Prepared for:
Tronox LLC
Henderson, Nevada

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

ENSR Corporation
September 2006
Document No.: 04020-023-400

TRONOX

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September 29, 2006

Mr. Brian Rakvica, P.E.
Nevada Division of Environmental Protection
1771 East Flamingo, Suite 121-A
Las Vegas, NV 89119-0837

Subject: NDEP Facility ID H-000539 – Tronox LLC ECA – *Phase A Source Area Investigation Work Plan*

Dear Mr. Rakvica:

Tronox LLC (Tronox) has undertaken an Environmental Conditions Assessment (ECA) as directed by Nevada Division of Environmental Protection (NDEP). Please find attached a revised *Phase A Source Area Investigation Work Plan*, which covers field sampling (both soil and groundwater) to be completed at the Henderson site.

Feel free to call either Keith Bailey (405) 775-6526 or me at (702) 651-2234 if you have any questions regarding this correspondence. Thank you.

Sincerely,

SM Crowley

Susan Crowley
Staff Environmental Specialist, CEM 1428 exp 3-8-07

Overnight Mail

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Mack	Joel	Montrose Counsel			

Phase A Source Area Investigation Work Plan
Tronox LLC-Henderson, Nevada

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.

SM Crowley 9-26-06

Susan M. Crowley, CEM 1428 exp. date 3/8/07
Staff Environmental Specialist
Tronox LLC

Individuals who provided input to this document

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ABBREVIATIONS AND ACRONYMS

AP&CC	American Potash and Chemical Company
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
bgs	below ground surface
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COPC	constituents of potential concern
DO	dissolved oxygen
DOT	Department of Transportation
DQL	data quality limit
ECA	Environmental Conditions Assessment
EPA	United States Environmental Protection Agency
F	Fahrenheit
ft/ft	feet per foot
GC/MS	Gas Chromatography/Mass Spectrometry
GRO	gasoline range organics
HASP	Health and Safety Plan
ICP	inductively coupled plasma
IDW	investigation-derived wastes
LOU	Letter of Understanding
MCcg1	Muddy Creek Formation, first (upper) coarse-grained facies
MCfg1	Muddy Creek Formation first (upper) fine-grained facies
MCL	Maximum Contaminant Level
NDEP	Nevada Division of Environmental Protection
OCPs	Organochlorine pesticides
OPPs	Organophosphorous pesticides
PAHs	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
PID	photoionization detector
PRGs	Preliminary Remediation Goals as established by EPA Region 9 October 2004
QA/QC	quality assurance/quality control
SAW	Source Area Investigation Work Plan
SCRs	site-related chemicals
SVOCs	semivolatile organic compounds

ABBREVIATIONS AND ACRONYMS

SWMU	solid waste management unit
TDS	total dissolved solids
TOC	total organic carbon
TPH	total petroleum hydrocarbons
Tronox	Tronox LLC
USA	Underground Services Alert
USCS	Unified Soils Classification System
VOA	volatile organic analysis
VOCs	volatile organic compounds
WECCO	Western Electrochemical Company

EXECUTIVE SUMMARY

This work plan describes activities intended to characterize soil and groundwater conditions at the approximately 450-acre 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 (formerly Kerr-McGee Chemical LLC), headquartered in Oklahoma City, Oklahoma (Tronox). The assessment is being conducted under the supervision of the Nevada Division of Environmental Protection (NDEP).

A draft Source Area Investigation Work Plan (SAW) Phase A was submitted to the NDEP in February 2006. The February SAW included eight borings and associated groundwater samples, and proposed a 3-phase investigation program (Phases A, B and C). Comments were received from the NDEP dated March 11, 2006.

In response to the comments received, and in cooperation with the NDEP during monthly meetings in March through September 2006, Tronox revised and expanded the SAW to include 27 borings and an equal number of groundwater samples. Whereas the original SAW was based on three phases of site characterization, the revised SAW, described herein, combines the work elements included in the former Phase A and Phase B. The scope of work included in this revised SAW includes the assessment and initial characterization of site related chemicals (SRCs) and the development of geologic and chemical impact data along five, sub-parallel, east-west transects across the site. The copies of Tronox and NDEP correspondence are included in **Appendix A.** Future work beyond that proposed herein was renamed from the former Phase C in the February SAW to Phase B in this work plan.

This work plan sets forth the objectives and work scope for the collection and analyses of soil and groundwater for the Phase A-Source Area Investigation (Phase A-SAW). This investigation focuses on the soil and groundwater conditions associated with areas within the Site that are suspected to be impacted or comprise potential contaminant source areas. **Table 1** lists the potential study areas identified by the NDEP in their August 15, 1994 Letter of Understanding (LOU). Historically these areas have been called LOU study areas, or LOU areas, for short, and many of them are suspected contaminant source areas. Along with the LOU areas, the U.S. Vanadium site was added to the **Table 1**.

Table 1 also presents the known and/or postulated chemicals of interest associated with the potential source areas. **Table 2** presents the general investigative parameters. The information summarized in **Tables 1 and 2** were combined in **Table 3** which presents the rationale for the proposed boring and groundwater sample locations. **Plate 1** depicts the LOU areas, other potential source areas, the proposed soil borings, and the groundwater sample locations.

The initial suite of chemical data collected during Phase A includes the analysis of 230 chemicals, as listed in **Table 4**. These data will be used to identify and characterize the SRCs present in soil and groundwater at the 27 locations sampled across the site. Cross sections will be developed to refine the understanding of the subsurface geology and the presence and distribution of SRCs.

Each of the SRC parameters will be evaluated to assess the adequacy of its characterization. The adequacy of characterization will be determined by applying appropriate statistical tools to verify the comparability of the parameter with other data populations; comparing the SRC parameter detections with the available EPA Industrial PRG values (Industrial PRG x 0.10) or MCLs; evaluating the SRC parameter occurrence and frequency of detection; comparing the SRC parameter with upgradient data and background conditions; and reviewing the SRC parameter for evidence of historical uses and or occurrence. Once a SRC parameter is established to be adequately characterized it will be recommended for exclusion from future characterization activities.

Phase B of the Source Area Investigation will be focused on defining the nature and extent of impacts identified during Phase A which require additional characterization. Additional soil borings and wells will be drilled to define the nature and extent of SRC parameters requiring additional characterization. The data generated during both Phase A and Phase B will be used to support risk assessment studies, fate and transport modeling, as necessary, and the evaluation of remedial alternatives, if appropriate.

This document describes the approach and methodology for Phase A – Source Area Investigation (Phase A). The following Phase A scope of work elements have been identified:

- Soil borings will be drilled at 27 locations on the Site.
- Sonic drilling techniques will be employed and the continuous core produced will be observed to prepare the boring log. The samples from 0.5 feet below ground surface (bgs) and at approximate 10 foot intervals to just above the water table in each of the borings will be submitted for laboratory analysis.
- Soil samples will be analyzed for up to 230 SRCs identified on **Table 4**. Approximately 10 percent duplicate samples will be collected and analyzed.
- Groundwater samples will be collected using micropurge methods from approximately 23 wells with 10 percent duplicate samples and analyzed for up to 230 SRCs identified on **Table 4.** Groundwater grab samples will be collected from four boreholes where there are not existing, useable monitoring wells near by. If a well identified for sampling is dry, or otherwise unusable for sampling, a groundwater grab sample will be collected from the borehole.
- Samples of the manganese ore and tailings stockpiles will be collected and analyzed for metals and radionuclides. The tailings sampling was completed in September 2006.

The soil and groundwater analytical data will be used to characterize the impacts present at the selected sample locations, and to identify which of the SRC parameter(s) have been adequately characterized.

The data will be compared to upgradient and background data as well as subjected to appropriate statistical tests and comparisons. These data will be used to direct the focus of the Phase B sampling efforts, to identify which SRC parameters require further characterization, and support future risk assessments.

1.0 Introduction

This work plan describes activities intended to characterize soil and groundwater conditions at the approximately 450-acre 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 (formerly Kerr-McGee Chemical LLC), headquartered in Oklahoma City, Oklahoma (Tronox). The assessment is being conducted under the supervision of the Nevada Division of Environmental Protection (NDEP).

A draft Source Area Investigation Work Plan (SAW) Phase A was submitted to the NDEP in February 2006. The February draft SAW included eight borings and associated groundwater samples, and proposed a 3-phase investigation program (Phases A, B and C). Comments were received from the NDEP dated March 11, 2006.

In response to the comments received, and in cooperation with the NDEP during monthly meetings in March through September 2006, Tronox revised and expanded the SAW to include 27 borings and an equal number of groundwater samples. Whereas the original SAW was based on three phases of site characterization, the revised SAW, described herein, combines the work elements included in the former Phase A and Phase B. The scope of work included in this revised SAW includes the assessment and initial characterization of site related chemicals (SRCs) and the development of geologic and chemical impact data along five, sub-parallel, east-west transects across the site. The copies of Tronox and NDEP correspondence are included in **Appendix A.** Future work beyond that proposed herein was renamed from the former Phase C in the February SAW to Phase B in this Workplan.

This work plan sets forth the objectives and work scope for the collection and analyses of soil and groundwater for the Phase A-Source Area Investigation (Phase A-SAW). This investigation focuses on the soil and groundwater conditions associated with areas within the Site that are suspected to be impacted or comprise potential contaminant source areas. **Table 1** lists the potential study areas identified by the NDEP in their August 15, 1994 Letter of Understanding (LOU). Historically these areas have been called LOU study areas, or LOU areas, for short, and many of them are suspected contaminant source areas. Along with the LOU areas, the U.S. Vanadium site was added to the **Table 1**.

Plate 1 depicts the LOU areas, the other potential source areas, the proposed borings, and the groundwater sample locations. The following U.S. Environmental Protection Agency (EPA) guidance documents were consulted during the preparation of this work plan:

- EPA 1989, Risk Assessment Guidance for Superfund Volume 1 Human Health Evaluation Manual (Part A) interim final (EPA/540/1-89/002), December.

- EPA 2002, Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers, OSWER Technology Innovation Office, May.

Table 1 also presents the known and/or postulated chemicals of interest associated with the potential source areas. **Table 2** presents the general investigative parameters. The information summarized in **Tables 1 and 2** were combined in **Table 3** which presents the rationale for the proposed boring and groundwater sample locations.

The initial suite of chemical data collected during Phase A includes the analysis of 230 chemicals, as listed in **Table 4**. These data will be used to identify and characterize the SRCs present in soil and groundwater at the 27 locations sampled across the site. Cross sections will be developed to refine the understanding of the subsurface geology and the presence and distribution of SRCs.

Each of the SRC parameters will be evaluated to assess the adequacy of its characterization. The adequacy of characterization will be determined by applying appropriate statistical tools to verify the comparability off the parameter with other data populations; by comparing the SRC parameter detections with the available EPA Industrial PRG values or MCLs; by evaluating the SRC parameter occurrence and frequency of detection; by comparing the SRC parameter with upgradient data and background conditions; and by reviewing the SRC parameter for evidence of historical uses and or occurrence. Once a SRC parameter is established to be adequately characterized it will be recommended for exclusion from future characterization activity(s).

Phase B of the Source Area Investigation will be focused on defining the nature and extent of impacts identified during Phase A. Additional soil borings and wells (if necessary) will be drilled to define the nature and extent of SRC parameters requiring additional characterization. The data generated during Phase A and Phase B will be used to support risk assessment studies, fate and transport modeling, as necessary, and the evaluation of remedial alternatives, if appropriate.

This document describes the approach and methodology for Phase A – Source Area Investigation (Phase A). Once Phase A has been completed and approved by the NDEP, a work plan for subsequent phases will be prepared for NDEP review and approval.

1.1 Site History

The BMI complex has been the site of industrial operations since 1942 and was originally sited and operated by the U.S. government as a magnesium production plant in support of the World War II effort. Following the war, a portion of the complex was leased by Western Electrochemical Company (WECCO). By August 1952, WECCO had purchased several portions of the complex, including six of the large unit buildings, and produced manganese dioxide, sodium chlorate, and various perchlorates. In addition, in the early 1950s, pursuant to a contract with the U.S. Navy, WECCO constructed and operated a plant to produce ammonium perchlorate on land purchased by the Navy. In 1956, WECCO merged with American Potash and Chemical Company (AP&CC) and continued to operate the processes, with the Navy's continued involvement in the ammonium perchlorate process.

