazardous waste. Soil under pad was sampled for total chromium. Chromium concentrations were 50.7 ppm, 17.8 ppm, and 24.7 ppm.	Phase A soil sampling at SA05 and SA06 has adequately characterized this area. No deep soil borings have been proposed.		
total	16 & 17	4.4.7	7	**AP-1, AP-2, and AP-3 and Associated Transfer lines** Ponds were part of the AP manufacturing process. Soil beneath ponds was analyzed for total chromium. Concentrations ranged from 3.4 mg/kg to 540 mg/kg. One soil sample in AP-2 exceeded 5 mg/kg for TCLP for chromium.	One deep soil boring has been proposed in the area of AP-1 Pond to address this potential source area.	6-10	SA64
	28	4.4.8		**Hazardous Waste Staging Area** Wastes handled consisted of used oil, flammable wastes from parts washing, hexavalent chromium-contaminated material, and miscellaneous compatible wastes. Materials placed on these pads were contained in drums. Soil beneath and around the pad was removed to a depth of four feet. No confirmation samples were reported for this area.	Phase A soil sampling at SA04 has adequately characterized this area. No deep soil borings have been proposed.		

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	32	4.4.9		**Groundwater Remediation System** The groundwater remediation includes a line of groundwater interceptor wells, the groundwater treatment process (GWTP), the groundwater barrier wall, two recharge trenches, and the GW-11 pond. The GWTP is located to the east of new D-1 building on a 60 foot by 20 foot concrete pad with containment curbing. In the early 1990s portions of the recharge trenches became plugged and required modifications. During this time treated water occasionally would emerge from the trenches' water elevation test wells and impact surface soils. This water contained iron oxide, which colored the affected area red.	One deep soil boring location has been proposed to address this area.	6-10	SA75
total	35	4.8.19	31	**Truck Emptying Area** "Unknown" waste materials disposed in this area. Soil samples collected in southern portion showed total chromium concentrations ranging from 13 mg/kg to 24.2 mg/kg.	One deep soil boring has been proposed in the center of this area to address this potential source area. Phase A soil sample SA09 has adequately characterized the northern portion of this area.	6-10	SA48
	43	4.4.10		**Unit 4 and 5 Basements** Sodium chlorate and sodium perchlorate (at times) were produced in electrolytic cells. Both of these processes contained chlorate and perchlorate as well as sodium dichromate (hexavalent chromium). The process liquids contained primarily sodium chlorate with sodium dichromate as a process chemical additive. Retention of process liquids in the basements and sump areas of Units 4 and 5 was identified as a potential source of chromium in groundwater. Some or all of the soils underlying Units 4 and 5 may be impacted with concentrations of perchlorate, chlorate, or chromium. The basements in these units were used as sumps to collect spillage and wash-water.	Five deep soil borings have been proposed in this area to address this potential source area, as well as two downgradient soil sample locations, for a total of 7 deep soil borings.	6-10	SA30 SA31 SA32 SA33 SA34 SA37 SA39
	46	4.4.11		**Former Old Main Cooling Tower and Recirculation Lines** The former old Main Cooling Tower was located north of the manganese dioxide process leach plant. Historically it experienced several recirculation water upsets, which resulted in discharge of high-conductivity water to the Beta ditch. Individual discharges varied from a few hours to several days. The estimated water discharge was reported to the NDEP along with analytical results for pH, conductivity, sodium chloride, zinc and phosphate. The NDEP required no further action. This area is upgradient of the on-Site groundwater interception system/groundwater barrier wall.	No deep soil borings have been proposed. The NDEP required no further action.		
total	54	4.8.25	32	**AP Plant Area Change House/Laboratory and Septic Tank** Wastewater effluent from the change house showers, restrooms, and laboratory sinks discharged to a septic system with an associated leach field. Laboratory operations included rinsing laboratory equipment, preparing standards, analyzing inorganic samples, preparing analytical solutions, and preparing dilute titrants. Hazardous solutions were collected and shipped to an appropriate disposal facility. Rinse water from the laboratory entered the septic system until August 1992. In August 1992, the use of the septic system was discontinued. The change house showers, restrooms, and laboratory sinks now discharge to a pump station, which transfers the water to the City of Henderson sanitary drains. Two soil borings were advanced and three soils samples collected from each boring in the area of the former septic system leach field. Chromium concentrations ranged from 13.9 mg/kg to 17.6 mg/kg.	One deep soil boring has been proposed to address this area.	6-10	SA85
	61	4.2.9		**Old Sodium Chlorate Plant Decommissioning** The old Sodium Chlorate Plant was located in Units 4 and 5. Production occurred in 1,300 electrolytic cells. The process liquids contained primarily sodium chlorate with sodium dichromate as a process chemical additive. Retention of process liquids in the basements and sump areas of Units 4 and 5 were identified as potential sources of chlorate in groundwater. As the process was decommissioned, the electrolytic cells and associated piping were emptied. Residual materials, including the cell shells and other materials, which were hazardous due the hexavalent chromium concentration, were transferred to a hazardous waste TSDF in Beatty, Nevada. The process equipment, such as tanks, pipes and pumps, was dismantled and transported off Site for disposal or recycling. The building area was cleaned and made available for other uses. The NDEP required no further action.	No deep soil borings have been proposed. The NDEP required no further action.		

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total	62	4.8.28	33	**State Industries Inc. Site, Including Impoundments and Catch Basin** State Industries leased the property for the manufacture and storage of hot water heaters. Two surface impoundments were operated and analysis of sludge samples indicated that the material was non-hazardous based on EP Toxicity tests. Soil borings were collected in the area of the former surface impoundments and chromium concentrations ranged from 6.7 mg/kg to 110 mg/kg.	One deep soil boring has been proposed in the eastern portion of this area to address the two surface impoundments as potential source areas. Phase A soil sampling at SA02 has adequately characterized the western portion of this area.	6-10	SA28
total	63	4.8.29	24	**J.B. Kelley, Inc. Trucking Site** J.B. Kelley, Inc. leased property and operated a trucking operation on site. The company hauled commodities such as lime and soda ash. The site included open concrete vaults which formerly served as foundations for storage buildings. A soil boring beneath the vault showed a chromium concentration of 19.3 mg/kg and for soil accumulated in the vault chromium was detected at 42.9 mg/kg.	No deep soil borings have been proposed.		
total	64	4.7.7	25	**Koch Materials Company Site** Koch Materials Company leased an area for use as an asphalt emulsion batch plant. TCLP values for chromium in soil samples collected in this area range from <1 mg/kg to 29 mg/kg.	Phase A soil sampling at SA10 has adequately characterized this area. No deep soil borings have been proposed.		
					Four additional deep soil borings are proposed to address extent in soil.	6-10	SA52 SA50 SA67 SA73
Hexachlorobenzene							
	5	4.8.4	28	**On-Site Portion of Beta Ditch Including the Small Diversion Ditch** The Beta Ditch could have carried a wide variety of chemicals throughout its history. Hexachlorobenzene was detected in three soil samples with concentrations of 0.54 mg/kg to 6.8 mg/kg.	One deep soil boring has been proposed to address this potential source area.	6-21	SA86
	64	4.7.7	25	**Koch Materials Company Site** Koch Materials Company leased an area west of the diesel storage tank for use as an asphalt emulsion batch plant. Hexachlorobenzene was detected above Phase A comparison levels at 1.2 and 1.7 mg/kg.	Two deep soil borings have been proposed to address this potential source area and one just to the north.	6-21	SA46 SA47 SA54
Iron							
	1			**Units 3, 4, 5, and 6**	Based on Phase A results for wells M13, M11, and M29, four deep soil borings have been proposed in this area.	6-11	SA30 SA32 SA34 SA35
Lead							
	1	4.8.1	26	**Trade Effluent Settling Ponds** The TE ponds were operated as unlined storage impoundments for acid waste neutralized with caustic liquor. Soil samples analyzed in 1997 show that lead ranged from 5.1 mg/kg to 184 mg/kg.	Phase A soil sampling at SA21, SA22, SA23, and SA24 has adequately characterized this area. All concentrations are less than background. No deep soil borings have been proposed.		
	5	4.8.4	28	**On-Site Portion of Beta Ditch Including the Small Diversion Ditch** The Beta Ditch could have carried a wide variety of chemicals throughout its history. Lead concentrations range from 110 mg/kg to 590 mg/kg. Phase A soil sample SA17-0.5 concentration is above background, but lower depths are not and groundwater is non-detect for lead in this area.	Phase A soil sampling at SA14, SA16, and SA17 has adequately characterized this area. No deep soil borings have been proposed.		
	35	4.8.19	31	**Truck Emptying Area** The Truck Emptying Area was used for the unloading of inorganic materials. The soil samples from the Truck Emptying Area show lead concentrations ranging from 7.9 mg/kg to 141 mg/kg. Phase A soil sample SA09-0.5 concentration is above background, but lower depths are not, and groundwater is non-detect for lead in this area.	Phase A soil sampling at SA09 has adequately characterized this area. No deep soil borings have been proposed.		

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	54	4.8.25	32	**AP Plant Area Change House/Laboratory and Septic Tank** Laboratory operations included rinsing laboratory equipment, preparing standards, analyzing inorganic samples, preparing analytical solutions, and preparing dilute titrants. Hazardous solutions were collected and shipped to an appropriate disposal facility. Rinse water from the laboratory entered the septic system until August 1992, when the use of the septic system was discontinued. The change house showers, restrooms, and laboratory sinks now discharge to a pump station, which transfers the water to the City of Henderson sanitary drains. The area was tested for metals and lead concentrations ranged from 7.2 mg/kg to 10.0 mg/kg.	Upon closer inspection, this is not a source area. No deep soil borings have been proposed in this area.		
	62	4.8.28	33	**State Industries Inc. Site, Including Impoundments and Catch Basin** State Industries leased portions of the Kerr-McGee property for the manufacture and storage of hot water heaters and operated two surface impoundments. Soil samples analyzed in 1996 show that lead concentrations ranged from 14 mg/kg to 31 mg/kg.	One deep soil boring has been proposed to address this potential source area.	6-12	SA28
	63	4.8.29	24	**J.B. Kelley, Inc. Trucking Site** J.B. Kelley, Inc. leased property and operated a trucking operation on site. The company hauled commodities such as lime and soda ash. The site included open concrete vaults which formerly served as foundations for storage buildings. A soil boring beneath the vault showed a lead concentration of 9.9 mg/kg. A composite sample of sediment that had accumulated in the vault had lead at a concentration of 257 mg/kg. While there are no Phase A soil samples in this area, lead is not detected in groundwater in this area.	Characterization is complete in this area. No deep soil borings have been proposed.		
	64	4.7.7	25	**Koch Materials Company Site** Koch Materials Company leased an area west of the diesel storage tank for use as an asphalt emulsion batch plant. Soil samples collected were analyzed for TCLP metals. Lead was detected in TCLP results.	Two deep soil borings have been proposed in the northern portion of this area to address this potential source area.	6-12	SA46 SA47
Manganese							
	20	4.3.1	13	**Pond C-1 and Associated Piping** Pond C-1 was a single-lined surface impoundment. The pond was used to evaporate non-hazardous process water, primarily from steam production, but at times also from the boron and manganese dioxide processes.	Two deep soil borings have been proposed in this area to address this potential source area.	6-13	SA62 SA71
	21	4.5.1	13	**Pond Mn-1 and Associated Piping** Pond Mn-1 received non-hazardous liquid wastes, including manganese dioxide cell fed filter waste and potassium phosphate cathode wash water. Mn-1 pond currently receives small amounts of waste water from the manganese production.	Two deep soil borings have been proposed in this area to address this potential source area.	6-13	SA59 SA61
	24 & 34	4.5.2	16	**Leach Beds, Associated Conveyance Facilities and Former Manganese Tailings Area** Prior to 1975, tailings from the beneficiation of manganese dioxide ores were transported as a slurry to unlined surface impoundments/leach beds to the west of the current tailings area. After 1975, filtering of the tailings yielded a semi-dry filter cake. The tailings were analyzed by EP toxicity in 1979 and by TCLP in 1990 and 1993, and were determined to be non-hazardous.	One deep soil boring has been proposed in the former manganese tailings area to address this potential source area. The current manganese tailings pile covers the leach beds; therefore, no additional soil samples are proposed.	6-13	SA39
	35	4.8.19	31	**Truck Emptying Area** The truck emptying area was used for the unloading of inorganic materials.	One deep soil boring has been proposed to address potential source areas.	6-13	SA48
	43	4.4.10		**Units 3 and Unit 4 Basement** Sodium chlorate and sodium perchlorate (at times) were produced in electrolytic cells in Unit 4. Both of these processes contained chlorate and perchlorate as well as sodium dichromate (hexavalent chromium). The basements in these units were used as sumps to collect spillage and wash-water.	Two deep soil borings have been proposed, located within the 50 ug/L isocontour to address potential source areas.	6-13	SA30 SA32
	44	4.5.3	17	**Unit 6 Basement** High-purity, battery-active manganese dioxide has been produced in electrolytic cells in Unit 6. The basement beneath the cells collected process spillage and wash water and was identified as a source of soil and groundwater impact. Remediation measures were undertaken in 1986. The basement was cleaned, the concrete floor was removed, and the subsurface soil was re-contoured. The basement was lined with a 100-mil HDPE liner.	Two deep soil borings have been proposed adjacent to the Unit building to address this potential source area. Additional deep soil borings have been proposed near Units 3 and 4 (within the 50 ug/L isoconcentration line).	6-13	SA34 SA35
	47	4.5.4		**Leach Plant Area Manganese Ore Piles** Manganese ore piles have been stored and processed at the site since 1951. The manganese ore was normally crushed, with particles varying in size but typically 0.25 inch and smaller. Manganese dust is composed of 55 percent by weight of manganese dioxide.	Phase A soil boring, SA13, is located in this area. In addition, two deep soil borings have been proposed to address this potential source area.	6-13	SA37 SA38

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	48	4.5.5	19	**Leach Plant Analyte Tanks** The analyte tanks are housed within a containment berm and are used to hold a manganese sulfate solution, that is used in the Unit 6 electrolytic cells, until the used solution is fortified and returned to the electrolytic cells.			
	49	4.5.5	19	**Leach Plant Area Sulfuric Acid Storage** The sulfuric acid tank is housed on a containment pad and is used to hold this process chemical (manganese sulfate solution) until needed by the process.			
	50 & 51	4.5.5	19	**Leach Plant Area and Leach Tanks and Leach Plant Area Transfer Lines to/from Unit 6** The leaching tanks are housed on containment pads and are used to leach the manganese dioxide ore to gain its manganese value for use in the Unit 6 electrolytic cells.			
	64	4.7.7	25	**Operations by Koch Materials Co.** Koch Materials Company leased this area for use as an asphalt emulsion batch plant. Soil was tested for metals in 1994. TCLP results for Mn range from 29 mg/kg to 1100 mg/kg.	Phase A soil sampling at SA10 has adequately characterized this area. No deep soil borings have been proposed.		
Molybdenum							
	62	4.8.28	33	**State Industries Inc. Site, Including Impoundments and Catch Basin** State Industries leased the property for the manufacture and storage of hot water heaters. Two surface impoundments were operated and analysis of sludge samples indicated that the material was non-hazardous based on EP Toxicity tests. Soil borings were collected in the area of the former surface impoundments and molybdenum was detected at concentrations ranging from 2.6 mg/kg to 15 mg/kg.	One deep soil boring has been proposed to address this potential source area.	6-15	SA28
Perchlorate							
	7, 5, 9, 13, & 14			**P-1, Old P-2, Old P-3, New P-2, and S-1 Ponds** Ponds used to collect and concentrate dilute sodium chlorate solutions as apart of the sodium chlorate production process. Ponds were lined with single-layer synthetic liners.	Phase A borings SA11 and SA12 are located in these areas. One additional deep soil boring is proposed.	6-19	SA51
	15	4.8.7	12	**Platinum Drying Unit** The platinum drying unit was a concrete-floored and concrete-bermed containment pad. In this area, a sodium perchlorate process byproduct which contained recoverable amounts of platinum was worked and platinum was recovered. In 1993 the pad concrete was sampled for metals using TCLP but not perchlorate. The area was demolished and the concrete was transported to a hazardous waste TSDF. Soil under the pad was sampled for total chromium.	No deep soil borings have been proposed.		
	16 & 17	4.1.1	7	**AP Ponds** AP-1, AP-2, AP-3 are three of five synthetically lined surface impoundments that were part of the ammonium perchlorate (AP) manufacturing process.	One deep soil boring has been proposed adjacent to AP-1 to address this potential source area.	6-19	SA64
	18	4.1.1	7	**AP-4 Pond** AP Ponds Soils from adjacent to the drum crushing area (LOU 31) were transported to AP-4 for recovery of the residual perchlorate.	One deep soil boring has been proposed to address this potential source area.	6-19	SA63
	19	4.1.1	7	**AP-5 Pond** AP-5 is one of five synthetically lined surface impoundments were part of the AP manufacturing process.	One deep soil boring has been proposed to address this potential source area.	6-19	SA72
	30	4.1.2		**Ammonium Perchlorate Area - Pad 35** "L" shaped concrete pad south of building known as old D-1. Area used for the accumulation of drummed common trash potentially contaminated with perchlorate and other industrial wastes, such as cooling tower sludge and iron oxide sludge.	Phase A borings SA19 and SA20 are located in this area. Three additional deep soil borings have been proposed in this area to further address these potential source areas.	6-19	SA75 SA76 SA77
	31	4.1.3		**Drum Crushing and Recycling Area** The drum crushing area (serving the ammonium perchlorate production) consisted of a drum crusher located on a concrete pad located just east of the old D-1 building. Drums destined for disposal were emptied and rinsed prior to delivery to this area. Soils adjacent to the drum crushing area were transported to the AP-4 pond for recovery of the residual perchlorate.			

Table I2-1
Phase B Sampling Rationale for Source Area Investigation
Phase B Source Area Investigation Results
Tronox Facility - Henderson, Nevada

Constituent	LOU #	Section in CSM Document	Table Number	Description	Proposed Phase B Sampling	Figure Number	Boring ID
	32	4.1.4		**Groundwater Remediation System** The groundwater remediation system includes a line of groundwater interceptor wells, the groundwater treatment process (GWTP), the groundwater barrier wall, two recharge trenches, and the GW-11 pond. The GWTP is located to the east of new D-1 building on a 60 foot by 20 foot concrete pad with containment curbing. In the early 1990s portions of the recharge trenches became plugged and required modifications. During this time treated water occasionally would emerge from the trenches' water elevation test wells and impact surface soils. This water contained iron oxide, which colored the affected area red.			
	56	4.1.10		**Plant Area Old Building D-1 Wash-down** Ammonia perchlorate dust fell on old D-1 building floor. Dust was swept up and washed down monthly. Wash-down water contained dissolved ammonia perchlorate and drained onto the asphalt pad surrounding the building. Some of the wash water drained onto the soil adjacent to the asphalt .			
	57 & 58	4.1.11		**AP Plant Area New Building D-1 Wash-down and AP Plant Transfer lines to Sodium Chlorate Process** Transfer lines lead to the AP Plant surface impoundments and the AP Plant. The transfer lines occasionally released process solution to the ground.	In addition to the borings proposed above, three additional borings have been proposed to address the transfer line area.	6-19	SA58 SA70 SA74
	33	4.1.5		**Sodium Perchlorate Platinum By-product Filter** The platinum recovery filter press was located on a concrete pad east of the Unit 5 cell floor. The pad was equipped with a sump that collected and contained liquids, including process liquids and wash-down water. Cracks in the floor, noted during the Phase I investigation, were coated with a Chevron industrial membrane material that provided a continuous cover over the floor.	One deep soil boring has been proposed north of this area to address this potential source.	6-19	SA34
	43	4.1.6		**Unit 4 and 5 Basements, and Unit 6** Sodium chlorate and sodium perchlorate (at times) were produced in electrolytic cells. Both of these processes contained chlorate and perchlorate as well as sodium dichromate (hexavalent chromium). The basements in these units were used as sumps to collect spillage and wash-water.	Six deep soil borings have been proposed in these areas, and two deep soil borings have been proposed downgradient of these areas.	6-19	SA30 SA31 SA32 SA33 SA34 SA35
	52	4.1.7		**AP Plant Area Screening Building, Dryer Building, and Associated Sump** Wash-down water, on rare occasions, would overflow. Soil exhibiting white stains was collected and recycled for perchlorate recovery.	One deep soil boring has been proposed to address this potential source.	6-19	SA65
	53	4.1.8		**AP Plant Area Tank Farm** Tank farm contained a number of vertical open-top and closed-top tanks used for process solution storage. Secondary containment and sump, contained reported spills.	One deep soil boring has been proposed to address this potential source area.	6-19	SA60
	54	4.8.25		**AP Plant Area Change House/Laboratory and Septic Tank** Laboratory operations included rinsing laboratory equipment, preparing standards, analyzing inorganic samples, preparing analytical solutions, and preparing dilute titrants. Hazardous solutions were collected and shipped to an appropriate disposal facility. Rinse water from the laboratory entered the septic system until August 1992 when the use of the septic system was discontinued. The change house showers, restrooms, and laboratory sinks now discharge to a pump station, which transfers the water to the City of Henderson sanitary drains. Based on this use, the buildings are not considered to be significant source areas.	One deep soil boring has been proposed to address the septic tank area as a potential source area.	6-19	SA85
	55	4.1.9	32	**Area Affected by July 1990 Fire** Fire occurred on ammonia perchlorate drum storage pad area. Soil around fire area was impacted with ammonium perchlorate, which was washed off the concrete pad by the fire suppression water. Impacted soil was collected and returned to the ammonia perchlorate process to recover residual perchlorate. Phase A boring SA20 is located in this area.	No deep soil borings have been proposed.		
	62	4.8.28	33	**State Industries Inc. Site, Including Impoundments and Catch Basin** State Industries leased the property for the manufacture and storage of hot water heaters. Two surface impoundments were operated and analysis of sludge samples indicated that the material was non-hazardous based on EP Toxicity tests.	One deep soil boring has been proposed in this area.	6-19	SA28
				Area in vicinity of Phase A boring location SA26 Elevated levels of perchlorate detected in this boring.	Two deep soil borings have been proposed in this area.	6-19	SA82 SA83

Table I2-1
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Constituent	LOU #	Section in CSM Document	Table Number	Description	Proposed Phase B Sampling	Figure Number	Boring ID
					Ten additional deep soil borings have been proposed within the 1,000 ug/L isocontour to address extent in soil.	6-19	SA29 SA37 SA42 SA54 SA59 SA69 SA78 SA79 SA80 SA81
Radium-226							
				No Sources Identified	No deep soil borings have been proposed.		
Strontium							
				No Sources Identified	Based on elevated concentrations of strotium in groundwater, ten deep soil borings have been proposed; five on the western property boundary and in the vicinity of the truck emptying area and five in the vicinity of the unit buildings.		SA30 SA32 SA34 SA35 SA37 SA48 SA56 SA57 SA67 SA68
	62	4.8.28	33	Soil samples were tested by "Water Soluble Salt Analysis in Soil 1:5 (soil:water) Aqueous Extraction ASTM D 1428, D516." Results indicate that percentages of sulfate in soil range from 0.02 to 1.39.	No deep soil borings have been proposed.		
TPH							
	28	4.7.2	14	**Hazardous Waste Storage Area** Used oil was handled in this area. Material placed on these pads was contained in drums. During later construction projects, the staging pad and surrounding soil was removed to a depth of four feet. The soil removed had elevated levels of TPH, as analyzed in October 1994. In November 1994 analysis of a soil composite sample from several locations in the bottom of the excavation was non-detect <10 mg/kg for TPH.	This area has been remediated. No deep soil borings have been proposed.		
	35	4.8.19	31	**Truck Emptying Area** The Truck Emptying Area was used for the unloading of inorganic materials. The soil samples from the Truck Emptying Area show TPH concentrations ranging from 41 mg/kg to 79 mg/kg.	Upon closer inspection, this is not a source area. No deep soil borings have been proposed.		
	39	4.7.3	21	**Satellite Accumulation Point - AP Maintenance Shop** Visibly stained soil resulting from a minor spill from a used oil drum was observed in the AP satellite accumulation point-AP maintenance shop during a Phase I investigation. Visibly affected soil was removed and a surface confirmation soil sample was collected. The sample results indicated that 180 mg/kg diesel and 1,500 mg/kg motor oil constituents remained in the soil. Additional soil was removed from the area and a second confirmation sample (S8-1RE) was collected from the bottom of the excavated area. The sample analytical result was non-detect (<31 mg/kg) for TPH in the diesel-range.	This area has been remediated. No deep soil borings have been proposed.		
	41	4.7.4	22	**Unit 1 Tenant Stains** Unit 1 Tenant stains were investigated as part of the 1997 Phase II ECA field investigation. Visibly stained soils were removed. Analytical results indicated that TPH in the range of motor oil was detected at a concentration of 250 mg/kg. TPH in the diesel range was quantified at 73 mg/kg and TPH in the gasoline range was not detected above the PQL of 29 mg/kg. Additional soils were removed from the area with the use of a backhoe. The area was re-sampled. A confirmation soil sample from the bottom of the excavation contained 100 mg/kg of TPH heavier than diesel, which is "below" the NDEP action level.	Phase A soil sampling at SA03 has adequately characterized this area. No deep soil borings have been proposed.		
	45	4.7.5	23	**Diesel Fuel Storage Tank** Samples were collected for TPH analysis from seven soil borings. Soil samples from three boreholes contained TPH-diesel at concentrations greater than 100 mg/kg (800 mg/kg to 16,000 mg/kg). Soil samples collected from the installation of a groundwater well show that TPH concentrations were below the NDEP action level of 100 mg/kg (no boring location provided).	Five deep soil borings have been proposed to address this potential source area for TPH-DRO, and the indicator compounds BTEX and PAHs.	6-22	SA40 SA41 SA42 SA43 SA44

Table I2-1
Phase B Sampling Rationale for Source Area Investigation
Phase B Source Area Investigation Results
Tronox Facility - Henderson, Nevada

Constituent	LOU #	Section in CSM Document	Table Number	Description	Proposed Phase B Sampling	Figure Number	Boring ID
	63			**J.B. Kelley, Inc. Trucking Site** J.B. Kelley, Inc. leased property from Kerr-McGee immediately south and east of the truck emptying area and operated a trucking operation on Site. The company hauled commodities such as lime and soda ash. A diesel UST (excavated in 1991) and an open concrete vaults which formerly served as foundations for peat storage buildings were located at this site. Soil borings surrounding the UST were collected at depths of 15, 25, 35, and 37 feet bgs. The soil samples were analyzed for TPH (diesel and gasoline range by EPA Method 8015M). The TPH results were non-detect (<10 mg/l).	Upon closer inspection, this is not a source area. No deep soil borings have been proposed.		
	64	4.7.7	25	**Koch Materials Company Site** Koch Materials Company leased an area west of the diesel storage tank for use as an asphalt emulsion batch plant. TPH spills were evident at the leased property and Koch removed visibly stained soils. Soil samples collected ranged from 17 mg/kg to 190 mg/kg for TPH.	Two deep soil boring have been proposed to address this potential source area for TPH-DRO, and the indicator compounds BTEX and PAHs.	6-22	SA46 SA47
	65	4.7.8	22	**Nevada Pre-cast Concrete Products, Green Ventures International, Buckles Construction Company, and Ebony Construction Sites** Nevada Pre-Cast Concrete utilized office space near the J.B. Kelley operations. Green Ventures International leased the S-1 change house for use as a marketing office for alfalfa sprouts. Only office activities were conducted by Green Ventures International. Buckles Construction Company leased a portion of the crane bay located in the northwest corner of Unit 1 for steel fabrication and equipment storage.	Upon closer inspection, this is not a source area. No deep soil borings have been proposed.		
	68	4.7.10		**Southern Nevada Auto Parts Site** Nevada Pick-a-Part, formerly Southern Nevada Auto Parts, leased property to store wrecked, impounded and repossessed vehicles. Stained soil was evident in some leased areas. Kerr-McGee worked with the lessee to implement practices to minimize the potential for impacts to soil or groundwater to occur.	This area will be evaluated in 2009-2010.	6-22	
				Area North of Unit 6 Phase A sample SA08-0.5 had a TPH-DRO result of 3,600 mg/kg. This location is under asphalt. TPH indicator compounds (BTEX and PAHs) were either not detected or below comparison levels for direct contact.	This area has been remediated. No deep soil borings have been proposed.		
Trichloroethene (TCE)							
	62	4.8.28	33	**State Industries Inc. Site, Including Impoundments and Catch Basin** State Industries leased portions of the Kerr-McGee property for the manufacture and storage of hot water heaters and operated two surface impoundments. Soil samples analyzed in 1996 show that TCE was detected at concentrations of 5 ug/kg to 14 ug/kg.	One deep soil boring has been proposed to address this potential source area.	6-26	SA28
				Units 3 and 4 Although there is no record of use of TCE in this area, there is a groundwater plume that appears to emanate from this area.	Three deep soil borings have been proposed to address this area.	6-26	SA30 SA31 SA32
				Western Property Boundary Groundwater concentrations are elevated in this area. The source could be off-site.	Four deep soil borings have been proposed in this area along the western property boundary.	6-26	SA56 SA57 SA67 SA68
Uranium (elemental)							
				Eastern Property Boundary Near Unit 6 Groundwater concentrations in wells M29 and M39 are above the comparison level of 30 ug/L. Groundwater in M39 is probably influenced by off-site sources and the groundwater gradient induced by the groundwater treatment process (GWTP).	Three deep soil borings have been proposed in the vicinity of M29 and the Unit 6 building to address this potential source area.	6-16	SA34 SA35 SA37
	No deep soil borings have been proposed in this area.						