In 1962, AP&CC purchased the ammonium perchlorate plant from the Navy but continued to supply the Navy, and its contractors, material from the operating process. AP&CC merged with Kerr-McGee Corporation (Kerr-McGee) in 1967. This merger included boron production processes in California, which were moved to Henderson and began operation in the early 1970s. These included elemental boron, boron trichloride, and boron tribromide. In 1994, the boron tribromide process was shut down and dismantled. In 1997, the sodium chlorate process was shut down, and in 1998, production of commercial ammonium perchlorate ended as well. The ammonium perchlorate production equipment was used to reclaim perchlorate from on-site materials until early 2002, when the equipment was permanently shut down.

In 2005, Kerr-McGee Chemical LLC's name was changed to Tronox LLC. Processes currently operated by Tronox at the Henderson facility are for production of manganese dioxide, boron trichloride, and elemental boron. Additional companies operate within the BMI complex; details regarding ownership and leases within the BMI complex are described in the 1993 Phase I Environmental Conditions Assessment (ECA) report (Kleinfelder 1993).

During the 1970s, the EPA, the State of Nevada, and Clark County investigated potential environmental impacts from the BMI companies' operations, including atmospheric emissions, groundwater and surface water discharges, and soil impacts (E&E 1982). From 1971 to 1976, Tronox, then Kerr-McGee, modified their manufacturing process and constructed lined surface impoundments to recycle and evaporate industrial wastewater. In 1976, the facility achieved zero discharge status regarding industrial wastewater management. In 1980, the EPA requested specific information from the BMI companies regarding their manufacturing processes and their waste management practices by issuing section 308 letters. In 1994, the NDEP issued a

Letter of Understanding (LOU) that identified 69 specific areas or items of interest and indicated the level of environmental investigation they wanted Tronox to conduct.

Tronox has undertaken environmental investigations to assess specific impacts in the area. A detailed discussion of the specific areas or items of interest identified in the LOU and a list of the products made, years of production, and approximate waste volumes for WECCO, AP&CC and Tronox are found in the Conceptual Site Model document (ENSR 2005).

1.2 Environmental Conditions Summary

Numerous investigations have been conducted to evaluate the nature, extent, and movement of contaminants on the Site and in downgradient and cross-gradient areas. A summary of the Site history, soil, and groundwater investigations is presented below.

In April 1991, Tronox, then Kerr-McGee, was one of six companies that entered into a Consent Agreement with the NDEP (NDEP 1991) to conduct environmental studies to assess site-specific environmental conditions that are the result of past and present industrial operations and waste disposal practices. The six companies that entered into the Consent Agreement included those past or present entities that conducted business within the BMI complex. The Consent Agreement specified that the companies accomplish the following:

- Identify past industrial practices and waste products generated;
- Identify known or suspected waste management units or areas active on or after November 19, 1980;
- Identify known or suspected spills of any pollutant or contaminant;
- Identify all current and prior owners and operators of any part of the Site;
- Collect and summarize records or investigations that identify, document, or address soil, surface water, groundwater, or air impacts; and
- Provide documentation of all measures that have been taken to monitor, characterize, mitigate, or clean up Site environmental impacts.

In April 1993, in compliance with the 1991 Consent Agreement, Tronox submitted the Phase 1 Environmental Conditions ECA (Kleinfelder 1993) to the NDEP. The purpose of the report was to identify and document site-specific environmental impacts resulting from past or present industrial activities. The Phase 1 ECA included a thorough assessment of the geologic and hydrologic setting, as well as historical manufacturing activities. The assessment identified 31 solid waste management units (SWMUs), 20 areas of known or suspected releases or spills, and 14 miscellaneous areas where Site activities may have impacted the soil, air, or groundwater.

In response to the NDEP review of the Phase 1 ECA and discussions between the NDEP and Tronox, the NDEP prepared a LOU summarizing requirements for additional information and data collection (NDEP 1994). The LOU identified 69 items to be addressed further (see ENSR 2005). The LOUs are listed on **Table 1**. Each of the LOU items was addressed by one or more of the following actions, as requested in the LOU by the NDEP:

1. Tronox provided additional information to the NDEP in a written response (35 items);
2. Tronox conducted field sampling and data collection (12 items);
3. Field investigation by the Henderson Industrial Site Steering Committee (2 items); or

4. “No further action required at this time” (20 items).

On October 2, 1996, Tronox submitted complete responses to the 35 LOU items requiring additional information or explanation (Kerr-McGee 1996b).

In 1996 and 1997, Tronox conducted additional data collection as part of a Phase II ECA. The field investigations were conducted in compliance with an NDEP-approved work plan (Kerr-McGee 1996a). The Phase II ECA addressed the 12 LOU items that were identified as needing additional characterization. In August 1997, Tronox submitted the Phase II ECA (ENSR 1997) report to the NDEP.

On June 10, 1998, the NDEP issued comments to the Phase II ECA report (NDEP 1998), which conditionally approved the document subject to selected additional work and development of a conceptual site model.

On November 9, 1998, Tronox submitted a response to the NDEP comments to the Phase II ECA report and included with the responses a Supplemental Phase II ECA Work Plan (Kerr-McGee 1998) designed to provide the supplemental data required by the NDEP for the Phase II ECA.

On December 17, 1998, the NDEP replied to Tronox, then Kerr-McGee; NDEP conditionally approved Tronox’s Response to Comments and the Supplemental Work Plan. According to the NDEP, the Work Plan was approved subject to “the development of a CSM [conceptual site model] for the Site and comparing the soil sample results that were and will be obtained to the Nevada cleanup standards and actual background values.”

In March and April 1999, the NDEP-approved field work for the supplemental Phase II ECA was conducted. In April 2001, Tronox prepared a report of the findings of the field work and submitted them to the NDEP as the Supplemental Phase II ECA (ENSR 2001).

In February 2004, the NDEP provided a response to the Tronox, then Kerr-McGee, Supplemental Phase II ECA (NDEP 2004). NDEP indicated that additional work would be required including identification of all potential contaminants associated with the Site, background sampling, assessment of site-specific action levels, and identification of data gaps.

In March 2006, six boreholes were drilled and sampled as part of the Tronox upgradient investigation. These data will be used to supplement the data generated through the source area investigation.

In February 2006, the SAW was provided to the NDEP. NDEP provided comments on the SAW March 11, 2006. This SAW has been revised to respond to the NDEP comments. Copies of Tronox and NDEP correspondence are included in **Appendix A**.

1.3 Source Area Investigation – Phase A Objectives

The objective of the Phase A Source Area investigation is to characterize the SRCs at 27 suspected source areas. The goal of the investigation is to develop data that can be used to refine the conceptual site model, to characterize site conditions, and to support for future risk assessments. An additional objective is to determine the compare the upgradient and downgradient chemistry of the soil and groundwater. On the basis of the characterization Tronox will make recommendations to the NDEP regarding which of the SRC parameters have been adequately characterized, and can be excluded from additional characterization through the Phase B investigation.

1.4 Work Plan Organization

The SAW is organized as follows:

- **Section 1** is the introduction and presents a brief history of the Site and summarizes the environmental conditions and source area investigation objectives at the Site;

- **Section 2** discusses the physical setting of the Site;

- **Section 3** contains a discussion of the project investigation rationale;

- **Section 4** describes the field methods that will be used to perform the Phase A Source Area Investigation;

- **Section 5** describes the procedures by which the laboratory data will be evaluated and a description of the resulting report;

- **Section 6** contains a brief description of the project personnel and their roles and responsibilities for the Source Area Investigation; and

- **Section 7** provides a bibliographic list for each of the references cited in this work plan.

Several appendices are included in this document including the following:

- **Appendix A** contains correspondence between the NDEP and Tronox;

- **Appendix B** contains the Site-specific Health and Safety Plan (HASP) that has been prepared for the Source Area Investigation; and

- **Appendix C** contains examples of field documentation forms that will be used during the performance of the Source Area Investigation.

2.0 Site Information – Physical Setting

2.1 Site Location

The Site is approximately 450 acres in size and is located 13 miles southeast of Las Vegas in an unincorporated section of Clark County, Nevada (**Figure 1**). It is completely surrounded by the incorporated area comprising the City of Henderson. The Site is in Township 22S, Range 62E, and covers portions of Sections 1, 12, and 13. The approximate center of the Site is longitude 36°02’45” W and latitude 115°00’20” N. Phase A of the Source Area Investigation is focused on gathering information from selected locations across the entire Site as depicted on **Plate 1**.

2.2 Topography

Elevations across the Site range from 1,677 to 1,873 feet above mean sea level. The land surface across the Site slopes toward the north at a gradient of approximately 0.023 feet per foot (ft/ft). The developed portions of the Site have been modified by grading to accommodate building foundations, surface impoundments, and access roads.

2.3 Climate

The climate of the Las Vegas Valley is arid, consisting of mild winters and dry hot summers. Average annual precipitation as measured in Las Vegas from 1971 to 2000 was 4.49 inches. Precipitation generally occurs during two periods, December through March and July through September. The winter storms generally produce low intensity rainfall over a large area. The summer storms generally produce a high intensity rainfall over a smaller area for a short duration. These violent summer thunderstorms account for most of the documented floods in the Las Vegas area. Temperatures can rise to 120^{O} Fahrenheit (F) in the summer, and average relative humidity is 20 percent. The mean annual evaporation from lake and reservoir surfaces ranges from 60 to 82 inches per year.

Winds frequently blow from the southwest or northwest and are influenced by nearby mountains. Strong winds in excess of 50 miles per hour are experienced occasionally.

2.4 Geology

2.4.1 Regional Geology

The Las Vegas Valley occupies a topographic and structural basin trending northwest-southeast and extending approximately 55 miles from near Indian Springs on the north to Railroad Pass on the south. The valley is bounded by the Las Vegas Range, Sheep Range, and Desert Range to the north; by Frenchman and Sunrise Mountains to the east; by the McCullough Range and River Mountains to the south and southeast; and the Spring Mountains to the west. The mountain ranges bounding the east, north, and west sides of the valley consist primarily of Paleozoic and Mesozoic sedimentary rocks (limestones, sandstones, siltstones, and fanglomerates), whereas the mountains on the south and southeast consist primarily of Tertiary volcanic rocks (basalts, rhyolites, andesites, and related rocks) that lie directly on Precambrian metamorphic and granitic rocks (Bell 1981).

In the Las Vegas Valley, basin-fill consists of Tertiary and Quaternary sedimentary and volcanic rocks and unconsolidated deposits, which can be up to 13,000 feet thick (Langenheim et al. 1998). The valley floor consists of fluvial, paludal (swamp), and playa deposits surrounded by more steeply sloping alluvial fan aprons derived from erosion of the surrounding mountains. Generally, the deposits grade finer with increasing distance from the source area and with decreasing elevation. The structure within the Quaternary and

Tertiary-age basin-fill is characterized by a series of generally north-south trending fault scarps. The origin of the faults is somewhat controversial; they may be tectonic in origin or may be the response to compaction and subsidence within the basin due to groundwater withdrawal.

A detailed discussion of the geology of the Site and surrounding area is found in the Conceptual Site Model document (ENSR 2005).

2.4.2 Local Geology

The local geology and hydrology are defined by data collected from the numerous borings and wells that have been installed in the area.

Alluvium. The Site is located on Quaternary age alluvial deposits that slope north toward Las Vegas Wash. The alluvium consists of a reddish brown heterogeneous mixture of well-graded sand and gravel with lesser amounts of silt, clay, and caliche. Clasts within the alluvium are primarily composed of volcanic material. Boulders and cobbles are common. Due to their mode of deposition, no distinct beds or units are continuous over the area.

A major feature of the alluvial deposits is the stream-deposited sands and gravels that were laid down within paleochannels that were eroded into the surface of the Muddy Creek Formation during infrequent flood runoff periods. These deposits are thickest within the paleochannel boundaries, which are narrow and linear. These sand and gravel deposits exhibit higher permeability than the adjacent, well-graded deposits. In general, these paleochannels trend northeastward.

The thickness of the alluvial deposits ranges from less than a foot to more than 50 feet beneath the Site. Soil types identified in boreholes on-site include poorly sorted gravel, silty gravel, poorly sorted sand, well sorted sand, and silty sand. The thickness of the alluvium, as well as the surface of the underlying Muddy Creek formation, was mapped to locate these paleochannels.