Table I2-2
Sampling Plan to Evaluate the Direct Contact Pathway
Phase B Source Area Investigation Work Plan
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Evaluation Area	Boring Location	Sample ID Number	Sample Depth (ft, bgs)	Arsenic (EPA 6020)	Hexavalent Chromium (EPA 7199)	Lead (EPA 6020)	Manganese (EPA 6020)	Perchlorate (314.0)	VOCs[1] (8260B/5035)	Ammonia (EPA 350.1)	Organochlorine Pesticides (EPA 8081A)	Asbestos EPA/540/R-97/028
EA-1		None Planned										
EA-2	SA87	SA87-0.5	0.5					X				
		SA87-10	10					X				
	SA88	SA88-0.5	0.5					X				
		SA88-10	10					X				
	SA89	SA89-0.5	0.5					X				
		SA89-10	10					X				
	SA90	SA90-0.5	0.5					X				
		SA90-10	10					X				
	SA91	SA91-0.5	0.5					X				
		SA91-10	10					X				
	SA92	SA92-0.5	0.5					X				
		SA92-10	10					X				
	SA93	SA93-0.5	0.5					X				
		SA93-10	10					X				
	SA94	SA94-0.5	0.5					X				
		SA94-10	10					X				
EA-3		None Planned										
EA-4		None Planned										
EA-5	SA95	SA95-0	0									X
		SA95-0.5	0.5		X			X				
		SA95-10	10		X			X				
	SA96	SA96-0	0									X
		SA96-0.5	0.5		X			X				
		SA96-10	10		X			X				
	SA97	SA97-0	0									X
		SA97-0.5	0.5		X			X				
		SA97-10	10		X			X				
	SA98	SA98-0	0									X
		SA98-0.5	0.5		X			X				
		SA98-10	10		X			X				
	SA99	SA99-0	0									X
		SA99-0.5	0.5		X			X				
		SA99-10	10		X			X				

Table I2-2
Sampling Plan to Evaluate the Direct Contact Pathway
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Evaluation Area	Boring Location	Sample ID Number	Sample Depth (ft, bgs)	Arsenic (EPA 6020)	Hexavalent Chromium (EPA 7199)	Lead (EPA 6020)	Manganese (EPA 6020)	Perchlorate (314.0)	VOCs[1] (8260B/5035)	Ammonia (EPA 350.1)	Organochlorine Pesticides (EPA 8081A)	Asbestos EPA/540/R-97/028
EA-6	SA100	SA100-0	0									X
		SA100-0.5	0.5		X			X	X		X	
		SA100-10	10		X			X	X		X	
	SA101	SA101-0	0									X
		SA101-0.5	0.5		X			X	X		X	
		SA101-10	10		X			X	X		X	
	SA102	SA102-0	0									X
		SA102-0.5	0.5		X			X	X		X	
		SA102-10	10		X			X	X		X	
EA-7	SA103	SA103-0	0									X
		SA102-0.5	0.5	X		X	X	X			X	
		SA103-10	10	X		X	X	X			X	
	SA104	SA104-0	0									X
		SA104-0.5	0.5	X		X	X	X			X	
		SA104-10	10	X		X	X	X			X	
	SA105	SA105-0	0									X
		SA105-0.5	0.5	X		X	X	X			X	
		SA105-10	10	X		X	X	X			X	
	SA106	SA106-0	0									X
		SA106-0.5	0.5	X		X	X	X			X	
		SA106-10	10	X		X	X	X			X	
EA-8	SA107	SA107-0	0									X
		SA107-0.5	0.5	X			X	X				
		SA107-10	10	X			X	X				
	SA108	SA108-0	0									X
		SA108-0.5	0.5	X			X	X				
		SA108-10	10	X			X	X				
	SA109	SA109-0	0									X
		SA109-0.5	0.5	X			X	X				
		SA109-10	10	X			X	X				
EA-9	SA110	SA110-0	0									X
		SA110-0.5	0.5	X				X				
		SA110-10	10	X				X				
	SA111	SA111-0	0									X
		SA111-0.5	0.5	X				X				
		SA111-10	10	X				X				

Table I2-2
Sampling Plan to Evaluate the Direct Contact Pathway
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Evaluation Area	Boring Location	Sample ID Number	Sample Depth (ft, bgs)	Arsenic (EPA 6020)	Hexavalent Chromium (EPA 7199)	Lead (EPA 6020)	Manganese (EPA 6020)	Perchlorate (314.0)	VOCs[1] (8260B/5035)	Ammonia (EPA 350.1)	Organochlorine Pesticides (EPA 8081A)	Asbestos EPA/540/R-97/028
EA-10	SA112	SA112-0.5	0.5			X						
		SA112-10	10			X						
	SA113	SA113-0.5	0.5			X						
		SA113-10	10			X						
	SA114	SA114-0.5	0.5			X						
		SA114-10	10			X						
	SA115	SA115-0.5	0.5			X						
		SA115-10	10			X						
	SA116	SA116-0.5	0.5			X						
		SA116-10	10			X						
	SA117	SA117-0.5	0.5			X						
		SA117-10	10			X						
	SA118	SA118-0.5	0.5			X						
		SA118-10	10			X						
	SA119	SA119-0.5	0.5			X						
		SA119-10	10			X						
EA11		None Planned										
Number of Field Samples Subtotal:				**18**	**16**	**24**	**14**	**50**	**6**	**0**	**14**	**17**
QA/QC Samples:												
Field Duplicates (10%)				2	2	3	2	5	1	0	2	2
Field Blanks				2	2	2	2	2	2	0	2	0
Equipment Rinsate Blanks				10	10	10	10	10	10	0	1	0
Trip Blank Samples				0	0	0	0	0	0	0	0	0
Matrix Spike (5%)				1	1	2	1	3	1	0	1	1
Matrix Spike Duplicate (5%)				1	1	2	1	3	1	0	1	1
Total Number of Samples:				**34**	**32**	**43**	**30**	**73**	**21**	**0**	**21**	**21**

Notes:
X. Sample will be collected and analyzed.
1. VOC analyses will include naphthalene.
2. Organochlorine Pesticide Analyses will include hexachlorobenzene.
The following deeper (soil to groundwater pathway) borings are also proposed to be sampled for the direct contact pathway. Refer to Table I2-3 for more details.
EA-05: SA73
EA-06: SA64, SA66, and SA69
EA-07: SA48, SA50, SA68, and SA85
EA-08: SA33, SA35, SA37, and SA61
EA-09: SA29, SA30, SA31, and SA32
EA-10: SA28

Table I2-3
Sampling Plan to Evaluate Potential Source Areas and the Soil-to-Groundwater Migration Pathway
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Phase B Boring No.	Sample ID Number	Sample Depths (ft, bgs)	Perchlorate (EPA 314.0)	Metals													TPH-DRO (EPA 8015B)	BTEX (EPA 8260)	PAHs (EPA 8270 (SIM))	VOCs (EPA 8260)	Ammonia (EPA 350.1)	Wet Chemistry (a)	Hexachlorobenzene (EPA 8081A)	OCPs (8081A)	Asbestos	NOTES
				Arsenic (EPA 6020)	Boron (EPA 6020)	Calcium (EPA 6010)	Hex Cr (EPA 7199)	Iron (EPA 6020)	Lead (EPA 6020)	Magnesium (EPA 6020)	Manganese (EPA 6020)	Molybdenum (EPA 6020)	Sodium (EPA 6020)	Strontium (EPA 6020)	Uranium (EPA 6020)	Vanadium (EPA 6020)										
SA28	SA28-0.0	0.0																							X	
	SA28-10	10	X	X		X	X		X	X		X	X							X	X	X				
	SA28-30	30	X	X		X	X		X	X		X	X							X	X	X				
	SA28-50	50	X	X		X	X		X	X		X	X							X	X	X				
	SA28-60	60	X	X		X	X		X	X		X	X							X	X	X				GW @ 65' (SA02)
SA29	SA29-0.0	0.0																							X	
	SA29-10	10	X	X		X				X			X								X	X				
	SA29-30	30	X																							
	SA29-35	35	X																							GW @ 37' (SA04)
SA30	SA30-0.0	0.0																							X	
	SA30-10	10	X	X		X	X	X		X	X		X	X							X	X	X				
	SA30-30	30	X			X	X	X		X	X		X	X							X	X	X				
	SA30-35	35	X			X	X	X		X	X		X	X							X	X	X				GW @ 37' (SA05)
SA31-0.0	SA31-0.0	0.0																							X	
	SA31-10	10	X	X		X	X			X			X								X	X	X				
	SA31-30	30	X			X	X			X			X								X	X	X				
	SA31-35	35	X			X	X			X			X								X	X	X				GW @ 37' (SA05)
SA32	SA32-0.0	0.0																							X	
	SA32-10	10	X	X		X	X	X		X	X		X	X							X	X	X				
	SA32-30	30	X			X	X	X		X	X		X	X							X	X	X				
	SA32-35	35	X			X	X	X		X	X		X	X							X	X	X				GW @ 36' (SA06)
SA33	SA33-0.0	0.0																							X	
	SA33-10	10	X	X	X	X	X			X	X		X								X	X	X				
	SA33-30	30	X		X	X	X			X			X								X	X	X				
	SA33-35	35	X		X	X	X			X			X								X	X	X				GW @ 36' (SA07)
SA34	SA34-0.5	0.5	X			X	X	X		X	X		X	X	X					X	X	X				
	SA34-10	10	X			X	X	X		X	X		X	X	X					X	X	X				
	SA34-30	30	X			X	X	X		X	X		X	X	X					X	X	X				
	SA34-35	35	X			X	X	X		X	X		X	X	X					X	X	X				GW @ 36' (SA07)
SA35	SA35-0.0	0.0																							X	
	SA35-10	10	X	X		X		X		X	X		X	X	X						X	X				
	SA35-30	30	X			X		X		X	X		X	X	X						X	X				
	SA35-35	35	X			X		X		X	X		X	X	X						X	X				GW @ 36' (SA07)
SA36	SA36-0.5	0.5	X		X	X				X			X								X	X				
	SA36-10	10	X		X	X				X			X								X	X				
	SA36-30	30	X		X	X				X			X								X	X				
	SA36-35	35	X		X	X				X			X								X	X				GW @ 36' (SA07)
SA37	SA37-0.0	0.0																							X	
	SA37-10	10	X	X	X	X	X			X	X		X	X	X	X					X	X				
	SA37-30	30	X		X	X	X			X	X		X	X	X	X					X	X				
	SA37-40	40	X		X	X	X			X	X		X	X	X	X					X	X				GW @ 41' (SA13)
SA38	SA38-0.5	0.5	X			X				X	X		X			X					X	X				
	SA38-10	10	X			X				X	X		X			X					X	X				
	SA38-30	30	X			X				X	X		X			X					X	X				
	SA38-40	40	X			X				X	X		X			X					X	X				GW @ 41' (SA13)

Table I2-3
Sampling Plan to Evaluate Potential Source Areas and the Soil-to-Groundwater Migration Pathway
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Phase B Boring No.	Sample ID Number	Sample Depths (ft, bgs)	Perchlorate (EPA 314.0)	Metals													TPH-DRO (EPA 8015B)	BTEX (EPA 8260)	PAHs (EPA 8270 (SIM))	VOCs (EPA 8260)	Ammonia (EPA 350.1)	Wet Chemistry (a)	Hexachlorobenzene (EPA 8081A)	OCPs (8081A)	Asbestos	NOTES
				Arsenic (EPA 6020)	Boron (EPA 6020)	Calcium (EPA 6010)	Hex Cr (EPA 7199)	Iron (EPA 6020)	Lead (EPA 6020)	Magnesium (EPA 6020)	Manganese (EPA 6020)	Molybdenum (EPA 6020)	Sodium (EPA 6020)	Strontium (EPA 6020)	Uranium (EPA 6020)	Vanadium (EPA 6020)										
SA39	SA39-0.5	0.5	X			X	X			X	X		X							X	X	X				
	SA39-10	10	X			X	X			X	X		X							X	X	X				
	SA39-30	30	X			X	X			X	X		X							X	X	X				GW @ 32' (SA11)
SA40	SA40-0.5	0.5	X														X	X	X							
	SA40-10	10	X														X	X	X							
	SA40-30	30	X														X	X	X							GW @ 32' (SA11)
SA41	SA41-0.5	0.5	X														X	X	X							
	SA41-10	10	X														X	X	X							
	SA41-30	30	X														X	X	X							GW @ 32' (SA11)
SA42	SA42-0.5	0.5	X														X	X	X							
	SA42-10	10	X														X	X	X							
	SA42-30	30	X														X	X	X							GW @ 32' (SA11)
SA43	SA43-0.5	0.5	X														X	X	X							
	SA43-10	10	X														X	X	X							
	SA43-30	30	X														X	X	X							GW @ 32' (SA11)
SA44	SA44-0.5	0.5	X														X	X	X							
	SA44-10	10	X														X	X	X							
	SA44-30	30	X														X	X	X							GW @ 32' (SA11)
SA45	SA45-0.5	0.5																		X						
	SA45-10	10																		X						
	SA45-30	30																		X						GW @ 32' (SA11)
SA46	SA46-0.5	0.5	X			X			X	X			X				X	X	X		X	X	X			
	SA46-10	10	X			X			X	X			X				X	X	X		X	X	X			
	SA46-30	30	X			X			X	X			X				X	X	X		X	X	X			
	SA46-35	35	X			X			X	X			X				X	X	X		X	X	X			GW @ 39' (SA10)
SA47	SA47-0.5	0.5	X			X			X	X			X				X	X	X		X	X	X			
	SA47-10	10	X			X			X	X			X				X	X	X		X	X	X			
	SA47-30	30	X			X			X	X			X				X	X	X		X	X	X			
	SA47-35	35	X			X			X	X			X				X	X	X		X	X	X			GW @ 39' (SA10)
SA48	SA48-0.0	0.0																							X	
	SA48-10	10	X	X		X	X		X	X	X		X	X						X	X	X		X		
	SA48-30	30	X			X	X			X	X		X	X						X	X	X				
	SA48-37	37	X			X	X			X	X		X	X						X	X	X				GW @ 39' (SA10)
SA49	SA49-0.5	0.5																		X						
	SA49-10	10																		X						
	SA49-30	30																		X						
	SA49-40	40																		X						GW @ 44' (SA09)
SA50	SA50-0.0	0.0																							X	
	SA50-10	10	X	X		X	X		X	X	X		X							X	X	X		X		
	SA50-30	30	X			X	X			X			X							X	X	X				GW @ 32' (SA11)
SA51	SA51-0.5	0.5	X																	X						
	SA51-10	10	X																	X						
	SA51-30	30	X																	X						GW @ 31' (SA12)

Table I2-3
Sampling Plan to Evaluate Potential Source Areas and the Soil-to-Groundwater Migration Pathway
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Phase B Boring No.	Sample ID Number	Sample Depths (ft, bgs)	Perchlorate (EPA 314.0)	Metals													TPH-DRO (EPA 8015B)	BTEX (EPA 8260)	PAHs (EPA 8270 (SIM))	VOCs (EPA 8260)	Ammonia (EPA 350.1)	Wet Chemistry (a)	Hexachlorobenzene (EPA 8081A)	OCPs (8081A)	Asbestos	NOTES
				Arsenic (EPA 6020)	Boron (EPA 6020)	Calcium (EPA 6010)	Hex Cr (EPA 7199)	Iron (EPA 6020)	Lead (EPA 6020)	Magnesium (EPA 6020)	Manganese (EPA 6020)	Molybdenum (EPA 6020)	Sodium (EPA 6020)	Strontium (EPA 6020)	Uranium (EPA 6020)	Vanadium (EPA 6020)										
SA52	SA52-0.5	0.5	X			X	X			X			X								X	X				
	SA52-10	10	X			X	X			X			X								X	X				
	SA52-30	30	X			X	X			X			X								X	X				GW @ 31' (SA12)
SA53	SA53-0.5	0.5																		X						
	SA53-10	10																		X						
	SA53-30	30																		X						GW @ 32' (SA11)
SA54	SA54-0.5	0.5	X																				X			
	SA54-10	10	X																				X			
	SA54-30	30	X																				X			
	SA54-37	37	X																				X			GW @ 39' (SA10)
SA55	SA55-0.5	0.5																		X						
	SA55-10	10																		X						
	SA55-30	30																		X						
	SA55-35	35																		X						GW @ 39' (SA10)
SA56	SA56-0.5	0.5	X	X		X				X			X	X						X	X	X		X		
	SA56-10	10	X	X		X				X			X	X						X	X	X		X		
	SA56-30	30	X	X		X				X			X	X						X	X	X		X		
	SA56-40	40	X	X		X				X			X	X						X	X	X		X		GW @ 44' (SA09)
SA57	SA57-0.5	0.5	X	X		X				X			X	X						X	X	X		X		
	SA57-10	10	X	X		X				X			X	X						X	X	X		X		
	SA57-30	30	X	X		X				X			X	X						X	X	X		X		
	SA57-40	40	X	X		X				X			X	X						X	X	X		X		GW @ 44' (SA09)
SA58	SA58-0.5	0.5	X																							
	SA58-10	10	X																							
	SA58-30	30	X																							
	SA58-35	35	X																							GW @ 37' (SA15)
SA59	SA59-0.5	0.5	X		X	X				X	X		X								X	X				
	SA59-10	10	X		X	X				X	X		X								X	X				
	SA59-22	22	X		X	X				X	X		X								X	X				GW @ 24' (SA17)
SA60	SA60-0.5	0.5	X																		X					
	SA60-10	10	X																		X					
	SA60-30	30	X																		X					
	SA60-35	35	X																		X					GW @ 37' (SA15)
SA61	SA61-0.0	0.0																							X	
	SA61-10	10	X	X	X	X				X	X		X								X	X				
	SA61-22	22	X		X	X				X	X		X								X	X				GW @ 24' (SA17)
SA62	SA62-0.5	0.5	X		X	X				X	X		X								X	X				
	SA62-10	10	X		X	X				X	X		X								X	X				
	SA62-22	22	X		X	X				X	X		X								X	X				GW @ 24' (SA17)
SA63	SA63-0.5	0.5	X																		X					
	SA63-10	10	X																		X					
	SA63-30	30	X																		X					GW @ 31' (SA16)
SA64	SA64-0.0	0.0																							X	
	SA64-10	10	X			X	X			X			X							X	X	X	X	X		
	SA64-30	30	X			X	X			X			X								X	X				GW @ 31' (SA16)