Muddy Creek Formation. The Muddy Creek Formation of Miocene and Pliocene (?) age occurs in Las Vegas Valley as valley-fill deposits that are coarse-grained near mountain fronts and become progressively finer-grained toward the center of the valley (Plume, 1989). Where encountered beneath the Site, the Muddy Creek Formation is composed of at least two thicker units of fine-grained sediments of clay and silt (the first and second fine-grained facies, respectively) interbedded with at least two thinner units of coarse-grained sediments of sand, silt, and gravel (the first and second coarse-grained facies, respectively). Everywhere beneath the Site, except for the southernmost 1,000 feet adjacent to Lake Mead Parkway, the first fine-grained facies (MCfg1) separates the first coarse-grained facies (MCcg1) from the overlying Quaternary alluvium. Within the southern 1,000 feet of the Site, the Muddy Creek Formation’s first fine-grained facies (MCfg1) pinches out along a generally west-northwesterly trending line. South of this line, the first coarse-grained facies (MCcg1) directly underlies the Quaternary alluvium.

The Muddy Creek Formation represents deposition in an alluvial apron environment from the Spring Mountains to the west grading into fluvial, paludal (swamp), playa and lacustrine environments further out into the valley center. On the Site, the Muddy Creek does not crop out but instead subcrops beneath a veneer of Quaternary alluvium.

In on-Site borings, the contact between the Quaternary alluvium and the Muddy Creek Formation (MCfg1) is typically marked by the appearance of well-compacted, moderate brown silt-to-sandy silts or a stiff clay-to-sandy clays, whereas near the Las Vegas Wash, the contact is marked by gray-green to yellow-green gypsiferous clays and silts.

2.4.3 Local Hydrogeology

Alluvial Aquifer. Beneath the northern portion of the Site, the first groundwater encountered occurs within the Quaternary-age alluvium at depths of more than 30 feet below ground surface (bgs) and shallows northward, occurring near the ground surface at Las Vegas Wash. In the alluvial aquifer, groundwater flows towards the north-northeast with minor variations, generally mimicking the slope of the ground surface.

Muddy Creek Aquifer. Beneath the central portion of the Site, the first groundwater encountered occurs within the first fine-grained facies of the Muddy Creek Formation (MCfg1) and can be more than 50 feet bgs as documented in historical water-level measurements from well M-10. South of the MCfg1 pinch-out, beneath the southern portion of the Site, the first groundwater encountered occurs within the first coarse-grained facies of the Muddy Creek Formation (MCcg1) and can be more than 70 feet bgs as documented in historical water-level measurements from well M-103 and further confirmed from water-level measurements from the new wells (M-120 and M-121) installed as part of the upgradient investigation. The gradient and flow direction of the potentiometric surface in both the shallow first fine-grained and first coarse-grained facies of the Muddy Creek also mimics the ground surface and is to the north-northeast with minor variations.

Deep beneath the Site and extending into the Las Vegas Valley, confined groundwater occurs within the deeper coarse-grained facies of the Muddy Creek Formation. The flow direction of this deeper groundwater is more northeasterly than the shallow unconfined groundwater aquifer. Deep wells drilled into the Muddy Creek Formation all exhibit artesian conditions with some wells flowing at the surface. Most shallow wells drilled into the shallow Muddy Creek also demonstrate an upward hydraulic gradient.

3.0 Source Area Investigation Rationale

3.1 Project Approach

The scope comprising this phase of investigative work consists of an initial assessment of soils and groundwater for the presence or absence of chemicals included on the SRC list. The assessment consists of an evaluation of soil conditions at 27 locations (SA-1 through SA-27) across the Site, each of which are suspected of contaminant impacts. In addition, groundwater samples will be collected at or near each borehole location. The manganese tailings and the manganese dioxide ore will also be analyzed.

One soil boring will be drilled using sonic drilling methods at each of the selected 27 locations as depicted on **Plate 1**. Soil samples destined for laboratory analyses will be collected at approximate depths of 0.5 bgs and, thereafter, at 10 foot depth intervals to just above the water table. Ground water levels will be estimated from extrapolated measurements in nearby wells. Each soil sample will be analyzed for the presence of up to 230 potential SRCs (listed in **Table 4**). The results will also be used to evaluate the need for additional site characterization activities at each of the 27 locations.

Twenty-three of the 27 soil borings will be drilled near existing monitoring wells. Groundwater samples will be collected from these existing monitoring wells and analyzed to assess the presence of potential SRCs. Where monitoring wells are not close to boring locations, a groundwater grab sample will be collected from four soil borings deepened into the water table. If a well proposed for sampling is dry, or otherwise unusable for sampling, a groundwater grab sample will be collected from the borehole.

The selected soil samples and groundwater samples will be analyzed for the SRCs identified on **Table 4**, which include the following chemicals.

- metals;
- volatile organic compounds (VOCs) including fuel oxygenates;
- semi-volatile organic compounds (SVOCs);
- polychlorinated biphenyl (PCB) compounds;
- total petroleum hydrocarbon [TPH as gasoline, diesel and oil range organics(GRO, DRO, and ORO) in soil only];
- radionuclides;
- perchlorate;
- organochlorinated pesticides (OCPs) and organophosphorous (OPP) pesticides;
- general chemistry (anions, physical, and aggregate properties);
- fuel alcohols;
- dioxins/dibenzofurans; and
- asbestos

Please see **Table 4** for the Site-Related Chemical Analytical List for Soil and Groundwater Samples, in which the proposed analytical plan for soil and groundwater samples is presented. Once the data analyses are completed and compiled, a report summarizing the results of the fieldwork and the analytical findings will be prepared and submitted to the NDEP.

3.2 Rationale for Proposed Drilling Locations

Since beginning operations in 1942, manufacturing activities and product and/or waste storage have been conducted at various locations on the Site. Areas that may constitute potential contaminant sources include former or existing production and/or storage areas. Many of these areas had been previously identified by the NDEP and Tronox through the 1994 LOU (described in more detail in Section 1.1).

Since 1994, the potential study areas identified in the LOU have been designated LOU areas (e.g., LOU 1, LOU 2, etc.). The locations of the LOU areas and the former U. S. Vanadium site are depicted on **Plate 1**, and a summary of the LOUs suspected chemicals of interest is presented in **Table 1**. At the request of the NDEP, U.S. Vanadium has been added to **Table 1**.

At this phase of the investigation, each of the individual suspected source areas will be evaluated for the chemicals most likely associated with the historic uses of that area. In addition, the NDEP has requested that each of the investigative areas undergo a much more inclusive screening for other constituents. A broad list of general investigative parameters will be applied to the investigation. **Table 2** lists the general investigative parameters and their proposed frequency of analysis. The specific SRC analytes for soil and groundwater sampling are listed on **Table 4**.

The rationale for selecting each of the boring locations and wells to be sampled is summarized on **Table 3**. In addition, each of the boring locations is twinned with a nearby groundwater sampling location. The groundwater monitoring well proposed for sampling is selected based on its proximity to the soil boring and its construction details (i.e., the screened interval must be suitable to measure potential impacts from the overlying vadose zone). The superposition of nearly co-located soil and groundwater data will allow the assessment of whether or not underlying groundwater is being impacted from chemicals detected in the overlying soils. **Table 3** lists each of the boring locations and its proposed associated groundwater monitoring location.

Of the 27 proposed boring locations, 23 have nearby monitoring wells that may be suitable to sample. For the remaining 4 boring locations without nearby monitoring wells, a grab sample of groundwater will be collected directly from the borehole. If a well identified for sampling is dry, or otherwise unusable, a groundwater grab sample will be collected from the borehole. **Tables 5 and 6** summarize the analytical plans for soil and groundwater sample locations, respectively.

3.3 Rationale for Proposed Sampling Parameters

Soil samples and groundwater samples will be analyzed for the SRCs as shown on **Tables 3 and 4**. Sample containers for each analytical parameter along with the respective holding times are shown on **Table 5** (for soil) and **Table 6** (for groundwater). A complete, alphabetically organized list of SRCs is presented in **Table 7**.

The extensive list of SRCs was developed at the request of the NDEP as specified in the February 11, 2004, letter. NDEP requested that all chemicals present at the Site or associated with historical operations be identified and included on the SRC list **(Table 7).**

The following text was excerpted from the February 11, 2004, NDEP letter (Attachment A pages 6 and 7):

> *SRCs include all raw materials, products processed, byproducts, waste products and any other chemical used at the facility. All degradation products associated with any chemical that may have been used at the facility are also SRCs. If it is unknown whether or not chemicals are present at the site or if all chemicals associated with historical operations have not been adequately documented, then a broad suite analysis is warranted for those chemical classes that may be present. Site-related chemicals associated with the KM facility need to be identified and justified for each chemical class including but not limited*

> *to: metals, radionuclides, volatile organic compounds, dioxins, furans, pesticides, and polycyclic aromatic hydrocarbons (PAHs).*

The development of the SRC list was accomplished by reviewing available historical documents and data sets, along with information available on adjacent properties whose operations may have impacted the Site. These data along with anecdotal information provided by company personnel allowed the assembly of iterative lists, which were progressively refined in cooperation with the NDEP. After repeated reviews, the NDEP approved the SRC list for the Tronox Site in March 2005. The list was expanded to include additional constituents in 2005 and 2006; the current SRC list, arranged alphabetically, is presented in **Table 7.**

The detailed sample analytical plans are listed in **Table 5** (soil) and **Table 6** (groundwater), and a summary of the rationale for the proposed sampling parameters is summarized below and described in **Table 2.**

- Metals – all soil and groundwater samples will be analyzed for aluminum, antimony, arsenic, barium, beryllium, boron, calcium, cadmium, chromium (total and Cr^6), cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, platinum, selenium, silver, sodium, thallium, tin, titanium, tungsten, vanadium, and zinc. Silicon has been eliminated from the metals list because the background levels in the sandy soil at the Site are very high and the results could not be used in any meaningful way to assess site-related contamination. Methylmercury will be analyzed only if total mercury concentrations exceed 5 parts per million (ppm) in soil or 0.2 micrograms per liter (µg/L) in water or if other indicators such as low dissolved oxygen concentrations are present. In general, anaerobic conditions, which are unlikely at the Site, are necessary for the formation of methylmercury.

- VOCs – all soil and groundwater samples will be analyzed for the VOCs listed on **Table 4** to determine where VOCs are present.

- SVOCs – all soil and groundwater samples will be analyzed for the SVOCs listed on **Table 4** to determine where SVOCs are present. The frequency of selected ion monitoring (SIM) analysis for PAHs and hexachlorobenzene will be 10 percent of the total samples analyzed for SVOCs. The dichlorobenzenes are not included in the SVOC list because they are duplicated in the VOC analyte list.

- PCBs – all soil and groundwater samples will be analyzed for PCBs to determine if and where PCBs are present.

- TPH – analysis will be limited to areas historically used for automobile and auto parts storage and maintenance.

- Radionuclides –Radionuclides will be analyzed by gamma spectroscopy reporting Radium-226 and Radium-228 on 100 percent of the soil samples. Water samples will be analyzed by gamma spectroscopy for Radium-228 and by radon emanation for Radium-226. Isotopic thorium and uranium will be analyzed by alpha spectroscopy on 10 percent of the soil and groundwater samples (using alpha spectroscopy leach method). This radiochemical dataset should provide enough information to confirm secular equilibrium and allow inference of the other radionuclide activities in the respective uranium and thorium isotope decay chains.

- Perchlorate – all soil and groundwater samples will be analyzed for perchlorate to determine where and at what concentration perchlorate is present.

- OCPs and OPPs – will be analyzed in the 0.5-foot soil sample only. Pesticides were not manufactured at the Site. The 10-foot samples from SA-2, SA-4, SA-16, SA-17, SA-18, SA-21, SA-22, and SA-23 will be collected. If OCPs or OPPs are detected in the 0.5 foot sample, the 10 foot sample will be analyzed. The herbicide Silvex will be added for the analysis of surficial soils in the vicinity of LOU 1 (SA-21, SA-22, and SA-23). Samples will be collected from 0.5 and 10 feet bgs. Samples from 10 feet will not be analyzed unless it is detected in the 0.5 foot sample. Groundwater will also be analyzed fro OPPs and OCPs as shown on **Table 6.**

- General Chemistry includes analysis of alkalinity, ammonia, bromide, chloride, chlorate, electrical conductivity (water only), nitrate, nitrite, orthophosphate, sulfate, surfactants (methylene blue active substances [MBAS]), pH, total dissolved solids (TDS), and total organic carbon (TOC). Sulfide, sulfite, residual chlorine, and flashpoint have been eliminated because they are or are related to highly reactive chemical species which are unlikely to persist at the Site.