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Phase B Boring No.	Sample ID Number	Sample Depths (ft, bgs)	Perchlorate (EPA 314.0)	Metals													TPH-DRO (EPA 8015B)	BTEX (EPA 8260)	PAHs (EPA 8270 (SIM))	VOCs (EPA 8260)	Ammonia (EPA 350.1)	Wet Chemistry (a)	Hexachlorobenzene (EPA 8081A)	OCPs (8081A)	Asbestos	NOTES
				Arsenic (EPA 6020)	Boron (EPA 6020)	Calcium (EPA 6010)	Hex Cr (EPA 7199)	Iron (EPA 6020)	Lead (EPA 6020)	Magnesium (EPA 6020)	Manganese (EPA 6020)	Molybdenum (EPA 6020)	Sodium (EPA 6020)	Strontium (EPA 6020)	Uranium (EPA 6020)	Vanadium (EPA 6020)										
SA65	SA65-0.5	0.5	X																		X					
	SA65-10	10	X																		X					
	SA65-30	30	X																		X					
	SA65-35	35	X																		X					GW @ 37' (SA15)
SA66	SA66-0.0	0.0																							X	
	SA66-10	10	X			X	X			X			X							X	X	X		X		
	SA66-30	30																			X					
	SA66-35	35																			X					GW @ 37' (SA14)
SA67	SA67-0.5	0.5	X	X		X	X			X			X	X						X	X	X		X		
	SA67-10	10	X	X		X	X			X			X	X						X	X	X		X		
	SA67-30	30	X	X		X	X			X			X	X						X	X	X		X		
	SA67-35	35	X	X		X	X			X			X	X						X	X	X		X		GW @ 37' (SA14)
SA68	SA68-0.0	0.0																							X	
	SA68-10	10	X	X		X			X	X	X		X	X						X	X	X		X		
	SA68-30	30	X	X		X				X			X	X						X	X	X		X		
	SA68-35	35	X	X		X				X			X	X						X	X	X		X		GW @ 37' (SA14)
SA69	SA69-0.0	0.0																							X	
	SA69-10	10	X			X	X			X			X							X	X	X	X	X		
	SA69-30	30	X																							GW @ 26' (SA19)
SA70	SA70-0.5	0.5	X																		X					
	SA70-10	10	X																		X					
	SA70-30	30	X																		X					
	SA70-35	35	X																		X					GW @ 37' (SA15)
SA71	SA71-0.5	0.5	X	X	X	X				X	X		X								X	X				
	SA71-10	10	X	X	X	X				X	X		X								X	X				
	SA71-22	22	X	X	X	X				X	X		X								X	X				GW @ 24' (SA17)
SA72	SA72-0.5	0.5	X																		X					
	SA72-10	10	X																		X					
	SA72-30	30	X																		X					GW @ 31' (SA16)
SA73	SA73-0.0	0.0																							X	
	SA73-10	10	X			X	X			X			X								X	X				
	SA73-25	25	X			X	X			X			X								X	X				GW @ 26' (SA19)
SA74	SA74-0.5	0.5	X																		X					
	SA74-10	10	X																		X					
	SA74-25	25	X																		X					GW @ 26' (SA19)
SA75	SA75-0.5	0.5	X			X	X			X			X								X	X				
	SA75-10	10	X			X	X			X			X								X	X				
	SA75-25	25	X			X	X			X			X								X	X				GW @ 26' (SA19)
SA76	SA76-0.5	0.5	X																							
	SA76-10	10	X																							
	SA76-25	25	X																							GW @ 27' (SA23)
SA77	SA77-0.5	0.5	X			X	X			X			X								X	X				
	SA77-10	10	X			X	X			X			X								X	X				
	SA77-25	25	X			X	X			X			X								X	X				GW @ 27' (SA23)
SA78	SA78-0.5	0.5	X			X	X			X			X								X	X				
	SA78-10	10	X			X	X			X			X								X	X				
	SA78-30	30	X			X	X			X			X								X	X				GW @ 32' (SA18)

Table I2-3
Sampling Plan to Evaluate Potential Source Areas and the Soil-to-Groundwater Migration Pathway
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Phase B Boring No.	Sample ID Number	Sample Depths (ft, bgs)	Perchlorate (EPA 314.0)	Metals													TPH-DRO (EPA 8015B)	BTEX (EPA 8260)	PAHs (EPA 8270 (SIM))	VOCs (EPA 8260)	Ammonia (EPA 350.1)	Wet Chemistry (a)	Hexachlorobenzene (EPA 8081A)	OCPs (8081A)	Asbestos	NOTES
				Arsenic (EPA 6020)	Boron (EPA 6020)	Calcium (EPA 6010)	Hex Cr (EPA 7199)	Iron (EPA 6020)	Lead (EPA 6020)	Magnesium (EPA 6020)	Manganese (EPA 6020)	Molybdenum (EPA 6020)	Sodium (EPA 6020)	Strontium (EPA 6020)	Uranium (EPA 6020)	Vanadium (EPA 6020)										
SA79	SA79-0.5	0.5	X																							
	SA79-10	10	X																							
	SA79-25	25	X																							GW @ 26' (SA24)
SA80	SA80-0.5	0.5	X																							
	SA80-10	10	X																							
	SA80-25	25	X																							GW @ 26' (SA24)
SA81	SA81-0.5	0.5	X																							
	SA81-10	10	X																							
	SA81-25	25	X																							GW @ 27' (SA23)
SA82	SA82-0.5	0.5	X																							
	SA82-10	10	X																							GW @ 10' (SA26)
SA83	SA83-0.5	0.5	X																							
	SA83-10	10	X																							GW @ 10' (SA26)
SA84	SA84-0.5	0.5	X	X		X				X			X								X	X		X		
	SA84-10	10	X	X		X				X			X								X	X		X		
	SA84-30	30	X	X		X				X			X								X	X		X		
	SA84-35	35	X	X		X				X			X								X	X		X		GW @ 37' (SA04)
SA85-0.0	SA85-0.0	0.0																							X	
	SA85-10	10	X	X		X	X		X	X	X		X							X	X	X		X		
	SA85-30	30	X			X	X			X			X							X	X	X				
	SA85-35	35	X			X	X			X			X							X	X	X				GW @ 37' (SA14)
SA86	SA86-0.5	0.5																					X			
	SA86-10	10																					X			GW @ 27' (SA16/17)
	SA86-25	25																					X			
	Number of Field Samples:		**185**	**50**	**26**	**119**	**69**	**16**	**21**	**119**	**51**	**7**	**119**	**40**	**12**	**8**	**23**	**23**	**23**	**74**	**142**	**119**	**20**	**32**	**17**	
SPLP Analyses			**0**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**4**	**4**	**10**	**10**	**4**	**4**	**4**	**10**	**0**	
QA/QC Samples:																										
Field Duplicates (10%)			19	5	3	12	7	2	3	12	6	1	12	4	2	1	3	3	3	8	15	12	2	4	2	
Field Blanks			2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	
Equipment Rinsate Blanks			17	9	4	17	10	2	4	17	8	3	17	3	2	1	4	4	4	11	5	17	3	5	9	
Trip Blank Samples			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Matrix Spike (5%)			10	3	2	6	4	1	2	6	3	1	6	2	1	1	2	2	2	4	8	6	1	2	1	
Matrix Spike Duplicate (5%)			10	3	2	6	4	1	2	6	3	1	6	2	1	1	2	2	2	4	8	6	1	2	1	
Total Number of Samples:			**243**	**92**	**59**	**182**	**116**	**44**	**54**	**182**	**93**	**34**	**182**	**73**	**40**	**34**	**40**	**40**	**46**	**113**	**184**	**166**	**33**	**57**	**32**	

Notes:

X	Sample will be collected and analyzed.
TPH-DRO	Total petroleum hydrocarbons - Diesel range organics.
BTEX	Benzene, toluene, ethylbenzene, total xylenes.
PAHs	Polycyclic aromatic hydrocarbons.
VOCs	Volatile Organic Compounds (includes analysis for naphthalene).
OCPs	Organochlorine Pesticides (includes analysis for hexachlorobenzene).
SPLP	Synthetic Precipitate Leaching Procedure (EPA Method 1312)
(a)	Wet chemistry parameters include: alkalinity (HCO^-_3), chlorate, chloride, and sulfate.

Table I2-4
Well Completion Data for Potential Monitor Wells for Consideration in Background Water Quality Analysis
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

WEST WELLS[1]	OWNER	FORMATION	SURVEY COORDINATES		Elevation		Screen Depth		Screen Elevation			TD		Qal Thickness
			NORTHING	EASTING	TOC	GROUND	Top	Bottom	Top	Mid	Bottom			
					ft msl	ft msl	ft bgs	ft bgs	ft msl	ft msl	ft msl	ft bgs	ft msl	ft
MW-AD	Ampac	Qal/MC-fg1	821179.00000	26717406.00000	1807.30	1807.65	28	48	1779.3	1769.3	1759.3	48	1,759	--
MW-AEX-35	Ampac	Qal/MC-fg1	821720.40000	26718438.60000	1782.70	1754.10	35	55	1747.7	1737.7	1727.7	56	1,727	--
MW-AGX-50	Ampac	MC-fg1	822805.00000	26719990.00000	1756.30	1754.10	50	70	1706.3	1696.3	1686.3	70	1,686	49
MW-AHX	Ampac	MC-fg1	823443.00000	26721020.30000	1735.60	1736.58	45	70	1690.6	1678.1	1665.6	70	1,666	52
MW-FX-25	Ampac	Qal/MC-fg1	820249.00000	26721316.00000	1758.30	1758.50	25	47	1733.3	1722.3	1711.3	47	1,711	33
MW-ZY-11	Ampac	Qal/MC-fg1	818099.90000	26722535.50000	1753.00	--	11	31	1742.0	1732.0	1722.0	36	1,717	--
MW-1	Ampac	--	--	--	--	--	--	--	--	--	--	--	--	--

SOUTH WELLS[1]	OWNER	FORMATION	SURVEY COORDINATES		Elevation		Screen Depth		Screen Elevation			TD		Qal Thickness
			NORTHING	EASTING	TOC	GROUND	Top	Bottom	Top	Mid	Bottom			
					ft msl	ft msl	ft bgs	ft bgs	ft msl	ft msl	ft msl	ft bgs	ft msl	ft
H-11	Montrose-Stauffer	MC-cg1	826574.86251	26714839.87784	1868.41	1867.26	--	--	--	--	--	116	1751.26	102
H-13	Montrose-Stauffer	MC-cg1	823311.90000	26716336.20000	--	1820.53	--	--	--	--	--	88	1732.53	38
M-121	Tronox	MC-cg1	827686.75893	26715004.83647	1875.63	--	77	97	1798.63	1788.63	1778.63	102	--	45
M-120	Tronox	MC-cg1	--	--	1878.58	1875.81	80	100	1798.58	1788.58	1778.58	105	1770.81	49
M-103	Tronox	MC-cg1	825009.896	26721975.166	1866.91	1864.53	69.5	89.5	1797.41	1787.41	1777.41	90	1774.53	43
TR-10	Tronox	MC-cg1	827562.530	26715739.770	1854.06	1851.72	80	100	1774.06	1764.06	1754.06	102	1749.72	45
MW-01	Montrose-Stauffer	--	830105.00000	26718320.00000	--	--	--	--	--	--	--	--	--	--

EAST WELLS[1]	OWNER	FORMATION	SURVEY COORDINATES		Elevation		Screen Depth		Screen Elevation			TD	TD	Qal Thickness
			NORTHING	EASTING	TOC	GROUND	Top	Bottom	Top	Mid	Bottom			
					ft msl	ft msl	ft bgs	ft bgs	ft msl	ft msl	ft msl	ft bgs	ft msl	ft
BRW-R1	TIMET	--	831591.74485	26716952.35275	--	--	--	--	--	--	--	69.9	--	--
CK-4	--	MC-fg1	831919.45156	26718390.95342	1805.39	1805.74	--	--	--	--	--	74	1731.74	--
CK-6	--	MC-fg1	831981.93503	26718402.31823	1805.83	1806.14	--	--	--	--	--	68	1738.14	--
HMW-20	Tronox	MC-fg1	834158.70000	26721321.70000	1753.90	1751.50	--	--	--	--	--	65	1686.5	--
HMW-21	Tronox	MC-fg1	835446.90000	26721504.20000	1762.30	1760.00	--	--	--	--	--	65	1695	--
HMW-22	Tronox	MC-fg1	835244.90000	26718085.30000	--	1832.00	--	--	--	--	--	87	1745	56
HMMWT-08	Tronox	MC-fg1	833239.40000	26720421.60000	1766.00	1766.00	56	71	1710	1702.5	1695	71	1695	50
MCF-03B	BRC	MC-cg1	836813.17000	26721066.60100	1785.72	1783.46	57	77	1728.72	1718.72	1708.72	80.15	1703.31	40

NOTES

1 Well completion data as shown in the Tronox "Mother Hen" database and the "All Wells" database provided to Tronox by BRC opn September 7, 2007.

DEFINITIONS

ft	feet
ft bgs	feet below ground surface
ft msl	feet above mean sealevel
mg/l	milligrams per liter
MC-fg1	Muddy Creek - fine grain unit 1
MC-cg1	Muddy Creek - coarse grain unit 1
Qal/MC-fg1	Quaternary alluvium/Muddy Creek - fine grain unit 1
--	Data not available in the database reviewed

Table I2-5
Analytical Plan to Evaluate Background Groundwater
Analytical Methods
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Analyte	Analytical Method for Water	Site-Related Chemical? (Yes or No)	Class
Metals			
Arsenic	EPA 6020	Yes	M
Boron	EPA 6020	Yes	M
Calcium	EPA 6020	Yes	M
Chromium (hexavalent)	EPA 7199/3060A+7199	Yes	M
Iron	EPA 6020	Yes	M
Lead	EPA 6020	Yes	M
Manganese	EPA 6020	Yes	M
Molybdenum	EPA 6020	Yes	M
Sodium	EPA 6020	Yes	M
Strontium	EPA 6020	Yes	M
Uranium	EPA 6020	Yes	M
Vanadium	EPA 6020	Yes	M
Wet Chemistry			
Alkalinity (total,CO3--,HCO3-)	EPA 310.1	Yes	W
Ammonia	EPA 350.1	Yes	W
Chlorate	EPA 9056	Yes	W
Chloride	EPA 9056	Yes	W
Conductivity	EPA 9050A	Yes	W
Nitrate	EPA 9056	Yes	W
Nitrite	EPA 9056	Yes	W
Perchlorate	EPA 314.0	Yes	W
pH	EPA 9040/9045C	Yes	W
Phosphate (ortho)	EPA9056	Yes	W
Sulfate	EPA 9056	Yes	W
Total Dissolved Solids (TDS)	EPA 160.1	Yes	W
Radionuclides			
Uranium 234	EML HASL 300 (alpha)	Yes	R
Uranium 238	EML HASL 300 (alpha)	Yes	R

Notes:
Class codes:
M = Metal.
W = Wet chemistry.
R = Radionuclide.

Table I2-6
Sampling Plan to Evaluate Potential Source Areas and Groundwater Migration Pathway
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Monitoring Well No.	Well Sampled for Phase A? (y/n)	Perchlorate (EPA 314.0)	Metals													VOCs (EPA 8260)	Ammonia (EPA 350.1)	Wet Chemistry (a)	U-238 (EML HASL 300 (alpha))	U-233/234 (EML HASL 300 (alpha))	OCPs (EPA 8081A)
			Arsenic (EPA 6020)	Boron (EPA 6020)	Calcium (EPA 6020)	Hex Cr (EPA 7199)	Total Cr (EPA 6020)	Iron (EPA 6020)	Magnesium (EPA 6020)	Manganese (EPA 6020)	Molybdenum (EPA 6020)	Sodium (EPA 6020)	Strontium (EPA 6020)	Uranium (EPA 6020)	Vanadium (EPA 6020)						
CLD1R	no	X		X	X	X	X		X			X					X	X			
CLD2R	no	X			X	X	X		X			X	X		X	X	X	X			
CLD3R	no	X			X			X	X			X	X			X	X	X	X	X	
CLD4R	no	X		X	X	X	X	X	X			X	X		X	X	X	X	X	X	
CLO4	no	X			X				X	X		X		X			X	X			
CLU1	no	X		X	X			X	X			X					X	X			
H11	no	X	X		X				X		X	X	X		X		X	X	X	X	
H38	no	X			X				X			X	X		X	X	X	X			X
H48	no	X																			
H49A	no	X			X	X	X		X			X					X	X			
IAR	yes	X			X	X	X	X	X		X	X			X	X	X	X			
M02A	yes	X		X	X				X		X	X				X	X	X			
M05A	yes	X			X				X			X	X		X	X	X	X	X	X	
M07B	yes	X			X	X	X		X		X	X	X			X	X	X			
M10	no	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
M11	yes	X		X	X			X	X		X	X	X	X	X	X	X	X	X	X	
M12A	yes	X		X	X			X	X		X	X	X		X	X	X	X	X	X	
M13	yes	X			X	X	X	X	X		X	X	X			X	X	X			
M17A	no															X	X				
M19	no	X		X	X	X	X		X			X			X	X	X	X			
M21	no	X			X				X		X	X				X	X	X			
M22A	no															X	X				
M23	no															X	X				
M25	no															X	X				
M29	yes	X		X	X	X	X	X	X			X	X		X		X	X	X	X	
M31A	yes	X		X	X				X		X	X	X	X		X	X	X			
M33	no	X	X	X	X				X	X		X	X	X		X	X	X	X	X	
M34	no	X			X				X	X		X		X		X	X	X	X	X	
M35	no	X	X		X				X			X			X		X	X			
M38	no															X	X				
M39	yes	X		X	X			X	X			X		X	X		X	X			
M44	no															X					
M48	no	X		X	X				X			X					X	X			
M50	no	X	X		X			X	X		X	X				X	X	X	X	X	
M52	no	X	X	X	X			X	X	X		X		X		X	X	X	X	X	
M55	yes	X		X	X			X	X		X	X					X	X	X	X	
M61	no															X					
M64	no															X	X				
M67	no															X					

Table I2-6
Sampling Plan to Evaluate Potential Source Areas and Groundwater Migration Pathway
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Monitoring Well No.	Well Sampled for Phase A? (y/n)	Perchlorate (EPA 314.0)	Metals													VOCs (EPA 8260)	Ammonia (EPA 350.1)	Wet Chemistry (a)	U-238 (EML HASL 300 (alpha))	U-233/234 (EML HASL 300 (alpha))	OCPs (EPA 8081A)
			Arsenic (EPA 6020)	Boron (EPA 6020)	Calcium (EPA 6020)	Hex Cr (EPA 7199)	Total Cr (EPA 6020)	Iron (EPA 6020)	Magnesium (EPA 6020)	Manganese (EPA 6020)	Molybdenum (EPA 6020)	Sodium (EPA 6020)	Strontium (EPA 6020)	Uranium (EPA 6020)	Vanadium (EPA 6020)						
M68	no	X		X	X				X			X				X	X	X			
M75	no	X	X		X				X			X				X	X	X			
M76	yes	X			X			X	X		X	X				X	X	X			
M77	no	X		X	X	X	X	X	X			X	X			X	X	X			
M78	no															X	X				
M79	no															X	X				
M83	no															X	X				
M84	no	X																			
M88	no	X	X		X				X			X					X	X			
M89	yes	X			X			X	X		X	X			X	X	X	X			
M92	yes	X			X	X	X		X		X	X	X		X	X	X	X			
M93	no															X					
M94	no															X					
M95	yes	X		X	X				X		X	X					X	X	X	X	
M96	no															X					
M97	yes	X			X	X	X	X	X		X	X				X	X	X			
M98	yes	X			X	X	X		X			X				X	X	X			
M99	no	X	X		X				X			X				X	X	X			
M100	yes	X			X	X	X		X			X				X	X	X			
M101	no	X	X		X				X			X				X	X	X			
M102	no	X			X	X	X		X			X					X	X			
M103	no	X	X		X				X		X	X	X		X		X	X	X	X	
M110	no															X					
M111R*	new well	X			X	X	X		X		X	X			X	X	X	X			
M117	no	X			X	X	X		X			X					X	X			
M118	no	X			X	X	X		X			X					X	X			
M120	yes	X			X	X	X		X			X	X				X	X	X	X	
M121	no	X	X		X				X		X	X	X		X	X	X	X	X	X	
M122	new well	X		X	X				X	X		X		X		X	X	X			
M123	new well	X			X	X	X		X	X	X	X			X	X	X	X			X
M124	new well	X			X	X	X		X		X	X			X	X	X	X			
M125	new well	X			X				X		X	X			X	X	X	X	X	X	X
M126	new well	X			X	X	X		X		X	X					X	X			
M127	new well	X	X		X				X	X	X	X			X	X	X	X			X
M128	new well	X			X	X	X		X		X	X			X	X	X	X			
MC3	no	X			X				X		X	X					X	X			
MC32	no															X					
MC45	yes	X			X				X		X	X	X				X	X	X	X	

Table I2-6
Sampling Plan to Evaluate Potential Source Areas and Groundwater Migration Pathway
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Monitoring Well No.	Well Sampled for Phase A? (y/n)	Perchlorate (EPA 314.0)	Metals													VOCs (EPA 8260)	Ammonia (EPA 350.1)	Wet Chemistry (a)	U-238 (EML HASL 300 (alpha))	U-233/234 (EML HASL 300 (alpha))	OCPs (EPA 8081A)
			Arsenic (EPA 6020)	Boron (EPA 6020)	Calcium (EPA 6020)	Hex Cr (EPA 7199)	Total Cr (EPA 6020)	Iron (EPA 6020)	Magnesium (EPA 6020)	Manganese (EPA 6020)	Molybdenum (EPA 6020)	Sodium (EPA 6020)	Strontium (EPA 6020)	Uranium (EPA 6020)	Vanadium (EPA 6020)						
MC53	no	X			X	X	X		X			X					X	X			
MC55	no	X			X	X	X		X			X				X	X	X			
MC59	no															X					
MC62	no	X			X	X	X		X			X					X	X			
MC65	no	X			X	X	X		X			X					X	X			
MC66	no	X			X	X	X		X			X					X	X			
MW6R	no	X			X	X	X		X			X	X	X	X		X	X			
PC21A	no	X			X	X	X		X			X					X	X			
PC33	no															X					
PC34	no															X					
PC37	no															X					
PC40	yes	X		X	X	X	X		X		X	X					X	X			
PC54	no															X					
PC64	no															X					
PC72	no										X					X					
TR03	no															X					
TR04	no															X					
TR06	no															X	X		X	X	
TR08	no																		X	X	
TR10	no	X	X		X				X		X	X	X		X	X	X	X	X	X	
Number of Field Samples:		**69**	**14**	**20**	**67**	**32**	**32**	**17**	**67**	**8**	**31**	**67**	**22**	**10**	**25**	**67**	**77**	**67**	**22**	**22**	**4**
QA/QC Samples:																					
Field Duplicates (10%)		7	2	2	7	4	4	2	7	1	4	7	3	1	3	7	8	7	3	3	1
Field Blanks		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0
Equipment Rinsate Blanks		17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	0	17	17
Trip Blank Samples		0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	17	0	0	0	0
Matrix Spike (5%)		4	1	1	4	2	2	1	4	1	2	4	2	1	2	4	4	4	2	2	1
Matrix Spike Duplicate (5%)		4	1	1	4	2	2	1	4	1	2	4	2	1	2	4	4	4	2	2	1
Total Samples:		**103**	**37**	**43**	**101**	**59**	**59**	**40**	**101**	**30**	**58**	**101**	**48**	**32**	**51**	**118**	**129**	**101**	**31**	**46**	**24**

Notes:
X = Sample will be collected and analyzed.
* = Replacement well for M111 (to be installed during Phase B Source Area Investigation).
U-238 = Uranium 238 isotope.
U-233/234 = Uranium-233/234 combined isotopes.
OCPs = Organochlorine pesticides (to include analysis for hexachlorobenzene).
VOCs = Volatile organic compounds (to include analysis for naphthalene).
(a) = Wet chemistry parameters include: alkalinity (HCO_3^-), chlorate, chloride, nitrate, nitrite, phosphate (ortho), sulfate, and total dissolved solids (TDS).

Table I2-7
Sampling Plan to Evaluate Soil Gas for the Vapor Intrusion to Indoor Air Pathway
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Evaluation Area	Soil Gas Probe Location	Soil Gas Sample ID Number	Sample Depths (ft, bgs)	VOCs (TO-15)
EA-1	SG01	SG01-10	10	X
	SG02	SG02-10	10	X
	SG03	SG03-10	10	X
	SG04	SG04-10	10	X
	SG05	SG05-10	10	X
	SG06	SG06-10	10	X
EA-2	SG07	SG07-10	10	X
	SG08	SG08-10	10	X
	SG09	SG09-10	10	X
	SG10	SG10-10	10	X
	SG11	SG11-10	10	X
	SG12	SG12-10	10	X
	SG13	SG13-10	10	X
	SG14	SG14-10	10	X
	SG15	SG15-10	10	X
EA-3	SG16	SG16-10	10	X
	SG17	SG17-10	10	X
	SG18	SG18-10	10	X
	SG19	SG19-10	10	X
EA-4	No soil gas samples will be collected from EA-4.			
EA-5	SG20	SG20-10	10	X
	SG21	SG21-10	10	X
	SG22	SG22-10	10	X
	SG23	SG23-10	10	X
	SG24	SG24-10	10	X
	SG51	SG51-10	10	X
	SG52	SG52-10	10	X
	SG53	SG53-10	10	X
	SG54	SG54-10	10	X
EA-6	SG25	SG25-10	10	X
	SG26	SG26-10	10	X
	SG27	SG27-10	10	X
	SG28	SG28-10	10	X
	SG29	SG29-10	10	X
	SG30	SG30-10	10	X
	SG55	SG55-10	10	X
EA-7	SG31	SG31-10	10	X
	SG32	SG32-10	10	X
	SG33	SG33-10	10	X
	SG34	SG34-10	10	X

Table I2-7
Sampling Plan to Evaluate Soil Gas for the Vapor Intrusion to Indoor Air Pathway
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Evaluation Area	Soil Gas Probe Location	Soil Gas Sample ID Number	Sample Depths (ft, bgs)	VOCs (TO-15)
EA-7 (continued)	SG56	SG56-10	10	X
	SG57	SG57-10	10	X
	SG58	SG58-10	10	X
	SG59	SG59-10	10	X
	SG60	SG60-10	10	X
	SG61	SG61-10	10	X
	SG62	SG62-10	10	X
	SG63	SG63-10	10	X
EA-8	SG35	SG35-10	10	X
	SG36	SG36-20	20	X
	SG37	SG37-20	20	X
	SG38	SG38-20	20	X
EA-9	SG39	SG39-10	10	X
	SG40	SG40-10	10	X
	SG41	SG41-20	20	X
	SG42	SG42-10	10	X
	SG43	SG43-10	10	X
	SG44	SG44-10	10	X
EA-10	SG45	SG45-10	10	X
	SG46	SG46-10	10	X
	SG47	SG47-10	10	X
	SG48	SG48-10	10	X
EA11	SG49	SG49-10	10	X
	SG50	SG50-10	10	X
			Number of Field Samples:	**63**

QA/QC Samples:

Field Duplicates (10%)	7
Field Blanks	0
Equipment Rinsate Blanks	0
Trip Blank Samples (2/day)	0
Matrix Spike (5%)	4
Matrix Spike Duplicate (5%)	4

Total Number of Samples: 78

Notes:
X Sample will be collected and analyzed for constituents shown on Table I2-8.

Table I2-8
Soil Gas Sample Analyte List
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

	CAS #	TO-15 Compound
1	67-64-1	Acetone
2	71-43-2	Benzene
3	75-27-4	Bromodichloromethane
4	75-25-2	Bromoform
5	74-83-9	Bromomethane
6	78-93-3	2-Butanone (MEK)
7	75-15-0	Carbon Disulfide
8	56-23-5	Carbon Tetrachloride
9	108-90-7	Chlorobenzene
10	75-00-3	Chloroethane
11	67-66-3	Chloroform
12	74-87-3	Chloromethane
13	124-48-1	Dibromochloromethane
14	106-93-4	1,2-Dibromoethane
15	95-50-1	1,2-Dichlorobenzene
16	541-73-1	1,3-Dichlorobenzene
17	106-46-7	1,4-Dichlorobenzene
18	75-34-3	1,1-Dichloroethane
19	107-06-2	1,2-Dichloroethane
20	75-35-4	1,1-Dichloroethene
21	156-59-2	Cis-1,2-Dichloroethene
22	156-60-5	trans-1,2-Dichloroethene
23	78-87-5	1,2-Dichloropropane
24	10061-01-5	Cis-1,3-Dichloropropene
25	10061-02-6	trans-1,3-Dichloropropene
26	100-41-4	Ethylbenzene
27	591-78-6	2-Hexanone
28	1634-04-4	Methyl tert-Butyl Ether
29	75-09-2	Methylene chloride
30	108-10-1	4-Methyl-2-pentanone (MIBK)
31	100-42-5	Styrene
32	79-34-5	1,1,2,2-Tetrachloroethane
33	127-18-4	Tetrachloroethene (PCE)
34	71-55-6	1,1,1-Trichloroethane
35	79-00-5	1,1,2-Trichloroethane
36	79-01-6	Trichloroethene (TCE)
37	75-69-4	Trichlorofluoromethane (Freon 11)
38	76-13-1	Trichlorotrifluoroethane (Freon 113)
39	108-88-3	Toluene
40	108-05-4	Vinyl Acetate
41	75-01-4	Vinyl Chloride
42	136777-61-2	m,p-Xylenes
43	95-47-6	o-Xylene

Table I3-1
Sample Containers, Analytical Methods, and Holding Times for Soil Samples
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Analyte	Method	Container (Minimum Volume)	Holding Time
Perchlorate	EPA 314.0/ Prep method 1:10 Di leach	4-oz. glass jar	None
Asbestos	EPA/540/R-97/028	1 kilogram in plastic bag or glass jar, no preservative	6 months
Metals*	EPA 6010 / 6020	4-oz. glass jar	6 months
Hexavalent Chromium	EPA 7199 by ion chromatography or EPA7196, EPA 3060A for digestion	4-oz. glass jar	28 days to digestion, then 7 days to analysis of digestate
BTEX	EPA 8260B/5035	4x40-mL VOA vials**	14 days
VOCs	EPA 8260B/5035	4x40-mL VOA vials**	14 days
TPH***	EPA 8015B	Metal sleeve or glass jar for DRO/ORO.	14 days
Organochlorinated Pesticides	EPA Method 8081A	4-oz. glass jar	14 days
SVOCs	EPA Method 8270 SIM	4-oz. glass jar	14 days
Radionuclides:			
Uranium (Isotopic)	EML HASL 300 Alpha Spec	4-oz. poly jar, no preservative	6-months

Note:
* Includes the metals listed on Table 2-3
For samples listing 4-oz. glass jar, one metal sleeve can be substituted.
** Three VOA vials preserved with sodium bisulfite and one VOA vial preserved with methanol.
*** TPH includes DRO