- Fuel alcohols including ethylene glycol will only be sampled in areas historically used for automobile and auto parts storage and maintenance.

- Dioxins/dibenzofurans analyses will be confined to the 0.5-foot soil samples only, due to the very low water solubility of these analytes and the fact that subsurface contamination is unlikely unless the 0.5-foot sample is significantly contaminated. Of the soil samples analyzed for polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDFs), 100 percent will be screened using the EPA Method 4025 immunoassay screen and 10 percent will be analyzed using EPA Method 8290 to confirm and calibrate the screen results.

- The asbestos analytical method for soil will be changed to the modified elutriator procedure per NDEP's request. Only surficial soils will be analyzed for asbestos.

- In response to the NDEP's request that 1,4 dioxane be added to the SRC, all soil and groundwater samples will be analyzed for this constituent.

Soil samples and groundwater samples collected during this phase of the source area investigation will be analyzed for the SRCs listed on **Table 4.** The proposed sample analytical plans for soil and groundwater are presented in **Tables 5 and 6**, respectively. Sample containers for each analytical parameter along with the respective holding times are shown on **Table 8** (for soil) and **Table 9** (for groundwater).

4.0 FIELD SAMPLING PLAN

The following sections describe the sampling strategy, investigative methods and procedures, sample analysis program, sample handling, decontamination procedures, and management of investigation-derived wastes (IDW).

4.1 Pre-Field Activities

The following activities will be performed prior to the start of field activities.

The proposed drilling locations will be marked, and at least 3 days before the start of drilling activities, Underground Services Alert (USA) (1-800-642-2444) will be notified of the intent to drill. USA will contact the utility owners of record within the Site vicinity and notify them of our intention to conduct a subsurface assessment in proximity to buried utilities. All utility owners of record, or their designated agents, will be expected to clearly mark the position of their utilities on the ground surface throughout the area designated for this assessment.

If necessary (and only after consultation with on-site Tronox staff and after reviewing as-built plans of underground utilities), an underground utility locating service will be contracted to mark underground utilities that may be near the proposed boring locations.

4.2 Field Activities

Twenty-seven soil borings will be drilled and soil samples will be collected at regular intervals. Soil samples from each boring will be submitted for laboratory analyses. Groundwater samples for laboratory analyses will be collected from approximately 23 existing on-site monitoring wells. Groundwater grab samples will be collected from the remaining four soil borings where there are not adequate groundwater monitoring wells nearby. If a well identified for sampling is dry, or otherwise unusable, a groundwater grab sample will be collected from the borehole. A description of the field activities is presented below.

4.2.1 Soil Borings

Soil borings (SA-1 through SA-27) will be drilled on the Tronox property at the locations shown on **Plate 1**. The soil borings will be drilled using a sonic drill rig. Each boring will be drilled to just above the water table, a depth of approximately 25 to 50 feet bgs. The depth to water will be determined from nearby monitoring wells. The boreholes will be backfilled upon completion and the surface restored to match the surrounding grade.

During drilling operations, organic vapors will be monitored with a Photovac™ microtip-photoionization detector (PID) with a 10.2 ev lamp. The boring logs will record the following sampling information: boring number and location; sample identification numbers; date and time; sample depth; lithologic description in accordance with the Unified Soils Classification System (USCS) and American Society of Testing Materials (ASTM) standards; description of any visible evidence of soil contamination (i.e., odor, staining); and organic vapor monitor readings. An example of a boring log form is included in **Appendix C.**

The following section describes the soil sampling methodology that will be used at the Site.

4.2.2 Soil Sampling

For each soil boring, the sonic core will be observed to prepare the lithologic description. In addition, discrete soil samples will be collected from the following depths for laboratory analyses. Soil samples will be collected at the following depths: 0.5 and, thereafter, at approximately 10 foot depth intervals to just above the water table.

When the target sample depth is reached, a modified split-spoon sampler mounted to a steel pipe will be inserted through the center of the hollow-stem auger flights, and the split-spoon sampler will be driven 18-inches into the soil below the drill bit in order to obtain samples of undisturbed soil for laboratory analyses. The sampler will be driven into the soil by the repeated percussive action of a 130-pound hammer falling approximately 30 inches onto the steel rod/split-spoon assembly. The split-spoon sampler will be fitted with three 6-inch-long brass or stainless steel liners (sleeves). As the split-spoon is advanced downward, soil is driven into the sleeves.

As soon as the split-spoon sampler is removed from the borehole and disassembled, the sleeve corresponding to the target sample depth will be chosen for analysis by an off-site laboratory. Teflon™ sheets will be placed on both ends of the sleeve; the sleeve will then be capped, labeled, and placed on ice inside an ice chest for delivery to the laboratory (under chain-of-custody protocol). As an alternative, soil samples designated for analyses for non-volatile constituents may be placed in a laboratory-supplied glass jar and sent to the laboratory. An example of a chain-of-custody (COC) form is included in **Appendix C**.

Soil samples designated for VOC and Gasoline Range Organics (GRO) analysis will be collected from the chosen sleeve and preserved in the field using both sodium bisulfate and methanol preservatives, as prescribed under EPA Method 5035. A new, disposable syringe (T-handle) will be used to collect a roughly 5-gram aliquot directly from the sample sleeve. The sample will be placed into 40-milliliter glass vials containing pre-weighed amounts of liquid sodium bisulfate or methanol. Two vials of sodium bisulfate-preserved soil and one vial of methanol-preserved soil will be collected at each sample depth for GRO or VOC analyses.

If a soil sample is designated for both GRO and VOC analyses, then one set of vials (two vials with sodium bisulfate, one vial with methanol) will be collected for GRO analyses and a second set of vials will be filled for VOC analyses. If the sample reacts with the sodium bisulfate, unpreserved samples will be collected. The label on the filled vials will be filled out, and the vials will be placed in Ziploc™ plastic bags and placed on ice in a cooler along with the rest of the samples pending delivery to the analytical laboratory. The pre-filled volatile organic analysis (VOA) vials containing the sodium bisulfate and methanol preservatives will be provided by the analytical laboratory. A new T-handle syringe will be used to obtain 5-gram aliquots of soil at each sample depth and then discarded to the trash.

The remaining unused portion of the soil core will be used for lithologic description and screening for VOCs with a PID. For headspace analysis by the PID, approximately 200 grams of soil will be removed from the sampling tube and placed in a Ziploc™ plastic bag. Care will be taken to select soil from the middle portion of the sampling tube. Once sealed in the bag, the soil will be broken apart and allowed to equilibrate to ambient temperatures for about 20 minutes. The probe tip of the PID will be inserted into the plastic bag and a reading obtained. These organic vapor readings will be recorded on boring logs prepared by the field geologist during drilling activities. The PID will be calibrated to 100 ppm isobutylene each day prior to its use.

4.2.3 Soil Sample Handling

Soil samples for laboratory analyses will be placed on ice in an ice chest for shipping to the laboratory. The soil samples will be logged on a COC form, and the samples will be shipped to the laboratory at the end of each day of sampling. Analytical methods, types of containers, and holding times are discussed in Section 4.4.1 – Soil Testing Analytical Program.

4.2.4 Borehole Abandonment

Each borehole will be abandoned once the target depth has been reached and the necessary soil (and, if necessary, groundwater) samples are obtained. The boreholes will be abandoned by backfilling each borehole with a bentonite/neat cement grout that will be placed into the borehole with a tremie pipe. The bentonite/neat cement grout will be placed from the bottom of the borehole to within 5 feet of the ground surface. A surface plug consisting of neat cement, cement grout, or concrete grout will be placed from a depth of 5 feet to the ground surface.

4.2.5 Groundwater Sampling

Groundwater samples will be collected from 23 existing monitoring wells and grab samples from four borings as listed on **Table 3**. Groundwater will be tested to assess for the presence of potential SRCs. The wells will be purged using micropurge methodology. Groundwater samples will be collected using the bladder pumps set at low-flow rates (less than 1 liter per minute).

Groundwater grab samples will be collected from boreholes where suitable wells are not present nearby. The borehole will be advanced at least two feet into the water table. Once the water enters the hole and stabilizes, a stainless steel bailer or hydropunch sampler will be used to withdraw the water.

The groundwater samples will be analyzed for SRCs including: perchlorate, chlorate, metals, cyanide, VOCs, pH, electrical conductivity, alkalinity, general water chemistry ions, radionuclides, SVOCs, organochlorinated pesticides, organophosphorus pesticides, and 1,4 dioxane.

The groundwater sampling procedures are described below.

4.2.5.1 Groundwater Elevation Measurement

Water levels will be measured with an electric sounder prior to sampling the well. The well sounder will be equipped with an indicator light, audible buzzer, or other mechanism to indicate when the water table has been contacted. The electric sounder will be decontaminated by rinsing with deionized water after each use. The typical procedure for obtaining depth to water is to check the sounder for audible or light activation by pressing the test button. The sounder is then carefully lowered into the well until it contacts the surface of the water and the buzzer sounds. The sampler then raises the sounder and lowers it again to verify the depth to water as measured at the marked measuring point on the well casing. When two consecutive readings are the same, the sampler records the depth to water on the sampling and purging form.

Depth to water is measured from the top of the casing reference point to the nearest 0.01 foot and recorded on the well sampling field form. The casing reference point is marked by a small notch in the top of the casing. The groundwater elevation at each monitoring well is calculated by subtracting the measured depth to water from the surveyed elevation of the top of the well casing. Total well depths for those wells scheduled for sampling are measured by lowering the sensor to the bottom of the well. Total well depth, used to calculate purge volumes and to determine whether the well screen is partially obstructed by sediment, is recorded to the nearest 0.5 foot on the sampling and purging form.

4.2.5.2 Monitoring Well Purging

<u>Monitoring wells:</u> These wells will be purged by micropurge methods (low-flow purging using bladder pump). The bladder pump will be placed approximately mid way along the screened interval. The water intake will be at least 2 feet from the top and 1 foot from the bottom of the screen. The pump will be lowered slowly into the well to minimize disturbance of the formation, and the water level will be allowed to equilibrate prior to purging and sampling. The water will be evacuated at 100 to 500 milliliters per minute. The water level will be monitored either on a continuous or periodic basis and should not vary more than 0.3 feet (3.6 inches). The water quality parameters will be monitored using a periodic or continuous meter. The flow-through cell is preferred, although a standard meter is also acceptable. Stabilization of water quality parameters is indicated when the following criteria are met in the final three consecutive readings: the pH is within 0.1 unit, temperature is within 1 degree Celsius, electrical conductivity is within 3 percent, and the dissolved oxygen

and turbidity are within 5 percent. If field parameters do not stabilize within 30 minutes, the deviation will be noted on the field sampling field sheet and a sample will be collected. An example of a low-flow groundwater sample collection record field form is included in **Appendix C**.

Field Measurements. Groundwater parameter field measurements obtained during sampling will be recorded on a Groundwater Sample Collection Record field log form, an example of which is included in **Appendix C**. Field data sheets will be reviewed for accuracy and completeness by the sampling coordinator after the sampling event is completed. Copies of the field sheets will be included in the monitoring report.

The pH, electric conductivity, turbidity, dissolved oxygen (DO), and temperature meters or flow through cells will be calibrated each day before beginning field activities. The calibration will be checked once each day to verify meter performance. The field meter calibrations will be recorded on an Instrument Calibration sheet. Copies of the calibration sheets will be included in the monitoring report.

4.2.5.3 Collection of Groundwater Samples from Monitoring Wells

Upon completion of well purging, a representative groundwater sample will be withdrawn from the well. Samples will be placed in containers in the order of decreasing volatilization sensitivity. Thus, the individual containers for analyses will be filled in the following order:

1. VOCs;
2. Metals (including platinum and hexavalent chromium; one filtered sample will be collected for comparison with unfiltered analysis);
3. Perchlorate;
4. General Water Chemistry/Anions/Ions (including cyanide and chlorate);
5. pH; and
6. Radionuclides (one filtered sample will be collected for comparison with unfiltered analysis).