Table I3-2
Sample Containers, Analytical Methods, and Holding Times for Groundwater Samples
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Analyte	Method	Container (Minimum Volume)	Holding Time
Perchlorate	EPA 314.0	(1) 125-ml plastic bottle	28 days
Metals*	EPA 6010B / 6020	(1) 500-ml plastic bottle w/ HNO3	6 months
Hexavalent Chromium	EPA 7199	(1) 250-ml plastic bottle	24 hours
VOCs	EPA 8260B	(3) 40-ml VOA vials	14 days
Organochlorinated Pesticides	EPA 8081A	(1) 1-liter amber glass/ no preservative	7 days
SVOCs	EPA 8270 SIM	(1) 1-liter amber glass/ no preservative	7 days
Radionuclides:			
Uranium (Isotopic)	EML HASL 300 Alpha Spec	(1) 1-liter poly bottle (must be full), Preservative pH <2 HNO3	6 months

Note:
* Includes the metals listed on Table 2-5

Table I3-3
DQLs for SRCs - Soil and Groundwater
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Analyte	Analytical Method	SRC? Y or N	Class	Tap Water PRG (ug/L)	Industrial Soil PRG (mg/kg)
Metals					
Arsenic	EPA 6020	Y	M	10	1.00E+00
Boron	EPA6010B/6020	Y	M	17.00	1.00E+05
Chromium (hexavalent)	EPA 7199/3060A+7199	Y	M	50	2.00E+00
Chromium (total)	EPA 6020	Y	M	100	2.00E+00
Iron	EPA 6010B/6020	Y	M	11000	1.00E+05
Lead	EPA 6020	Y	M	15	8.00E+02
Manganese	EPA 6020	Y	M	880	1.90E+04
Molybdenum	EPA 6020	Y	M	180	5.11E+03
Strontium	EPA 6020	Y	M	22000	1.00E+05
Uranium	EPA 6020	Y	M	7	2.00E+02
Vanadium	EPA 6020	Y	M	36	3.00E+02
Wet Chemistry					
Ammonia	EPA 350.1	Y	W		
Asbestos	EPA/540/R-97/028	Y	W	7 MFL	
Perchlorate	EPA 314.0	Y	W	3	1.02E+02
TPH					
DRO(C10-C28)	EPA 8015B	Y	T		3.00E+04
OCPs					
4,4'-DDD	EPA 8081A	Y	P	0.28	8.00E-01
4,4'-DDE	EPA 8081A	Y	P	0.2	3.00E+00
4,4'-DDT	EPA 8081A	Y	P	0.2	2.00E+00
Aldrin	EPA 8081A	Y	P	0.004	2.00E-02
alpha-BHC	EPA 8081A	Y	P	1.07E-02	3.00E-05
alpha-Chlordane	EPA 8081A	Y	P	0.192	5.00E-01
beta-BHC	EPA 8081A	Y	P	0.0374	1.00E-04
Chlordane, technical	EPA 8081A	Y	P	0.192	5.00E-01
delta-BHC	EPA 8081A	Y	P	0.0107	3.00E-05
Dieldrin	EPA 8081A	Y	P	0.0042	2.00E-04
Endosulfan I	EPA 8081A	Y	P	219	9.00E-01
Endosulfan II	EPA 8081A	Y	P	219	9.00E-01
Endosulfan sulfate	EPA 8081A	Y	P	219	9.00E-01
Endrin	EPA 8081A	Y	P	2	5.00E-02
Endrin aldehyde	EPA 8081A	Y	P	2	5.00E-02
Endrin Ketone	EPA 8081A	Y	P	2	5.00E-02
gamma-BHC (Lindane)	EPA 8081A	Y	P	0.0517	5.00E-04
gamma-Chlordane	EPA 8081A	Y	P	0.192	5.00E-01
Heptachlor	EPA 8081A	Y	P	0.0149	3.80E-01
Heptachlor epoxide	EPA 8081A	Y	P	0.007+3	3.00E-02
Methoxychlor	EPA 8081A	Y	P	40	8.00E+00
Toxaphene	EPA 8081A	Y	P	0.061	1.60E+00

Table I3-3
DQLs for SRCs - Soil and Groundwater
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Analyte	Analytical Method	SRC? Y or N	Class	Tap Water PRG (ug/L)	Industrial Soil PRG (mg/kg)
Radionuclides					
Uranium (isotopic)	EML HASL 300 Alpha Spec	Y	R		various
Volatile Organic Compounds					
1,1,1,2-Tetrachloroethane	EPA 8260	N	V	4.32E-01	7.30E+00
1,1,1-Trichloroethane	EPA 8260	Y	V	2.00E+02	1.00E-01
1,1,2,2-Tetrachloroethane	EPA 8260	N	V	5.53E-02	2.00E-04
1,1,2-Trichloroethane	EPA 8260	N	V	2.00E-01	9.00E-04
1,1-Dichloroethane	EPA 8260	N	V	8.11E+02	1.00E+00
1,1-Dichloroethene	EPA 8260	N	V	7.00E+00	3.00E-03
1,1-Dichloropropene	EPA 8260	N	V	3.95E-01	2.00E-04
1,2,3-Trichlorobenzene	EPA 8260	N	V	7.16E+00	3.00E-01
1,2,3-Trichloropropane	EPA 8260	N	V	5.60E-03	7.60E-02
1,2,4-Trichlorobenzene	EPA 8260	N	V	7.16E+00	3.00E-01
1,2,4-Trimethylbenzene	EPA 8260	Y	V	1.23E+01	1.70E+02
1,2-Dibromo-3-chloropropane	EPA 8260	N	V	4.76E-02	2.02E+00
1,2-Dibromoethane	EPA 8260	N	V	0.0056	7.30E-02
1,2-Dichlorobenzene	EPA 8260	Y	V	3.70E+02	9.00E-01
1,2-Dichloroethane	EPA 8260	N	V	1.23E-01	1.00E-03
1,2-Dichloropropane	EPA 8260	N	V	1.65E-01	1.00E-03
1,3,5-Trimethylbenzene	EPA 8260	Y	V	1.23E+01	6.97E+01
1,3-Dichlorobenzene	EPA 8260	Y	V	1.83E+02	6.00E+02
1,3-Dichloropropane	EPA 8260	N	V	5.00E+00	3.61E+02
1,4-Dichlorobenzene	EPA 8260	Y	V	5.02E-01	1.00E-01
2,2-Dichloropropane	EPA 8260	N	V	1.65E-01	1.13E+05
2-Butanone	EPA 8260	Y	V	6.97E+03	5.60E+02
2-Chlorotoluene	EPA 8260	N	V	1.22E+02	1.13E+05
2-Hexanone	EPA 8260	Y	V	6.97E+03	5.60E+02
4-Chlorotoluene	EPA 8260	N	V	1.22E+02	4.70E+04
4-Methyl-2-pentanone	EPA 8260	Y	V	2.00E+03	8.00E-01
Acetone	EPA 8260	Y	V	5.50E+03	2.00E-03
Benzene	EPA 8260	Y	V	3.54E-01	9.22E+01
Bromobenzene	EPA 8260	N	V	2.03E+01	3.00E-02
Bromochloromethane	EPA 8260	N	V	1.81E-01	3.00E-02
Bromodichloromethane	EPA 8260	N	V	1.81E-01	4.00E-02
Bromoform	EPA 8260	N	V	8.51E+00	1.00E-02
Bromomethane	EPA 8260	N	V	8.66E+00	3.00E-03
Carbon Tetrachloride	EPA 8260	N	V	1.71E-01	7.00E-02
Chlorobenzene	EPA 8260	Y	V	100	6.49E+00
Chloroethane	EPA 8260	N	V	4.64E+00	3.00E-02
Chloroform	EPA 8260	Y	V	8.00E+01	1.56E+02
Chloromethane	EPA 8260	N	V	1.58E+02	2.00E-02
cis-1,2-Dichloroethene	EPA 8260	N	V	6.08E+01	2.00E-04
cis-1,3-Dichloropropene	EPA 8260	N	V	3.95E-01	2.00E-02

Table I3-3
DQLs for SRCs - Soil and Groundwater
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Analyte	Analytical Method	SRC? Y or N	Class	Tap Water PRG (ug/L)	Industrial Soil PRG (mg/kg)
Dibromochloromethane	EPA 8260	N	V	1.33E-01	2.34E+02
Dibromomethane	EPA 8260	N	V	6.08E+01	3.08E+02
Dichlorodifluoromethane	EPA 8260	N	V	3.95E+02	na
Diisopropyl ether (DIPE)	EPA 8260	Y	V		7.00E-01
Ethylbenzene	EPA 8260	Y	V	7.00E+02	na
Ethyl-tert-butyl ether (ETBE)	EPA 8260	Y	V		1.00E-01
Hexachlorobutadiene	EPA 8260	N	V	8.62E-01	1.98E+03
Isopropyl Benzene	EPA 8260	Y	V	6.58E+02	1.00E+01
Methylene Chloride	EPA 8260	N	V	4.28E+00	1.00E-03
Methyl-tert-butyl ether (MTBE)	EPA 8260	N	V	1.10E+01	3.64E+01
Naphthalene	EPA 8260	N	V	6.20E+00	4.00E+00
n-Butylbenzene	EPA 8260	Y	V	2.43E+02	2.40E+02
n-Propylbenzene	EPA 8260	Y	V	2.43E+02	2.40E+02
p-Isopropyltoluene	EPA 8260	Y	V	6.58E+02	1.98E+03
sec-Butylbenzene	EPA 8260	Y	V	2.43E+02	2.20E+02
Styrene	EPA 8260	N	V	1.00E+02	2.00E-01
tert-Amyl-methyl ether (TAME)	EPA 8260	Y	V		na
tert-Butyl alcohol (TBA)	EPA 8260	Y	V		na
tert-Butylbenzene	EPA 8260	N	V	2.43E+02	3.90E+02
Tetrachloroethene	EPA 8260	Y	V	5.00E+00	3.00E-03
Toluene	EPA 8260	Y	V	7.20E+02	6.00E-01
trans-1,2-Dichloroethene	EPA 8260	N	V	1.00E+02	3.00E-02
trans-1,3-Dichloropropene	EPA 8260	N	V	3.95E-01	2.00E-04
Trichloroethene	EPA 8260	Y	V	5.00E+00	3.00E-03
Trichlorofluoromethane	EPA 8260	N	V	1.29E+03	2.00E+03
Vinyl Chloride	EPA 8260	N	V	1.98E-02	7.00E-04
Xylenes (total)	EPA 8260	Y	V	2.10E+02	1.00E+01
Semi-Volatile Organic Compounds					
Acenaphthene	EPA 8270 SIM	Y	S	3.70E+02	2.90E+01
Acenaphthylene	EPA 8270 SIM	Y	S	3.65E+02	2.90E+01
Anthracene	EPA 8270 SIM	Y	S	1.80E+03	5.90E+02
Benzo(a)anthracene	EPA 8270 SIM	Y	S	9.20E-02	8.00E-02
Benzo(a)pyrene	EPA 8270 SIM	Y	S	9.20E-05	2.10E-01
Benzo(b)fluoranthene	EPA 8270 SIM	Y	S	9.20E-02	2.00E-01
Benzo(g,h,i)perylene	EPA 8270 SIM	Y	S	1.83E+02	2.10E+02
Benzo(k)fluoranthene	EPA 8270 SIM	Y	S	9.20E-02	2.00E+00
Bis(2-ethylhexyl)phthalate	EPA 8270	Y	S	4.80E+00	1.23E+02
Butylbenzylphthalate	EPA 8270	Y	S	7.30E+03	8.10E+02
Chrysene	EPA 8270	Y	S	9.00E+00	8.00E+00
Dibenzo(a,h)anthracene	EPA 8270 SIM	Y	S	9.21E-03	8.00E-02
Fluoranthene	EPA 8270 SIM	Y	S	1.50E+03	2.10E+02
Fluorene	EPA 8270 SIM	Y	S	2.70E+03	2.80E+01
Hexachlorobenzene	EPA 8270 SIM	Y	S	1.00E+00	1.00E-01
Indeno(1,2,3-cd)pyrene	EPA 8270 SIM	Y	S	9.20E-02	7.00E-01

Table I3-3
DQLs for SRCs - Soil and Groundwater
Phase B Source Area Investigation Work Plan
Tronox Facility - Henderson, Nevada

Analyte	Analytical Method	SRC? Y or N	Class	Tap Water PRG (ug/L)	Industrial Soil PRG (mg/kg)
Naphthalene	EPA 8270 SIM	Y	S	6.00E+00	4.00E+00
Phenanthrene	EPA 8270 SIM	Y	S	1.83E+03	5.90E+02
Pyrene	EPA 8270 SIM	Y	S	1.80E+02	2.10E+02

Y = Yes, N = No.
DQL = Data quality level.
TPH = Total Petroleum Hydrocarbon.
SRC = Site Related Chemical.
Class codes
M = Metal.
V= Volatile.
S = Semivolatile.
P = Pesticide.
R= Radionuclide.
W = Wet chemistry.
D = Dioxin.
MFL = million fibers per liter
PRG = EPA Region IX Preliminary Remediation Goals October 2004.
* units = pCi/L. ** units = pCi/g.

FIGURES

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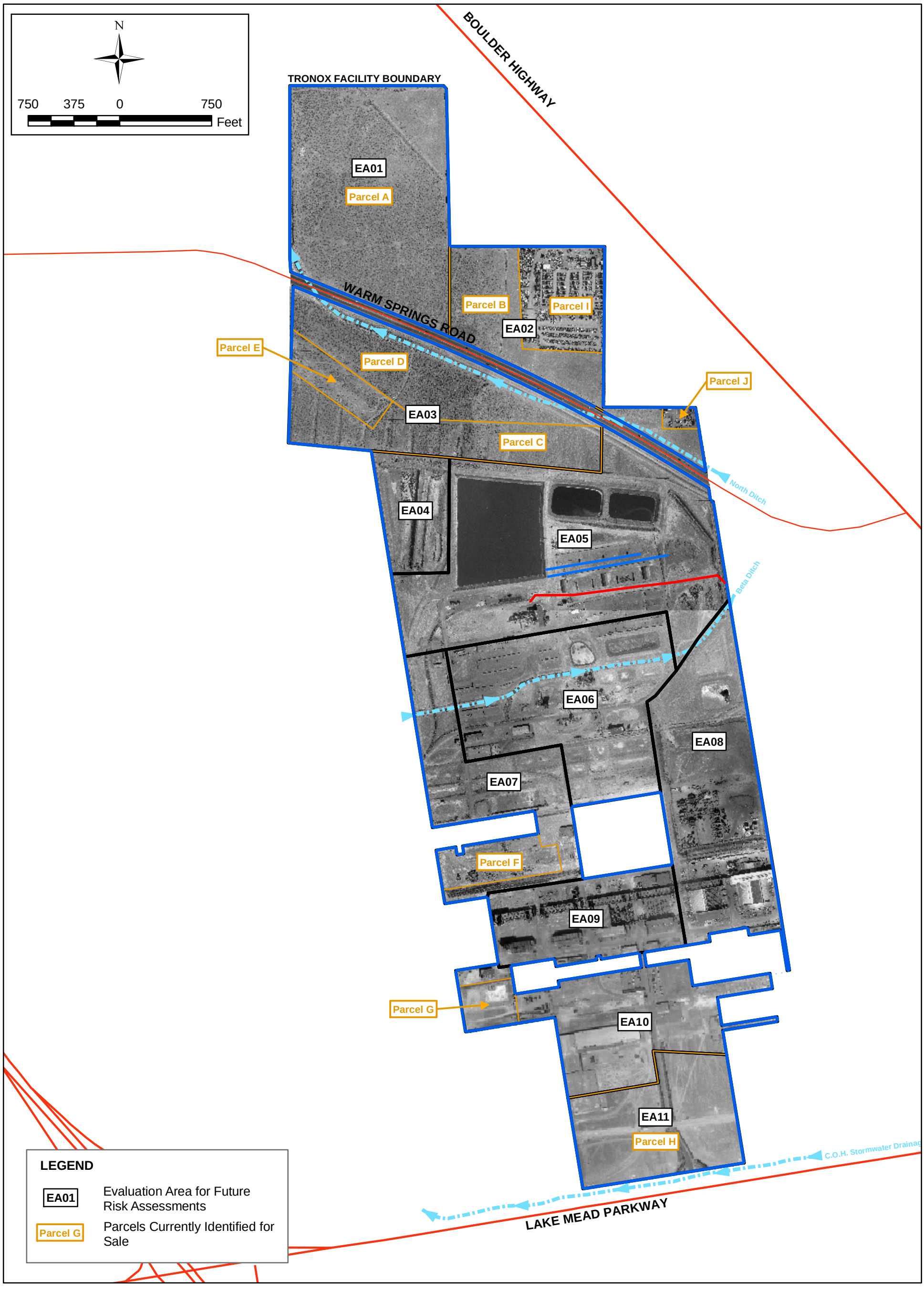

SHEET NUMBER: X	I2-1	FIGURE NUMBER:

PHASE B EVALUATION AREA LOCATION MAP

PHASE B SOURCE AREA INVESTIGATION WORK PLAN
TRONOX FACILITY
HENDERSON, NEVADA

SCALE:	DATE:	PROJECT NUMBER:
1:9,000	9/18/2007	04020-023-430

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LB	NO:	DESCRIPTION:	DATE:	BY:
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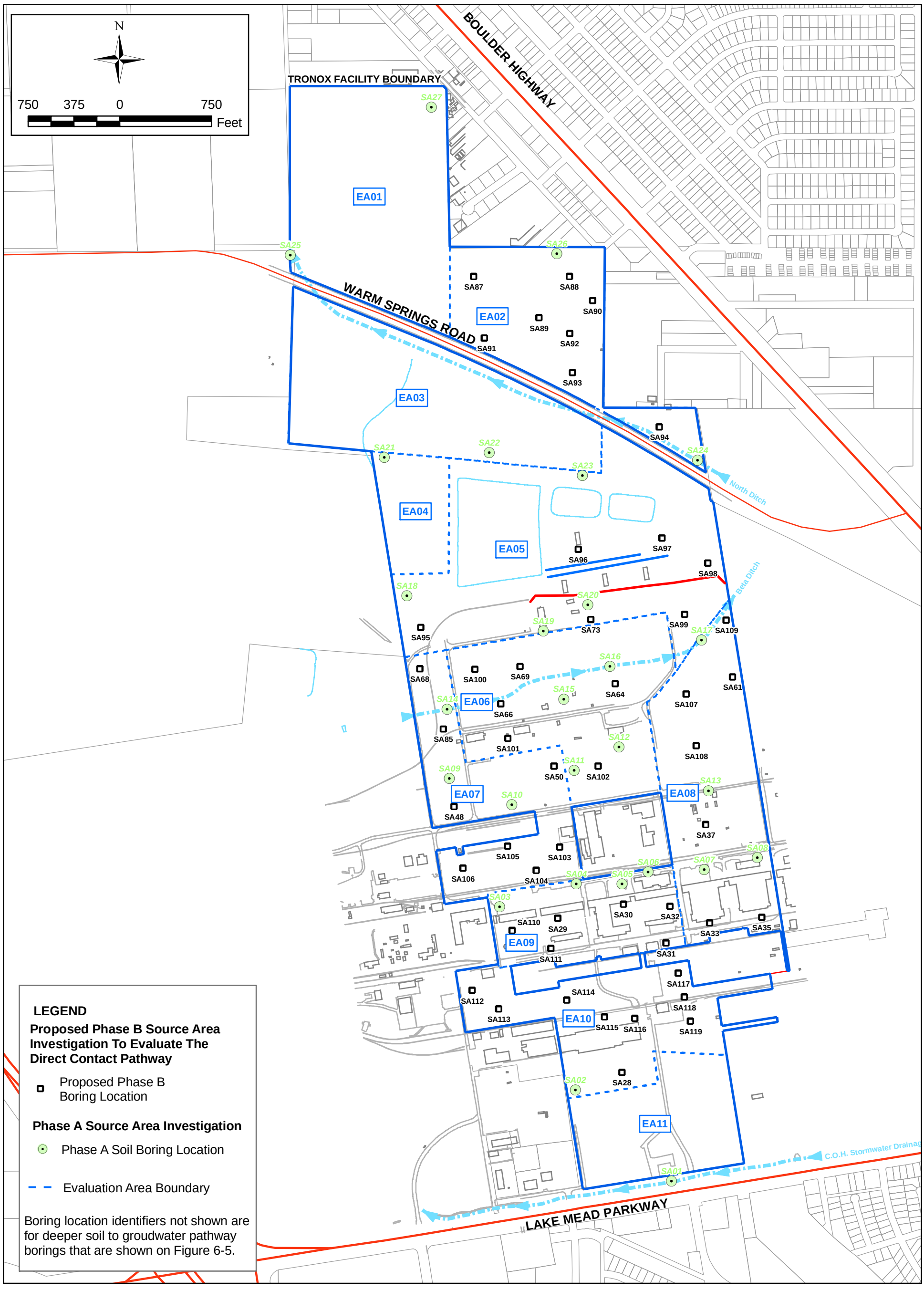

FIGURE NUMBER:	SHEET NUMBER:
I2-2	X

EVALUATION AREAS AND PROPOSED PHASE B SOIL SAMPLE LOCATIONS TO EVALUATE THE DIRECT CONTACT PATHWAY

PHASE B SOURCE AREA INVESTIGATION WORK PLAN
TRONOX FACILITY
HENDERSON, NEVADA

SCALE:	DATE:	PROJECT NUMBER:
1:9,000	8/24/07	04020-023-430

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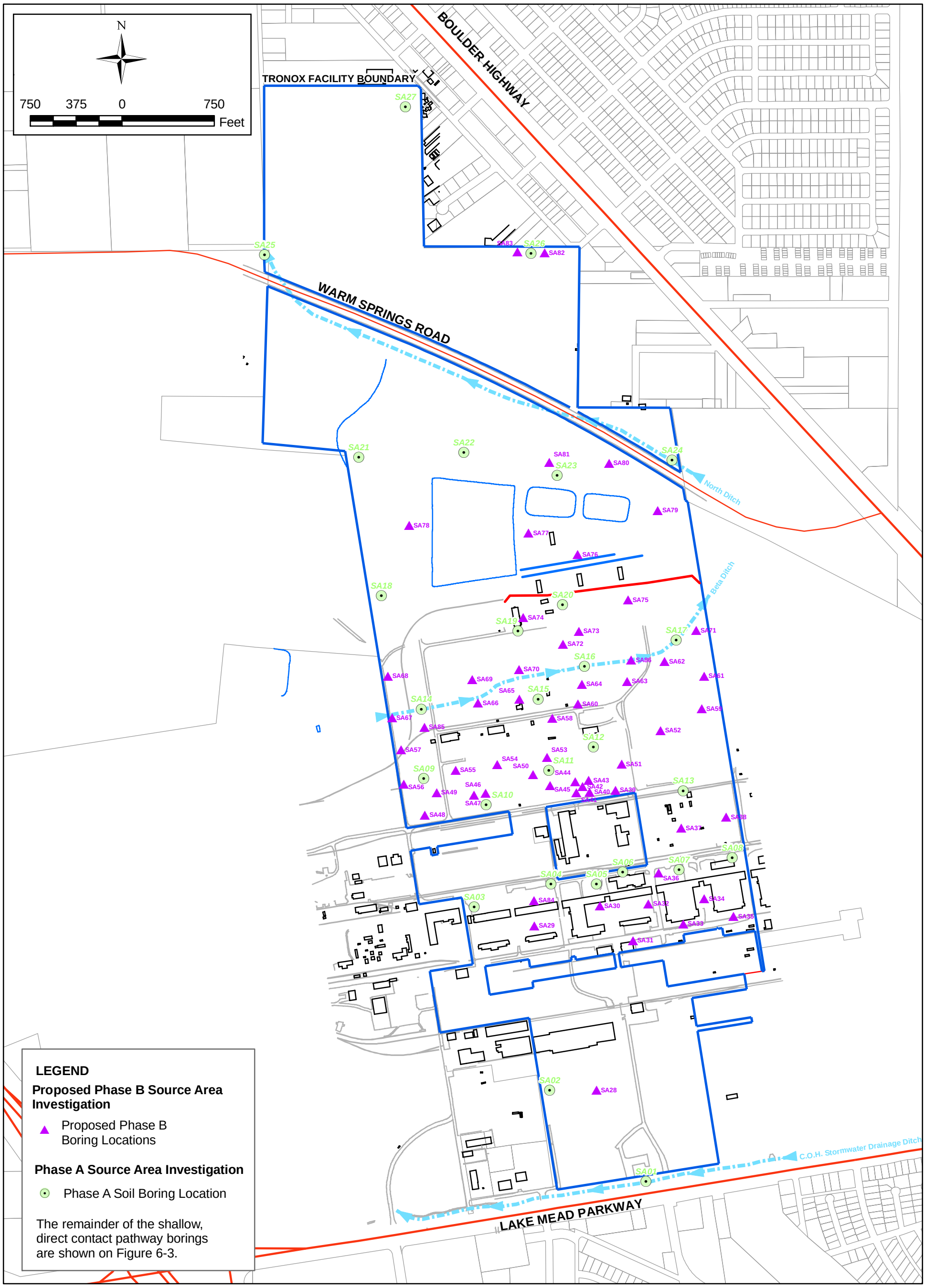

LEGEND

Proposed Phase B Source Area Investigation

▲ Proposed Phase B Boring Locations

Phase A Source Area Investigation

⊙ Phase A Soil Boring Location

The remainder of the shallow, direct contact pathway borings are shown on Figure 6-3.

SHEET NUMBER:	FIGURE NUMBER:
X	I2-3

SITEWIDE COMPILATION OF PROPOSED BORING LOCATIONS TO EVALUATE POTENTIAL SOURCE AREAS AND SRCs ALONG THE SOIL TO GROUNDWATER PATHWAY

PHASE B SOURCE AREA INVESTIGATION WORK PLAN
TRONOX FACILITY
HENDERSON, NEVADA

SCALE:	DATE:	PROJECT NUMBER:
1:9,000	8/21/07	04020-023-430

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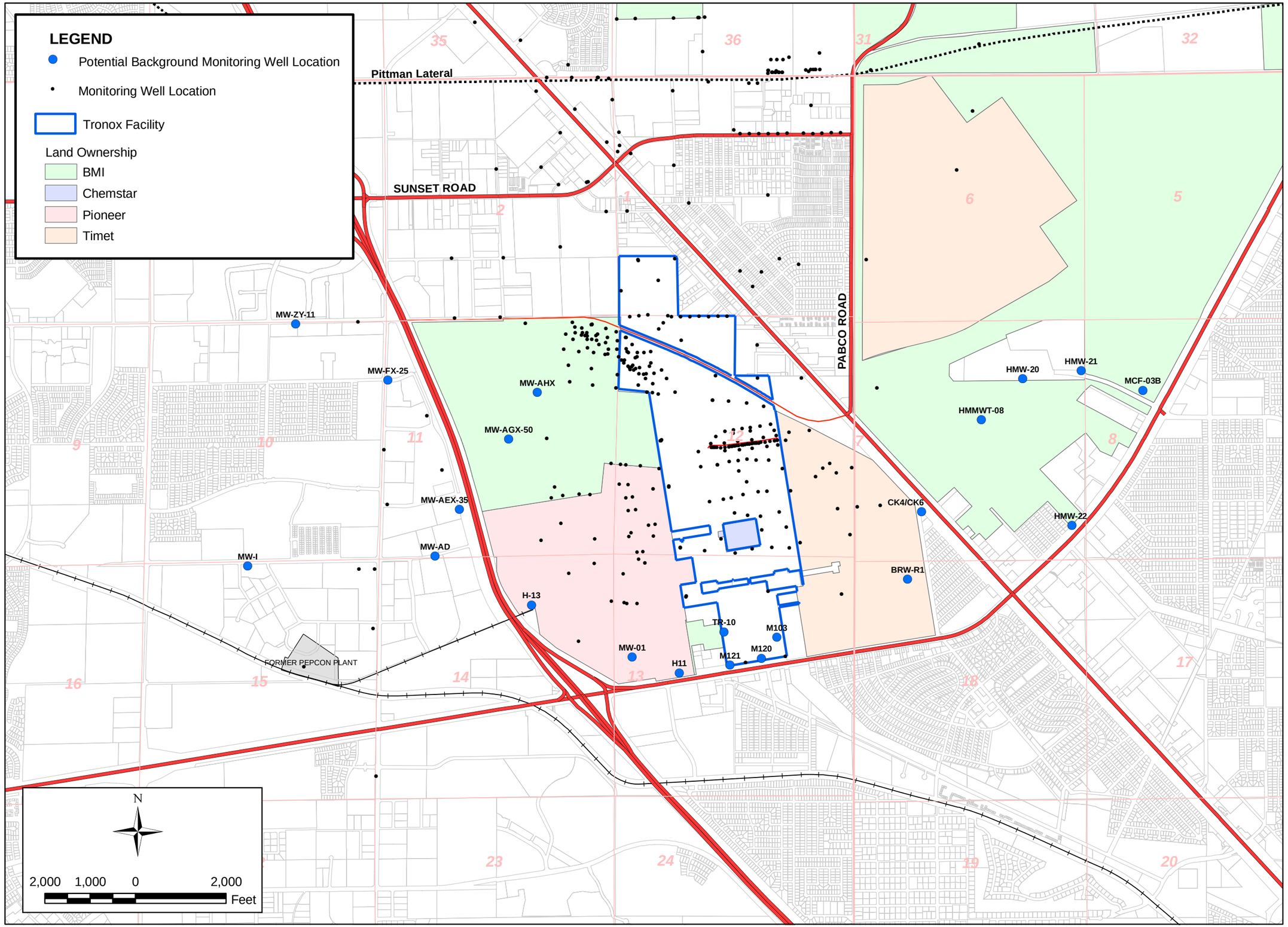

REVISIONS:	NO:	DESCRIPTION:	DATE:	BY:

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MF	TM	CCS	DG

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POTENTIAL MONITOR WELLS FOR CONSIDERATION IN BACKGROUND WATER QUALITY ANALYSIS

PHASE B SOURCE AREA INVESTIGATION WORK PLAN
TRONOX FACILITY
HENDERSON, NEVADA

SCALE:	DATE:	PROJECT NUMBER:
1:24,000	9/24/2007	04020-023-430

FIGURE NUMBER:

I2-4

SHEET NUMBER:

X

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N

750 375 0 750

Feet

TRONOX FACILITY BOUNDARY

BOULDER HIGHWAY

WARM SPRINGS ROAD

LAKE MEAD PARKWAY

North Ditch

Bea Ditch

C.O.H. Stormwater Drainage Ditch

H48 SA27 PC40 PC64 PC34 H49A PC33 SA25 MC62 PC72 M44 M94 M95 M96 SA26 MC66 MC65 MC45 PC37 PC54 MC53 MC55 MC3 MC59 MC32 M7B H28A SA21 SA22 M98 M99 SA23 M100 M101 M102 CLD3R M23 M48 PC21A SA24 M88 M84 M83 M79 CLD1R CLD2R M61 M68 M67 M5A SA18 SA20 M55 M64 M78 M126 SA19 M38 M25 M22A M39 SA17 M127 I-A-R M110 SA16 M19 M89 M111R SA15 M17A M125 TR-4 TR-3 SA14 H38 M35 M34 CLD4R M75 M2A M76 M128 SA11 SA12 CLU1 M123 SA09 M21 M50 M31A M33 SA13 M124 SA10 M52 M77 M97 M122 SA08 M93 SA06 SA07 MW-6R TR-6 M92 SA04 SA05 M11 M13 M12A M29 SA03 M10 TR-8 SA02 TR-10 M103 M120 M117 SA01 M121 M118 H11