A low flow bladder pump (micropurge pump) will be used to dispense the water samples into the appropriate sample container as long as static water level is maintained for the duration of bottle-filling activities.

When taking samples for VOC or GRO analyses, containers will be filled to produce a positive meniscus over the lip of the container. Upon capping, the VOC sample bottles will be inverted and tapped to check for bubbles. If bubbles are observed, a new sample will be obtained.

4.2.5.4 Collection of Groundwater Grab Samples

Groundwater grab samples will be collected from boreholes where there are not suitable monitoring wells nearby. The borehole will be advanced at least two feet into the water table. The groundwater sample will be obtained from a bailer or a hydropunch tool. The procedure for collecting the water sample from the bailer is to carefully lower a stainless steel bailer into the water table and retrieve the sample. If the hydropunch method is used, the hydropunch tool is lowered through the casing and driven forward through the borehole bottom into the formation and then pulled back approximately 18 inches to expose a stainless steel screen. Once the groundwater flows through the hydropunch screen, past a check valve and into the sample chamber by hydrostatic pressure, the sample is retrieved.

4.2.5.5 Groundwater Sample Containers and Preservatives

Sample containers required for the specified analyses will generally be provided by the laboratory immediately prior to the sampling event. The containers will be pre-cleaned and will not be rinsed prior to sample collection. Preservatives, if required, will have been added to the containers by the laboratory prior to shipment of the sample containers to the sample collector.

Analytical methods, number of samples, types of containers, preservative, and holding times are summarized in Section 4.4.2 - Groundwater Analytical Testing Program.

4.2.5.6 Sample Packaging and Shipment

To identify and manage samples obtained in the field, a sample label will be affixed to each sample container. The sample labels will include the following information:

- Project number
- Site name
- Boring number
- Sample identification number
- Sampler's initials
- Date and time of collection
- Preservative

Following collection and labeling, samples will be immediately placed in a sample cooler for temporary storage. The following protocol will be followed for sample packaging:

- Sample containers will be placed in leak-resistant clear plastic bags prior to placement in the ice chest. Screw caps will be checked for tightness prior to placing the sample in the bag.

- Samples to be shipped will be placed in the cooler and packed with packaging materials to minimize the potential for disturbance and/or breakage of the sample containers.

- Ice will be placed in leak-resistant plastic bags and included in the coolers to keep samples at a chilled temperature during storage and transport to the analytical laboratory. When ice is used, the drain plug of the cooler will be secured with fiberglass tape to prevent melting ice from leaking out of the cooler.

- The COC form will be placed in a water-resistant plastic bag and taped on the inside of the lid of the cooler.

- Samples designated for fuel alcohol analyses will not be placed in the same cooler as VOC vials containing methanol as a preservative.

A temperature blank consisting of a 40-milliliter glass vial of distilled water will be included in each cooler sent to the analytical laboratory. The purpose of the temperature blank is to allow the analytical laboratory to obtain a representative measurement of the temperature of samples enclosed in a cooler without disturbing the actual samples. The field team will package and label the temperature blank like a regular water sample; however, the analytical laboratory will only measure the temperature of the blank.

Every effort will be made to transport the samples to the analytical laboratory at the end of each sampling day. However, if sampling runs late and the laboratory is closed, samples will be stored overnight in a secured location under appropriate COC procedures, and the samples will be shipped to the laboratory the next day.

Prior to overnight storage, the cooler(s) will be restocked with new ice to maintain the samples in a chilled state. The temperature blank inside each cooler will be checked by the sample collector at the beginning of the evening and in the morning, and the temperature readings will be recorded in the field logbook.

4.3 Field Documentation

4.3.1 Field Logbooks

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. Logbooks will be bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in black ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions or other terminology that might prove inappropriate. If an error is made, corrections will be made by crossing a line through the error and entering the correct information. Corrections will be dated and initialed. No entries will be obliterated or rendered unreadable.

Entries in the field logbook will include at a minimum the following for each sample date:

- Site name and address
- Recorder's name
- Team members and their responsibilities
- Time of site arrival/entry on-site and time of site departure
- Other personnel on-site
- A summary of any on-site meetings
- Deviations from sampling plans and site safety plans
- Changes in personnel and responsibilities, as well as reasons for the changes
- Levels of safety protection
- Calibration readings for any equipment used and equipment model and serial number

At a minimum, the following information will be recorded during the collection of each sample:

- Sample identification number
- Sample location and description
- Site sketch showing sample location and measured distances
- Sampler name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Type of sample (i.e., matrix)
- Type of preservation
- Type of sampling equipment used
- Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors, etc.)
- Instrument readings (e.g., PID, etc.)

- COC form numbers and COC seal numbers
- Transport arrangements (courier delivery, lab pickup, etc.)
- Recipient laboratory(ies)

4.3.2 Boring Logs

A lithologic description of the materials encountered and collected will be maintained on boring logs compiled by the field geologist. Soils will be classified in accordance with the USCS, and descriptions will include soil type, particle size and distribution, color, moisture content, and evidence of contamination (discoloration, unusual odors, etc.). The soil samples will be screened in the field for the presence of elevated organic vapor concentrations using a PID, and the measurements will be recorded on the boring log.

4.3.3 Chain-of-Custody Records

COC records are used to document collection and shipment of samples to the laboratory for analyses. All sample shipments for analyses will be accompanied by a COC record. Form(s) will be completed and sent with the samples for each laboratory and each shipment. If multiple coolers are sent to a single laboratory on a single day, COC form(s) will be completed and sent with the samples for each cooler. The COC record will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until receipt by the laboratory, the custody of the samples will be the responsibility of the sample collector. An example of a COC form is provided in **Appendix C**.

The shipping containers in which samples are stored (usually sturdy picnic cooler or ice chest) will also be sealed with self-adhesive custody seals any time they are not in someone's possession or view before shipping. All custody seals will be signed and dated.

4.4 Analytical Testing Program

The analytical testing program is designed to evaluate the environmental condition of soils and groundwater at various locations on the Site. A description of the analytical program is discussed below.

4.4.1 Soil Analytical Testing Program

The proposed soil analytical plan is shown in **Table 5**. Sample containers, analytical methods, and holding times for the various analytes that the soil samples will be tested for are shown on **Table 8. Table 4** presents the Site-Related Chemicals Analyte List for both soil and groundwater samples. This table also contains the data quality limits (DQLs). The DQLs are industrial-based Preliminary Remediation Goals (PRGs) for soil (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 throughout the source characterization process regarding the certification process and status of certification regarding the methods proposed for use.

4.4.2 Groundwater Analytical Testing Program

For the Source Area Investigation – Phase A, groundwater samples will be collected from 23 on-site monitoring wells listed on **Table 3**. Groundwater grab samples will be collected from four boreholes where there are not suitable monitoring wells nearby. If a well identified for sampling is dry, or otherwise unusable, a groundwater grab sample will be collected from the borehole. The groundwater analytical plan is summarized on **Table 6**. Sample containers, analytical methods, and holding times for the various analytes that the groundwater samples will be tested for are shown on **Table 8.** A full list of the analytes that groundwater will be tested for is presented on **Table 4**. The groundwater DQLs listed in **Table 4** are drinking water maximum contaminant levels (MCLs) or tap water PRGs (EPA 2004).

4.4.3 Geotechnical Testing Program

Up to four soil samples will be collected and sent to a geotechnical engineering laboratory in order to measure physical parameters of the soil encountered during the course of this investigation. Data from the geotechnical tests will be used to support risk assessment studies, modeling of the vadose zone for potential contaminant migration pathways, and (if necessary) to support evaluation of remedial alternatives.

Fine-grained and coarse-grained soil samples will be collected and analyzed for the following parameters:

- Moisture content (dry weight basis) using American Society for Testing and Materials (ASTM) Method D-2216;
- TOC using the Lloyd Kahn or Walkley-Black Method, or equivalent;
- Effective permeability, permeability to air, volumetric water content (wet weight basis), grain, and bulk density (dry and natural) using the Dean Stark methods described in the American Petroleum Institute (API) RP-40 technique;
- Intrinsic permeability using ASTM Method D-4525;
- Particle size analysis using ASTM Method D-422;
- Specific gravity using ASTM Method D-854 or API RP-40 technique; and
- Hydraulic conductivity using ASTM Method D-2434 of two fine-grained and two coarse-grained samples.

4.5 Equipment Decontamination

Drilling equipment will be decontaminated prior to the beginning of each boring by steam cleaning in a designated area on-site. All non-disposable soil sampling equipment (e.g., split-spoon samplers, etc.) will be disassembled and decontaminated prior to the collection of each sample. This equipment may be decontaminated by either steam cleaning or by washing with a non-phosphate detergent solution (Simple Green™ or similar) followed by rinsing with distilled/deionized water. Decontamination fluids will be temporarily stored on-site in Department of Transportation (DOT)-approved 55-gallon steel drums pending results of the soil analyses.

If non-dedicated groundwater sampling equipment is used to collect groundwater samples, the equipment will be decontaminated by circulating a solution of water and detergent (e.g., Simple Green™) through the equipment followed by rinsing with distilled water.

4.6 Management of Investigation-Derived Wastes

Soil cuttings (including unused cores), and other solid or liquid wastes (decontamination fluids, 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 appropriate manner based on the results of the chemical analyses. It is anticipated that groundwater and decontamination liquids will be placed in GW-11 and treated on-site.

4.7 Surveying

The boring locations will be surveyed to an accuracy of 0.01-foot vertical and 0.1-foot horizontal relative to U.S. Geological Survey elevation and Nevada Coordinate System datums by a licensed-land surveyor.

4.8 Quality Assurance/Quality Control Program

An integral part of the Source Area Investigation sampling and analysis 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 Source Area Investigation at the Site.

4.8.1 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.

4.8.1.1 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.

4.8.1.2 Trip Blanks

Trip blanks are provided by the laboratory. One pair of VOA trip blanks will be included in each cooler. One trip blank per day will be analyzed for the VOCs and GRO 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.

4.8.1.3 Equipment Decontamination Blanks

Equipment decontamination blanks will consist of reagent 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 will be obtained for each pump used before and after use for the groundwater sampling event.

4.8.1.4 Field Blanks

Field blanks consist of the source water used for the equipment decontamination blanks. At a minimum, one field blank from each event or work period will be collected and analyzed for the same set of parameters as samples collected during the event.

All of the above-mentioned QA samples will be sent to the laboratory as blind samples with sample numbers sequenced in with actual Site samples.

4.8.2 Laboratory QA/QC Procedures

Laboratory 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 Quality Assurance Project Plan (QAPP; ENSR 2006).

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 5 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)-like 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 EPA QC results; and
- Instrument standardization and response factors.

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

4.8.3 Quality Assurance Program

Specific quality assurance objectives for measurement are defined by precision, accuracy, representativeness, comparability, completeness, and sensitivity.

Specific requirements for data accuracy, precision, representativeness, comparability and completeness will be based on standard laboratory methods, QAPP requirements, and data validation guidelines. Definitions of accuracy, precision, and completeness as they pertain to analytical data and standard methods used to assess accuracy, precision, and completeness are briefly described below and more thoroughly described in the associated QAPP. If data do not meet data quality objectives, action will be taken to address the issues and resolve them as appropriate.

4.8.3.1 Definitions

Accuracy = 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.

Precision = 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.

Completeness = the percentage of measurements made that are judged to be valid measurements. The completeness goal is the same for all data uses that a sufficient amount of valid data be generated to accomplish the objectives of the study.

Standard methods of evaluation will be used to assess accuracy and precision data. Completeness can be quantitatively assessed simply by calculation of the percentage of valid data obtained. Specific methods of assessing accuracy and precision will be as follows:

Accuracy will be evaluated using percent recovery data. Percent recovery is defined as:

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

where:

S = spiked concentration.

R = reported concentration.

Percent recovery limits are analyte-specific.

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:

$$\%RPD = (A1 - A2)/(A1 + A2)/2 \times 100$$

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

4.8.4 Comparison of Data Sets

Representativeness is defined by the EPA as 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 Section 4.3.

5.0 Data Evaluation and Reporting

5.1 Data Review

Data will be evaluated to verify that soil, 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.

5.2 Reporting of Results

A report will be prepared that presents the results of the source area investigation – Phase A for soil and groundwater 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). The groundwater data will be used to assess on-site conditions and identify SRCs that are present in the water table beneath the Site. These soil and groundwater data will be compared to available on-site and off-site data.

5.3 Assessment of Adequate Characterization for SRC Parameters

Each of the SRC parameters investigated during Phase A 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 verify the comparability of the parameter with other data populations;
- Determine if parameter detections are less than one tenth (0.10) 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 tools, 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.

5.4 Assessment of Inadequate Characterization for SRC Parameters

A particular SRC parameter may be determined to be inadequately characterized when applying a combination of the following evaluation steps:

- Apply the application of appropriate statistical tools to verify the comparability off the parameter with other data populations;
- Determine if the parameter detections exceed one tenth (010) 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 likely due to the evidence(s) 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(s).

5.5 Additional Investigation

For those parameters found to be inadequately characterized, additional investigative work will be needed. The subsequent Phase B investigation is proposed to collect the data necessary to characterize the nature and extent of those SRC parameters that are inadequately characterized.

The scope of the Phase B investigation will be dependent upon the results of the Phase A Source Area Investigation, and the identified data gaps. Once the Phase A Source Area Investigation is completed and the data are compiled and interpreted, a Workplan outlining additional recommended characterization work will be developed for NDEP review and approval.

6.0 Project Management Plan

The overall organization of the project includes the following individuals and agencies, and is illustrated in **Figure 2**.

This work is being conducted as part of the ECA 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, 2007) 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 technical specialists Mr. Keith Bailey (engineer) and Mr. Tom Reed (hydrogeologist).

ENSR Corporation is Tronox's environmental consultant. Mr. David Gerry, Senior Program Manager, Sally Bilodeau, Senior Geologist, Edward Krish, Field Manager, Brian Ho and Robert Kennedy, Quality Assurance Officers, and ENSR Staff Geologists will be assisting with this project as needed. Ms. Margaret Sharpe 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 with 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 the 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 Geologist 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 2 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;
- Collection, labeling, handling, storage, shipping, and filling out 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 implementing the work plan or 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 and/or state-approved protocol; 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.

7.0 References

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TABLES

Table 1
LOUs and Known and/or Postulated Chemicals of Interest
Source Area Investigation, Tronox Facility -
Henderson, Nevada

LOU Number	Name of LOU	Description of Chemicals identified	Metals	VOCs	SVOCs	PCBs	TPH	Rad	Perchlorate	Pesticides	General Chemistry [1]	Ethylene Glycol	Dioxin/furan	Asbestos
1	Trade Effluent Settling Ponds	Acid waste neutralized with caustic liquor, hydrochloric acid, sodium hydroxide, The area of the former TE ponds is now occupied by the closed hazardous waste landfill, surface impoundments WC-East and WC-West addressed as separate LOUs. Chemicals mentioned included Silvex. Previously tested for RCRA metals.	X							X (this area will also be tested for herbicides because Silvex is a herbicide)	X			
2	Open Area Due South of "Trade Effluent Disposal Ponds"	Identified in LOU as "poorly defined historic disposal area."	X							X	X			
3	Air Pollution Emissions Associated with Industrial Processes	Particulates	X		X								X	
4	Hardesty Chemical Company Site (prior to J. B. Kelley Operations)	Muriatic acid, synthetic hydrochloric acid, monochlorobenzene, paradicyhlorobenzene, orthodichlorobenzene, DDT, and soda arsenite solution, two underground storage tanks for kerosene and benzene.	X	X	X		X			X	X			
5	On-Site Portion of Beta Ditch, Including "Small Diversion Ditch" Northwest of Pond C-1	VOCs, SVOCs, pesticides/ polychlorinated biphenyls (PCBs), metals, cyanide, chlorate, pH, asbestos and radionuclides.	X	X	X	X	X	X	X	X	X			X
6	Unnamed Drainage Ditch Segment (BMI Landfill)	Wastewater and stormwater	X	X	X		X			X				
7	Old P-2 Pond and Associated Conveyance Facilities	Old P-2 Pond received chlorate process liquids which contained hexavalent chromium, sodium chloride, sodium chlorate, and sodium perchlorate. The latter compound was from the caustic scrubber solution generated at the AP plant.	X						X		X			
8	Old P-3 Pond and Associated Conveyance Facilities	Ammonium perchlorate and chromium	X						X		X			
9	New P-2 Pond and Associated Piping	Ammonium perchlorate and chromium	X						X		X			
10	On-Site Hazardous Waste Landfill (Closed)	Hazardous Waste	X	X	X	X	X	X	X	X	X			
11	Sodium Chlorate Filter Cake Holding Area	Filter Cake Drying Pad was used to dry particulate material removed from the sodium chlorate process, chromium, chlorate and TDS.	X						X		X			
12	Hazardous Waste Storage Area	Container for waste from the sodium chlorate process	X						X		X			
13	Pond S-1	Liquids from the sodium chlorate, sodium perchlorate, potassium perchlorate, sodium perchlorate, and boron manufacturing processes. Cooling tower and reboiler wastes from the boron trichloride process were also discharged to S-1.	X						X		X			
14	Pond P-1, and Associated Conveyance Piping	Liquids from the sodium chlorate, sodium perchlorate, potassium perchlorate, and boron manufacturing processes. Cooling tower and reboiler wastes from the boron trichloride process were also discharged to P-1. Liquors, residual salt solutions, and rinsates from decommissioning and closure of S-1 and from the decommissioning of potassium perchlorate manufacturing process.	X						X		X			
15	Platinum Drying Unit	Platinum, sodium perchlorate byproducts, chromium.	X						X					
16 & 17	Ponds AP-1, AP-2, and AP-3 and Associated Transfer Lines	Nitrate, nitrite, chromium	X						X		X			
18	Pond AP-4	Ammonium perchlorate and chromium	X						X		X			
19	Pond AP-5	Ammonium perchlorate and chromium	X						X		X			
20	Pond C-1 and Associated Piping	Used to evaporate non-hazardous process water, primarily from steam production, but at times also from the boron and manganese dioxide processes.	X								X			
21	Mn-1 and Associated Piping	The manganese pond received non-hazardous process water wastes, including filter wash water and cathode wash water. The pond contents contain manganese as well as high TDS	X								X			
22	Pond WC-1 and Associated Piping	Process water	X						X		X			
23	Pond WC-2 and Associate Piping	Process water. Sodium hypochlorite and other water treatment chemicals, were placed in WC-East pond (WC-2)	X						X		X			
24	Leach Beds, Associated Conveyance Facilities, and Mn Tailings Area	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, demolition debris was also put into the tailings piles.	X											
25	Process Hardware Storage Area	Used to store process hardware, scrap metal parts and equipment from decommissioning of the former sodium chlorate and perchlorate processes, equipment was rinsed prior to placement.	X						X		X			
26	Trash Storage Area	Two asphalt areas were used to store trash from the sodium chlorate and sodium perchlorate process. Common trash was placed in 55 gallon drums then shipped to Beatty Nevada as a precautionary measure.	X						X		X			
27	PCB Storage Area	A concrete and plastic lined area received PCB waste.		X	X	X	X							
28	Hazardous Waste Storage Area	Hazardous and non hazardous waste was stored in drums in this area including used oil and flammable maintenance parts washing wastes. The concrete pad and 4 feet of soil were removed. TPH was discovered in the soil and removed in 1994.	X	X	X	X	X		X					
29	Solid Waste Dumpsters	Open metal dumpsters were placed on concrete surfaces separated by gravel covered soil. The dumpsters contained common trash, recyclable steel and other recyclable metals. Scrap metal was washed before being placed in this area.	X	X	X	X	X		X		X			X
30	AP Area-Pad 35	Used for the accumulation of trash potentially contaminated with perchlorate and other industrial wastes, such as cooling tower sludge, and iron oxide sludge.	X	X	X	X	X		X		X			
31	Drum Recycling Area	Drums from the ammonium perchlorate production were emptied and rinsed prior to delivery to this area.	X						X					

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32	Ground Water Remediation Unit	This LOU includes the treatment system the extraction wells and the recharge trenches. The treatment system reduces chromium and other heavy metals from impacted groundwater. The recharge trenches became plugged and discharged treated water to the shallow soils.	X						X					
33	Sodium Perchlorate Platinum By-Product Filter, Unit 5	A sodium perchlorate platinum recovery filter press with a sump that collected and contained process liquids and wash down water.	X						X					
34	Former Manganese Tailings Area	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, demolition debris was also put into the tailings piles	X											
35	Truck Emptying/Dumping Site	"Unknown" waste materials disposed in this area. Analytical results detected metals and TPH. One soil sample contained 2.4 ug/kg of trichloroethane (estimated value below PQL).	X	X	X		X							
36	Former Satellite Accumulation Point, Unit 3, Maintenance Shop	Accumulation point includes a parts washer and storage of lead acid batteries and waste from the parts washer. Solvent-based and caustic detergent was used for washing. Waste stored included drums of oil and grease, solvents (mainly 1,1,1-TCA), sludge, caustic detergent and metal parts.	X	X	X	X	X				X			
37	Former Satellite Accumulation Point, Unit 6, Maintenance Shop	Area included a parts washer and the drum for temporary storage of parts washer waste. Solvent-based washer and caustic detergent was used for washing. Waste stored in this area included drums of oil and grease, solvents (mainly 1,1,1-TCA), sludge, caustic detergent and metal parts.	X	X	X	X	X				X			
38	Former Satellite Accumulation Point, AP-Laboratory	Hazardous chemicals (flammable liquids) used in the on-site laboratory were stored in this area.	X	X					X					
39	Satellite Accumulation Point-AP Maintenance Shop	TPH in the range of motor oil and diesel range were detected.	X		X		X		X					
40	PCB Transformer Spill	Approximately 1.75 lbs of PCB-containing fluid was released.				X	X							
41	Unit 1 Tenant Stains	TPH in the range of motor oil and diesel range were detected.	X		X		X							
42	Unit 2 Salt Redler	Sodium chlorate spillage to the ground occurred during transfer from storage in Unit 2 to the conveyor feed hopper.	X								X			
43	Unit 4 and 5 Basements	Soil beneath units may be impacted with concentrations of sodium perchlorate, sodium chlorate, or sodium dichromate (hexavalent chromium). from electrolytic processes.	X						X		X			
44	Unit 6 Basement	High-purity, battery-active manganese dioxide has been produced in electrolytic cells in Unit 6. Process spillage and wash water was identified as a source of soil and groundwater impact.	X						X		X			
45	Diesel Storage Tank	TPH-diesel.	X	X	X		X							
46	Former Old Main Cooling Tower and Recirculation Lines	Several recirculation water upsets, which resulted in discharge of high-conductivity water to the Beta ditch, were reported. Chromium was added as a treatment chemical in the cooling tower.	X								X			
47	Leach Plant Area Manganese Ore Piles	Manganese ore was stored at this site. The dust is composed of 55 percent by weight of manganese dioxide.	X											
48	Leach Plant Analyte Tanks	A variety of process equipment is used to beneficiate the manganese dioxide ore and produce high-quality, battery-grade manganese dioxide. A manganese sulfate solution and sulfuric acid were contained in tanks.	X								X			
49	Leach Plant Area Sulfuric Acid Storage Tanks	A variety of process equipment is used to beneficiate the manganese dioxide ore and produce high-quality, battery-grade manganese dioxide. A manganese sulfate solution and sulfuric acid were contained in tanks.	X								X			
50	Leach Plant Area Leach Tanks	A variety of process equipment is used to beneficiate the manganese dioxide ore and produce high-quality, battery-grade manganese dioxide. A manganese sulfate solution and sulfuric acid were contained in tanks.	X								X			
51	Leach Plant Area Transfer Lines	A variety of process equipment is used to beneficiate the manganese dioxide ore and produce high-quality, battery-grade manganese dioxide. A manganese sulfate solution and sulfuric acid were contained in tanks.	X								X			
52	AP Plant Area Screening Building, Dryer Building and Associated Sump	The sump collected wash-down water. Soil exhibiting white stains was collected and recycled for perchlorate recovery.	X						X					
53	AP Plant Area Tank Farm	Contained a number of vertical open-top and closed-top tanks used for process solution storage.	X						X		X			
54	AP Plant Area Change House/ Laboratory Septic Tank	Wastewater effluent from the change house showers, restrooms, and laboratory sinks discharged to a septic system with an associated leach field. Hazardous solutions were collected and shipped to an appropriate disposal facility.	X						X					
55	Area Affected by July 1990 Fire	Ammonium perchlorate impacted soil around the fire area.	X						X					
56	AP Plant Area Old Building D-1- Washdown	Wash-down water contained dissolved ammonium perchlorate.	X						X					
57 58	AP Plant Area New Building D-1- Washdown and AP Plant Transfer Lines to Sodium Chlorate Process, AP Plant SI's and Transfer Lines	Ammonium perchlorate was transferred from the AP process to the sodium chlorate ponds.	X						X		X			
59	Storm Sewer System	Between 1941 and 1976, storm sewer system conveyed storm water and process effluent. After 1976, process solutions were controlled in vessels or in lined surface impoundments.	X	X		X			X		X			