LEGEND

Proposed Phase B Source Area Investigation

- Proposed Phase B Groundwater Sample Locations (Existing Wells)
- Proposed Phase B Groundwater Sample Locations (New or Replacement Wells)

Phase A Source Area Investigation

- Phase A Soil Boring Location

FIGURE NUMBER:	SHEET NUMBER:
I2-5	X

SITEWIDE PROPOSED PHASE B GROUNDWATER SAMPLE LOCATIONS

PHASE B SOURCE AREA INVESTIGATION WORK PLAN
TRONOX FACILITY
HENDERSON, NEVADA

SCALE:	DATE:	PROJECT NUMBER:
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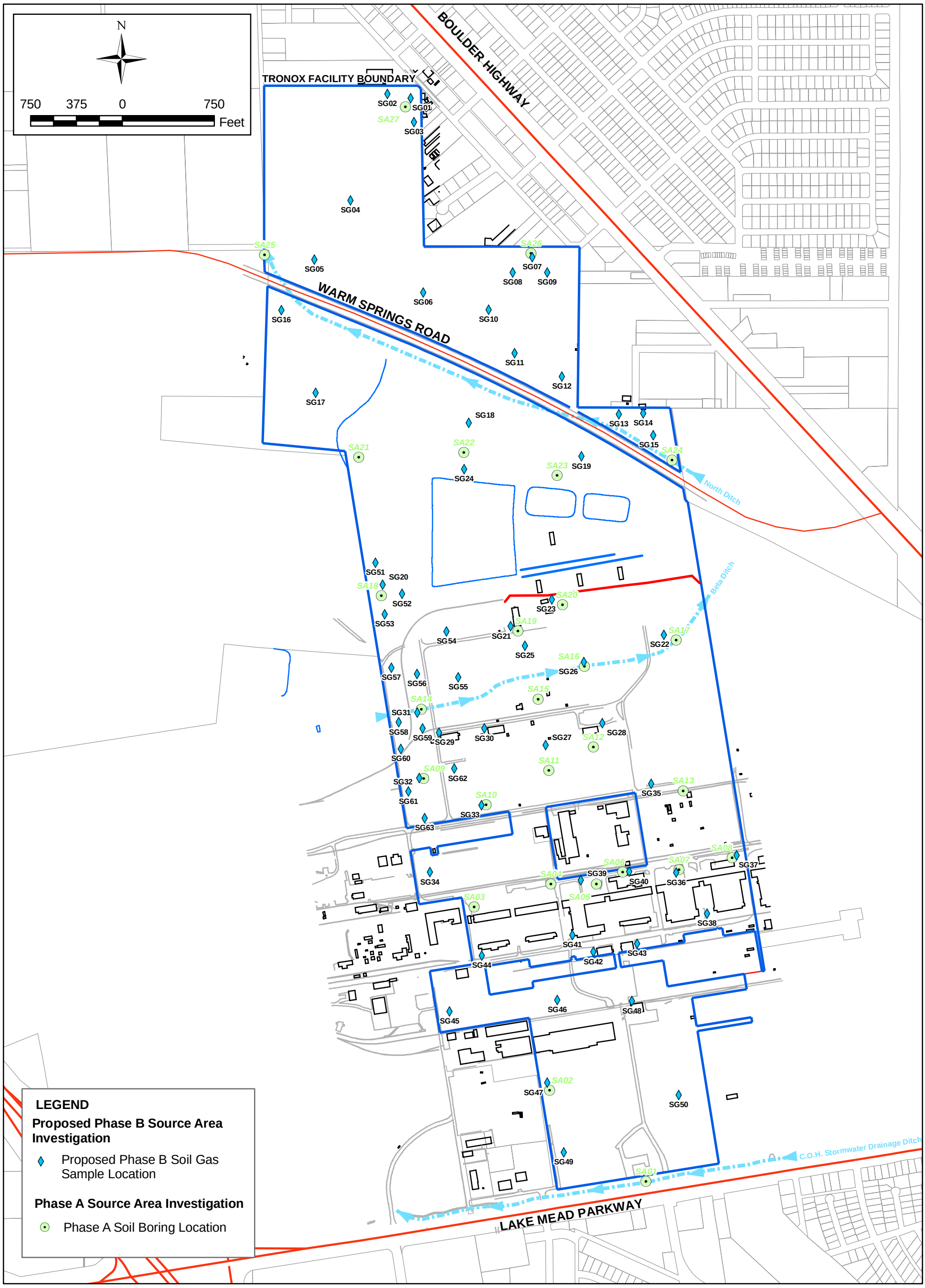

FIGURE NUMBER:	SHEET NUMBER:
I2-6	X

PROPOSED PHASE B SOIL GAS SAMPLE LOCATIONS TO EVALUATE VAPOR INTRUSION PATHWAY

PHASE B SOURCE AREA INVESTIGATION WORK PLAN
TRONOX FACILITY
HENDERSON, NEVADA

SCALE:	DATE:	PROJECT NUMBER:
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BH				

APPENDIX A
Examples of Field Forms

ENSR

Client:			***BORING ID:***
Project Number:			
Site Location:			
Coordinates:		*Elevation:*	*Sheet: 1 of 1*
Drilling Method:			*Monitoring Well Installed:*
Sample Type(s):		*Boring Diameter:*	*Screened Interval:*
Weather:	*Logged By:*	*Date/Time Started:*	*Depth of Boring:*
Drilling Contractor:	*Ground Elevation:*	*Date/Time Finished:*	*Water Level:*

Depth (ft)	Geologic sample ID	Sample Depth (ft)	Blows per 6"	Recovery (inches)	Headspace (ppm)	U.S.C.S	MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known)	Lab Sample ID	Lab Sample Depth (Ft.)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

NOTES:

Date	Time	Depth to groundwater while drilling

Checked by _____ Date: _____

ENSR International
1220 Avenida Acaso
Camarillo, CA 93012-8738
Phone (805) 388-3775
Fax (805) 388-3577

ANALYTICAL LAB: _____

_____

_____ SITE _____ DATE _____ PAGE _____ OF _____

CLIENT

PROJECT NAME:

PROJECT MANAGER:

JOB #:

COELT LOG CODE: YES / NO ☐ ☐ ☐ ☐

SAMPLER SIGNATURE

_____

ANALYTICAL METHODS

LINE ITEM	SAMPLE NO.	DATE	TIME	8260B / 5035 Volatile Organics	8260B BTEX / MTBE / Oxygenates	8015 Diesel / Gasoline / Full Range	8081A Pesticides	CAM 17 Metals													MATRIX TYPE	CONTAINER TYPE	NUMBER OF CONTAINERS	TURN-AROUND TIME / OBSERVATIONS/ COMMENTS
1.																								
2.																								
3.																								
4.																								
5.																								
6.																								
7.																								
8.																								
9.																								
10.																								

MATRIX TYPE: S - Soil, W - Water, O - Other

CONTAINER TYPE: G - Glass Bottle, P - Plastic, O - Other

PRESERVATIVES:
All samples are preserved on ice.
Water samples are preserved as indicated on the sample labels.

TEMPERATURE BLANK EACH COOLER ☐ YES ☐ NO

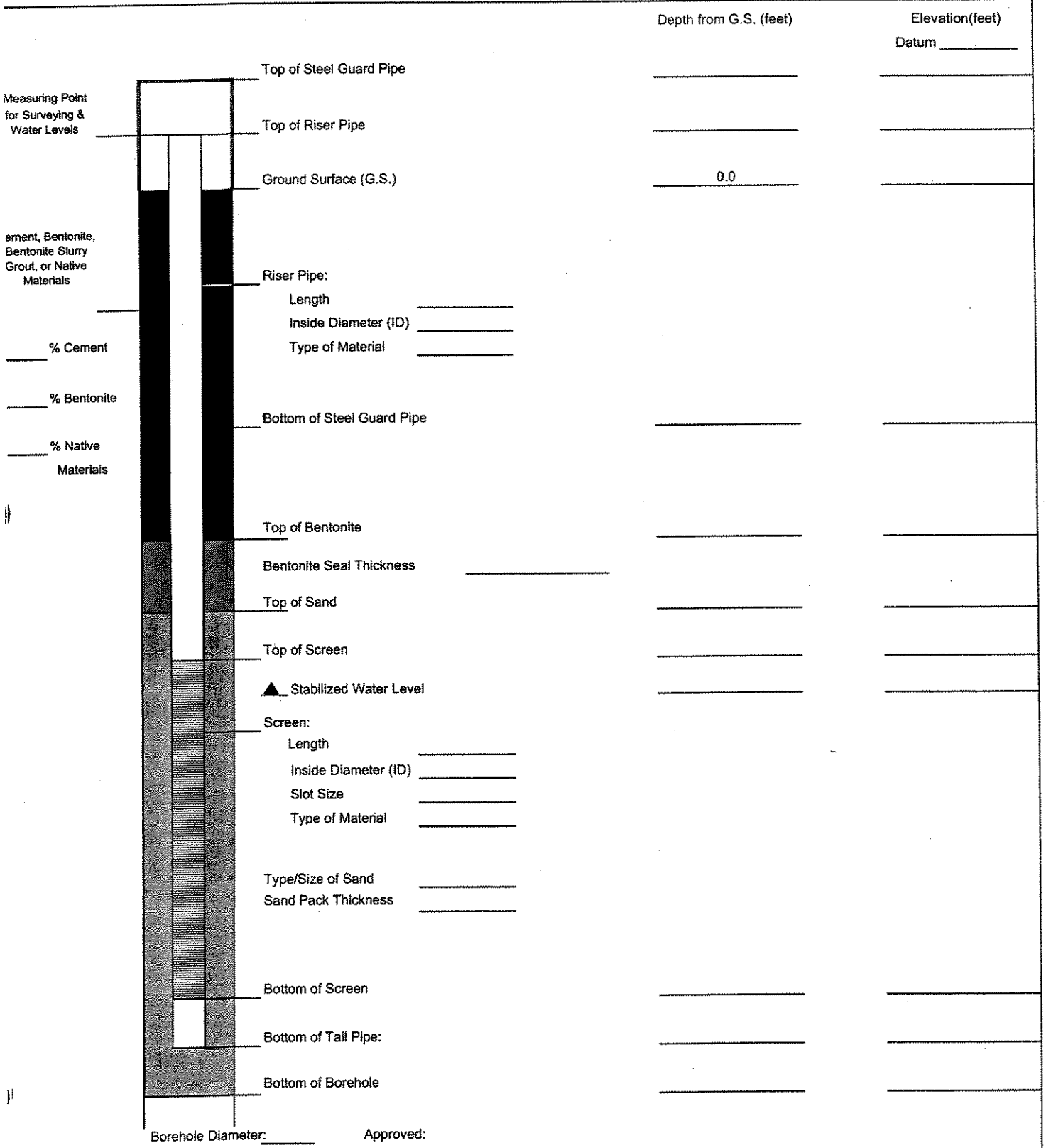
RELINQUISHED BY:	SIGNATURE	**ENSR International**	DATE	TIME	TOTAL NUMBER OF CONTAINERS:
RECEIVED BY:	SIGNATURE	COMPANY	DATE	TIME	METHOD OF SHIPMENT
RELINQUISHED BY:	SIGNATURE	COMPANY	DATE	TIME	SPECIAL SHIMENT/HANDLING/STORAGE REQUIREMENTS:
RECEIVED BY	SIGNATURE	COMPANY	DATE	TIME	

DISTRIBUTION: White and Canary = Laboratory **Pink = ENSR International**

Serial No. 2626

ENSR	*Client:*	***WELL ID:***
	Project Number:	
	Site Location:	*Date Installed:*
	Well Location: *Coords:*	*Inspector:*
	Method:	*Contractor:*

MONITORING WELL CONSTRUCTION DETAIL



ENSR

Well/Piez. ID:

Monitoring Well Development Record

Client: _____ Site Location: _____

Project No: _____ Date: _____ Developer: _____

WELL/PIEZOMETER DATA

Well ☐ Piezometer ☐ Diameter _____ Material _____

Measuring Point Description _____

Depth to Top of Screen (ft.) _____

Depth to Bottom of Screen (ft.) _____

Total Well Depth (ft.) _____

Depth to Static Water Level (ft.) _____

Geology at Screen Interval (if known) _____

Time of Water Level Measurement _____

Calculate Purge Volume (gal.) _____

Disposal Method _____

Wellhead PID/FID _____

Original Well Development ☐ Redevelopment ☐ Date of Original Development _____

DEVELOPMENT METHOD _____ **PURGE METHOD** _____

Field Testing Equipment Used: Make Model Serial Number

_____

_____

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (____ well volumes) _____gallons

Maximum Turbidity Allowed _____ NTUs

Stabilization of parameters _____%

	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A explain below:

_____

_____

_____

Signature _____ Date: _____

ENSR

Well ID:

Low Flow Ground Water Sample Collection Record

Client: _____ Date: _____ Time: Start _____ am/pm
Finish _____ am/pm
Project No: _____
Site Location: _____
Weather Conds: _____ Collector(s): _____

1. WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length _____ c. Length of Water Column _____ (a-b)

Casing Diameter/Material _____

b. Water Table Depth _____ d. Calculated System Volume (see back) _____

2. WELL PURGE DATA

a. Purge Method: _____

b. Acceptance Criteria defined (see workplan)

- Temperature	3%	-D.O.	10%
- pH	± 1.0 unit	- ORP	± 10mV
- Sp. Cond.	3%	- Drawdown	< 0.3'

c. Field Testing Equipment used: Make Model Serial Number

_____

_____

Time (24hr)	Volume Removed (Liters)	Temp. (°C)	pH	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (feet)	Color/Odor

(continued on back)

d. Acceptance criteria pass/fail

	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A - Explain below.

_____

3. SAMPLE COLLECTION: Method: _____

Sample ID	Container Type	No. of Containers	Preservation	Analysis Req.	Time

Comments _____

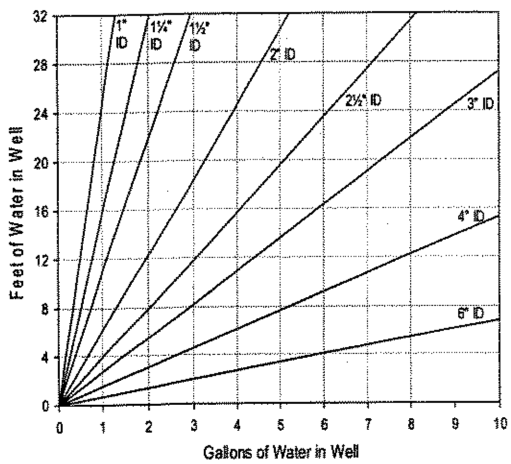
_____

_____

_____

Signature _____ Date _____

Purge Volume Calculation



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600

(continued from front)

Time (24 hr)	Volume Removed (Liters)	Temp (°C)	pH	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (ft)	Color/Odor

ENSR

Well/Piezo ID:

Ground Water Sample Collection Record

Client: _____ Date: _____
Project No: _____ Time: Start _____ am/pm
Site Location: _____ Finish _____ am/pm
Weather Conds: _____ Collector(s) _____

WATER LEVEL DATA: (measured from Top of Casing) Well ☐ Piezometer ☐

a. Total Well Length _____ c. Casing Material _____ e. Length of Water Column _____

b. Water Table Depth _____ d. Casing Diameter _____ f. Calculated Well Volume (see back) _____

WELL PURGING DATA

a. Purge Method _____

b. Acceptance Criteria defined (from workplan)
- Minimum Required Purge Volume (@ _____ well volumes) _____
- Maximum Allowable Turbidity _____ NTUs
- Stabilization of parameters _____ %

c. Field Testing Equipment Used: Make Model Serial Number

_____

_____

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page #_____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other

e. Acceptance criteria pass/fail

	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A - Explain below.

_____

_____

SAMPLE COLLECTION: Method: _____

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time

Comments _____

_____

Signature _____ Date _____