Table 1
LOUs and Known and/or Postulated Chemicals of Interest
Source Area Investigation, Tronox Facility -
Henderson, Nevada

LOU Number	Name of LOU	Description of Chemicals identified	Metals	VOCs	SVOCs	PCBs	TPH	Rad	Perchlorate	Pesticides	General Chemistry [1]	Ethylene Glycol	Dioxin/furan	Asbestos
60	Acid Drain System	System used to collect acid effluent from throughout the BMI complex. Acid drains in the non-operating portions of the facility (Units 1 and 2) have been filled with concrete debris and soil.	X	X	X		X				X			
61	Old Sodium Chlorate Plant Decommissioning	The process liquids contained primarily sodium chlorate with sodium dichromate as a process chemical additive.	X						X		X			
62	State Industries, Inc. Site, Including Impoundments and Catch Basin	Used acid drain system to convey various process wastes to the Beta Ditch. Monthly discharges of process waste averaged ~35,000-gallons and included spent sulfuric acid, borax, soda ash and phosphate chemicals. Liquid waste containing spent cyanide was periodically discharged. Two surface impoundments, "western" and "eastern" received spent pickling process wastes which included spent sulphuric acid, borax soda ash (anhydrous sodium carbonate) and phosphates (chemical combinations), and TURCO II H.T.C. soap. Low levels of lead and molybdenum were found. VOCs were also detected.	X	X	X		X			X	X			
63	J. B. Kelley, Inc. Trucking Site	Trucking activities included the washing of truck exteriors and interiors, vehicle fueling (from 10,000-gallon fiberglass UST), and minor repair work including oil changes. Toluene, TCA, acetone, and total chromium were identified at the site. TPH was not detected.	X	X	X	X	X			X	X	X		
64	Koch Materials Company Site	Area uses as an asphalt emulsion batch plant. Soil samples were analyzed for VOCs, SVOCs, metals, and confirmatory TPH analysis.	X	X	X	X	X							
65	Nevada Precast Concrete Products, Green Ventures International, Buckles Construction Company and Ebony Construction Sites	TPH in the range of motor oil, diesel range was detected. TPH in the gasoline range was not detected above the PQL of 29 mg/kg. TPH heavier than diesel was detected at 100 mg/kg.	X	X	X		X							
66	Above-Ground Diesel Storage Tank Leased by Flintkote Co.	Diesel tank located near the southwest corner of the Chemstar property.	X		X		X							
67	Delbert Madsen and Estate of Delbert Madsen Site	Property was used as a storage and salvage yard. Material and trash was removed and disposed of at the Silver State Landfill in Apex, Nevada.	X	X	X	X	X					X		
68	Southern Nevada Auto Parts Site (Pick A Part)	The leased property was used to store wrecked, impounded and repossessed vehicles. Stained soil was present in some areas.	X	X	X	X	X					X		
69	Dillon Potter Site	The area was used for livestock management and to store approximately 25 vehicles.	X				X				X			
NA	U. S. Vanadium	Production of tungston	X											

LOU = Site identified in letter of understanding dated August 15, 1994
Yellow highlight indicates LOU where no further action was specified in the past
VOCs = Volatile organic compounds
SVOCs = Semi-volatile organic compounds
PCBs = Polychlorinated biphenyls
TPH = Total petroleum hydrocarbons
1 Includes general chemistry parameters listed on Table 4.
NA Not applicable (not a LOU identified in 1994)

Table 2
General Investigation Parameters
Source Area Investigation, Tronox Facility - Henderson, Nevada

In addition to the specific Site Investigation issues associated with known areas of potential contamination, NDEP has requested a general screening of the site for other constituents. The analytical plan for the Tronox site will be governed by the following guidelines.

Constituent	Frequency of Analysis	Comments
Metals	Analyze all soil and groundwater samples for standard metals suite including Hg.	No need to analyze for Si since sand background is very high.
Methyl mercury	Analyze soil and groundwater samples for methyl mercury only if total Mercury is >5 ppm, and other indicators such as DO warrant.	Anaerobic conditions are necessary for the formation of methyl mercury.
VOCs	Analyze all soil and groundwater samples for VOCs.	
SVOCs	Analyze all soil and groundwater samples for SVOCs as follows (do not run constituents covered in VOC analysis): - Run for 26 SRCs. - For PAH and HCB, use SIM for 10%	
PCBs	Analyze all soil and groundwater samples for PCBs.	
Radionuclides	Analyze 100% of soil and water samples with gamma spec reporting for Ra^{226} and Ra^{228}. Analyze 10% of samples with alpha spec reporting for Th^{232}, Th^{230}, U^{238}, U^{235}, and U^{234} to demonstrate secular equilibrium/calibration.	
Perchlorate	Analyze all soil and groundwater samples for perchlorate.	
Pesticides	Analyze all surficial soil samples (0.5 ft. bgs) and groundwater samples for OCP and OPP. Samples from 10 feet will also be collected at SA-2, SA-4, SA-16, SA-17, SA-18, SA-21, SA-22, and SA-23. If OCPs or OPPs are detected in the 0.5 foot sample, the 10 foot sample will be analyzed for the detected constituents.	
General Chemistry	Analyze all soil and groundwater samples for general chemistry parameters	
Dioxins/Furans	Analyze all surficial soil samples (0.5 ft. bgs) using EPA 4025 immunoassay screening method (soil sensitivity about 50 ppt) and confirm with laboratory analysis for 10% of total samples using EPA method 8290. No groundwater analysis.	Limit dioxin/furan soil analyses to surficial samples only. No groundwater analysis because of low solubility.
Ethylene Glycol	Limit Ethylene Glycol analyses to areas historically used for auto parts storage/maintenance.	
TPH	Limit TPH analyses to areas historically used for auto parts storage/maintenance.	
Fuel Alcohols	Limit fuel alcohols analyses to areas historically used for auto parts storage/maintenance.	
Asbestos	Analyze all surficial soil samples (0.5 ft. bgs) for asbestos.	

VOCs = Volatile organic compounds.
TPH = Total Petroleum Hydrocarbons.
SVOCs = Semi-volatile organic compounds.
PCBs = Polychlorinated biphenyls.
DO = Dissolved oxygen.

Table 3
Rationale for Borings and Monitoring Wells to be Sampled
Source Area Investigation, Tronox Facility - Henderson, Nevada

Boring ID	Characterized Areas & Location Rationale	Total Depth (ft. bgs)	Proposed GW Sample Location	Metals[2]	VOCs	SVOCs	PCBs	TPH	Radionuclides (100% will be tested using gamma spec reporting for Ra^{226} and Ra^{228}, 10% will be tested with alpha spec reporting for Th232, Th230, U238, U235, and U234 to demonstrate secular equilibrium/calibration.)	Perchlorate	Pesticides (test the 0.5 ft. bgs sample and groundwater)	General Chemistry[1]	Ethylene Glycol	Fuel Alcohols	Dioxin/furan (test the 0.5 ft. bgs sample, 90% will be tested by immunoassay, 10% will be analyzed by HRGC/HRMS in the lab) no groundwater.	Asbestos (test the 0.5 ft. bgs sample, no groundwater)
SA-1	South Stormwater Drainage Channel - channel bottom sediment (adjacent to M-120 which was sampled for SRC at depth)	10 est.	M-120	X	X	X	X	X	X	X	X	X			X	X
SA-2	LOU 62 (State Industries) - former surface impoundment	60 est.	Grab Sample	X	X	X	X	X	X	X	X	X			X	X
SA-3	LOU 41, 59, 60 & 65 - Immediately downgradient of Unit 1 former leased area including soil stained area	45 est.	M-92	X	X	X	X	X	X	X	X	X	X	X	X	X
SA-4	LOU 4, 27, 59 & 60 and possibly 26 and 28 - Immediately downgradient of Unit 2 former leased area, former buried tanks and PCB waste staging areas	45 est.	M-97	X	X	X	X	X	X	X	X	X			X (lab analyses)	X
SA-5	LOU 11, 12, 59 & 60 - Immediately downgradient of Unit 3 activities and drilled through waste staging area	50 est.	M-13	X	X	X	X	X	X	X	X	X			X	X
SA-6	LOU 43, 59, 60 & 61 - Immediately downgradient of Unit 4 activities, including the basement's liquid storage	45 est.	M-12A	X	X	X	X	X	X	X	X	X	X	X	X	X
SA-7	LOU 43, 59, 60 & 61 - Immediately downgradient of Unit 5 activities, including historic chlorate, perchlorate and current manganese dioxide production operations	45 est.	M-11	X	X	X	X	X	X	X	X	X			X	X
SA-8	LOU 44, 59 & 60 - Immediately downgradient of Unit 6 activities, including manganese dioxide production	45 est.	M-29	X	X	X	X	X	X	X	X	X			X	X
SA-9	LOU 35 - stained soil from trucking activity	45 est.	Grab Sample	X	X	X	X	X	X	X	X	X	X	X	X	X
SA-10	LOU 64 - Koch Materials Company Site	45 est.	Grab Sample	X	X	X	X	X	X	X	X	X			X	X
SA-11	LOU 8 - floor of closed P-3 surface impoundment	50 est.	M-76	X	X	X	X	X	X	X	X	X			X	X
SA-12	LOU 13 - floor of closed S-1 surface impoundment	50 est.	M-2A	X	X	X	X		X	X	X	X			X	X
SA-13	LOU 48, 49 & 50 - Downgradient of Mn ore leaching area and in vicinity of Mn tailings	45 est.	M-31A	X	X	X	X		X	X	X	X			X	X
SA-14	LOU 5, Entrance of beta ditch onto site and downgradient of the lab septic leach bed and lab satellite waste storage area	35 est.	Grab Sample	X	X	X	X	X	X	X	X	X			X	X
SA-15	LOU 57 AP Process Cooling Tower - Site of AP process liquor cooling tower and adjacent to dryer building sump	35 est.	M-111	X	X	X	X		X	X	X	X			X	X

Table 3
Rationale for Borings and Monitoring Wells to be Sampled
Source Area Investigation, Tronox Facility - Henderson, Nevada

Boring ID	Characterized Areas & Location Rationale	Total Depth (ft. bgs)	Proposed GW Sample Location	Metals^2	VOCs	SVOCs	PCBs	TPH	Radionuclides (100% will be tested using gamma spec reporting for Ra^{226} and Ra^{228}, 10% will be tested with alpha spec reporting for Th232, Th230, U238, U235, and U234 to demonstrate secular equilibrium/calibration.)	Perchlorate	Pesticides (test the 0.5 ft. bgs sample and groundwater)	General Chemistry^1	Ethylene Glycol	Fuel Alcohols	Dioxin/furan (test the 0.5 ft. bgs sample, 90% will be tested by immunoassay, 10% will be analyzed by HRGC/HRMS in the lab) no groundwater.	Asbestos (test the 0.5 ft. bgs sample, no groundwater)
SA-16	LOU 5, 16 & 17 - Floor of Beta ditch mid-way across property and downgradient of AP-1, AP-2 and AP-3 surface impoundments	30 est.	M-89	X	X	X	X	X	X	X	X	X			X	X
SA-17	LOU 5, Exit of beta ditch from site and downgradient of C-1 and Mn-1 ponds	30 est.	M-39	X	X	X	X	X	X	X	X	X			X	X
SA-18	LOU 2 - Disturbed area	35 est.	M-5A	X	X	X	X	X	X	X	X	X			X	X
SA-19	LOU 56, 57 & 58 - Vicinity of D-1 (old and new) AP blending area including washdown areas. This boring is above an area of elevated perchlorate concentrations in groundwater.	35 est.	IAR	X	X	X	X		X	X	X	X			X	X
SA-20	LOU 30 & 55 - Vicinity of AP drum storage pad 35, drum pad burn area	30 est.	M-55	X	X	X	X		X	X	X	X			X (lab analyses)	X
SA-21	LOU 1 & 10 - Immediately downgradient of closed hazardous waste landfill and former trade effluent ponds	30 est.	M-6A or M-6B (use the well with the best recovery)	X	X	X	X	X	X	X	X (and Silvex)	X			X	X
SA-22	LOU 1 & GW-11 Pond - Downgradient of former trade effluent ponds and GW-11 pond	35 est.	M-98	X	X	X	X	X	X	X	X (and Silvex)	X			X	X
SA-23	LOU 1 & 22 - Downgradient of trade effluent ponds and WC-West(1)	30 est.	M-100	X	X	X	X		X	X	X (and Silvex)	X			X	X
SA-24	NW Drainage Ditch - floor of ditch onto property	30 est.	M-48	X	X	X	X	X	X	X	X	X			X	X
SA-25	NW Drainage Ditch - floor of ditch exiting property	30 est.	MC-60	X	X	X	X	X	X	X	X	X			X	X
SA-26	LOU 68 - Auto salvage yard soil stain	30 est.	M-95	X	X	X	X	X	X	X	X	X	X	X	X	X
SA-27	LOU 67 - Recycle / salvage yard soil stain	30 est.	PC-40	X	X	X	X	X	X	X	X	X	X	X	X	X
	Manganese Dioxide Ore		Grab sample	X					X							
	Manganese Dioxide Tails		Grab sample	X					X							

Notes:

Soil samples will be analyzed from the following depths until groundwater is encountered (unless otherwise indicated) 0.5, 10, 20, 30, 40, 50, 60 ft. bgs.
VOCs = Volatile organic compounds
SVOCs = Semi-volatile organic compounds
PCBs = Polychlorinated biphenyls
TPH = Total petroleum hydrocarbons (GRO, DRO, ORO)
ft. bgs = feet below ground surface
est. = estimated
1 Includes general chemistry parameters listed on Table 4.
2 Includes metals listed on Table 4

Table 4
Site-Related Chemicals Analyte List for Soil and Groundwater Samples
Source Area Investigation, Tronox Facility - Henderson, Nevada

Analyte	Method Water/Soil	SRC? Y or N	Class	Water DQL (ug/L)	Soil DQL (mg/kg)
Metals					
Aluminum	EPA 6020	Y	M	36000	1.00E+05
Antimony	EPA 6020	Y	M	6	3.00E-01
Arsenic	EPA 6020	Y	M	10	1.00E+00
Barium	EPA 6020	Y	M	2000	8.20E+01
Beryllium	EPA 6020	Y	M	4	3.00E+00
Boron	EPA6010B/6020	Y	M	17.00	1.00E+05
Cadmium	EPA6020	Y	M	5	4.00E-01
Calcium	EPA 6010B/6020	Y	M		na
Chromium (hexavalent)	EPA 7199/3060A+7199	Y	M	50	2.00E+00
Chromium (total)	EPA 6020	Y	M	100	2.00E+00
Cobalt	EPA 6020	Y	M	730	1.92E+03
Copper	EPA 6020	Y	M	1300	4.10E+04
Iron	EPA 6010B/6020	Y	M	11000	1.00E+05
Lead	EPA 6020	Y	M	15	8.00E+02
Magnesium	EPA 6010B/6020	Y	M		na
Manganese	EPA 6020	Y	M	880	1.90E+04
Mercury	EPA 7470/6020	Y	M	0.2	3.10E+02
Molybdenum	EPA 6020	Y	M	180	5.11E+03
Nickel	EPA 6020	Y	M	730	7.00E+00
Platinum	EPA 6020	Y	M		na
Potassium	EPA 6010B/6020	Y	M		na
Selenium	EPA 6020	Y	M	50	3.00E-01
Silver	EPA 6020	Y	M	180	2.00E+00
Sodium	EPA 6010B/6020	Y	M		2.00E+00
Strontium	EPA 6020	Y	M	22000	1.00E+05
Thallium	EPA 6020	Y	M	2	6.70E+01
Tin	EPA 6020	Y	M	22000	1.00E+05
Titanium	EPA 6010B/6020	Y	M	150000	1.00E+05
Tungsten	EPA 6020	Y	M		1.50E+05
Uranium	EPA 6020	Y	M	7	2.00E+02
Vanadium	EPA 6020	Y	M	36	3.00E+02
Zinc	EPA 6020	Y	M	5.00E+00	6.20E+02
Wet Chemistry					
Alkalinity (total,CO_3^{--},HCO_3^{-})	SM 2320B	Y	W		
Ammonia	EPA 350.1	Y	W		
Asbestos	EPA/540/R-97/028	Y	W	7 MFL	
Bromide	EPA 9056	Y	W		
Chlorate	EPA 9056	Y	W		
Chloride	EPA 9056	Y	W		
Conductivity	EPA 9050A/SM 2510B	Y	W		
Cyanide (total)	EPA 9012A/9014	Y	W	200	3.50E+01
Nitrate	EPA 9056	Y	W	10000	

Table 4
Site-Related Chemicals Analyte List for Soil and Groundwater Samples
Source Area Investigation, Tronox Facility - Henderson, Nevada

Analyte	Method Water/Soil	SRC? Y or N	Class	Water DQL (ug/L)	Soil DQL (mg/kg)
Nitrite	EPA 9056/300.0	Y	W		
Perchlorate	EPA 314.0	Y	W	3	1.02E+02
pH	EPA 9040B	Y	W		
Phosphate (ortho)	EPA9056	Y	W		
Sulfate	EPA 9056	Y	W	2.10E+01	
Surfactants (MBAS)	EPA 425.1/425.1	Y	W		
TDS	EPA 160.1	Y	W		
Total Organic Carbon	EPA 9060/ WB	Y	W		
TSS	EPA 160.2	Y	W		
TPH and fuel alcohols					
GRO(C6-C10)	EPA 8015B	Y	T		3.00E+04
DRO(C10-C28)	EPA 8015B	Y	T		3.00E+04
ORO (C28-C38)	EPA 8015B	Y	T		3.00E+04
Methanol	EPA 8015B	Y	T		1.00E+05
Ethanol	EPA 8015B	Y	T		
Ethylene glycol	EPA 8015B	Y	T		1.00E+05
OCPs & PCBs					
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
Aroclor 1016	EPA 80882	Y	P	0.96	2.10E+02
Aroclor 1221	EPA 8082	Y	P	0.5	7.40E-01
Aroclor 1232	EPA 8082	Y	P	0.5	7.40E-01
Aroclor 1242	EPA 8082	Y	P	0.5	7.40E-01
Aroclor 1248	EPA 8082	Y	P	0.5	7.40E-01
Aroclor 1254	EPA 8082	Y	P	0.034	7.40E-01

Table 4
Site-Related Chemicals Analyte List for Soil and Groundwater Samples
Source Area Investigation, Tronox Facility - Henderson, Nevada

Analyte	Method Water/Soil	SRC? Y or N	Class	Water DQL (ug/L)	Soil DQL (mg/kg)
Aroclor 1260	EPA 8082	Y	P	0.5	7.40E-01
PCDD/PCDFs	EPA 1613B/ 8290	Y	D	3E-11	0.0000039
1,2,3,4,6,7,8,9-Ocatchlorodibenzofuran	EPA 1613B/ 8290	Y	D		3.90E+04
1,2,3,4,6,7,8,9-Ocatchlorodibenzo-p-dioxin	EPA 1613B/ 8290	Y	D		3.90E+04
1,2,3,4,6,7,8-Heptatchlorodibenzofuran	EPA 1613B/ 8290	Y	D		3.90E+02
1,2,3,4,6,7,8-Heptatchlorodibenzo-p-dioxin	EPA 1613B/ 8290	Y	D		3.90E+02
1,2,3,4,7,8,9-Heptatchlorodibenzofuran	EPA 1613B/ 8290	Y	D		3.90E+02
1,2,3,4,7,8-Hexachlorodibenzofuran	EPA 1613B/ 8290	Y	D		3.90E+01
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	EPA 1613B/ 8290	Y	D		3.90E+01
1,2,3,6,7,8-Hexachlorodibenzofuran	EPA 1613B/ 8290	Y	D		3.90E+01
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	EPA 1613B/ 8290	Y	D		3.90E+01
1,2,3,7,8,9-Hexachlorodibenzofuran	EPA 1613B/ 8290	Y	D		3.90E+01
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	EPA 1613B/ 8290	Y	D		3.90E+01
1,2,3,7,8-Pentachlorodibenzof-p-dioxin	EPA 1613B/ 8290	Y	D		3.90E+00
1,2,3,7,8-Pentachlorodibenzofuran	EPA 1613B/ 8290	Y	D		7.80E+01
2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 1613B/ 8290	Y	D		3.90E+01
2,3,4,7,8-Pentachlorodibenzofuran	EPA 1613B/ 8290	Y	D		7.80E+00
2,3,7,8-Tetrachlorodibenzofuran	EPA 1613B/ 8290	Y	D		3.90E+01
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 1613B/ 8290	Y	D		3.90E+00
Radionuclides					
Radium 226	EML HASL 300 (gamma)	Y	R	0.000823*	3.7**
Radium 228	EML HASL 300 (gamma)	Y	R	0.0458*	8.4**
Thorium (isotopic)	EML HASL 300 Alpha Spec	Y	R		various
Uranium (isotopic)	EML HASL 300 Alpha Spec	Y	R		various
Organophosphorous Pesticides					
Azinphos-methyl	EPA 8141	Y	O		
Bolstar	EPA 8141	Y	O		
Chlorpyrifos	EPA 8141	Y	O	1.09E+02	1.80E+03
Coumaphos	EPA 8141	Y	O		na
Demeton-O	EPA 8141	Y	O	1.50E+00	2.50E+01
Demeton-S	EPA 8141	Y	O	1.50E+00	2.50E+01
Diazinon	EPA 8141	Y	O	3.28E+01	5.50E+02
Dichlorvos	EPA 8141	Y	O	2.32E-01	5.90E+00
Dimethoate	EPA 8141	Y	O	7.30E+00	1.20E+02
Disulfoton	EPA 8141	Y	O	1.46E+00	2.50E+01
EPN	EPA 8141	Y	O	3.60E-01	6.20E+00
Ethoprop	EPA 8141	Y	O		
Famphur	EPA 8141	Y	O		
Fensulfothion	EPA 8141	Y	O		
Fenthion	EPA 8141	Y	O		
Malathion	EPA 8141	Y	O	7.30E+02	1.20E+04
Merphos	EPA 8141	Y	O	1.09E+00	1.80E+01
Mevinphos	EPA 8141	Y	O		na
Naled	EPA 8141	Y	O	7.30E+01	1.20E+03
Parathion-ethyl	EPA 8141	Y	O	2.20E+02	3.70E+03

Table 4
Site-Related Chemicals Analyte List for Soil and Groundwater Samples
Source Area Investigation, Tronox Facility - Henderson, Nevada

Analyte	Method Water/Soil	SRC? Y or N	Class	Water DQL (ug/L)	Soil DQL (mg/kg)
Parathion-methyl	EPA 8141	Y	O	2.20E+02	3.70E+03
Phorate	EPA 8141	Y	O	7.30E+00	1.20E+02
Ronnel	EPA 8141	Y	O	1.82E+03	3.10E+04
Stirphos	EPA 8141	Y	O	2.80E+00	7.20E+01
Sulfotepp	EPA 8141	Y	O	1.80E+01	3.10E+02
Thionazin	EPA 8141	Y	O		
Tokuthion	EPA 8141	Y	O		
Trichloronate	EPA 8141	Y	O		
Herbicides					
Silvex	EPA 8151	Y	H	2.90E+02	4.90E+03
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

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Site-Related Chemicals Analyte List for Soil and Groundwater Samples
Source Area Investigation, Tronox Facility - Henderson, Nevada

Analyte	Method Water/Soil	SRC? Y or N	Class	Water DQL (ug/L)	Soil DQL (mg/kg)
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
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					
1,4-Dioxane	EPA 8270 modified	Y	S	6.10E+00	1.60E+02
2-Methylnaphthalene	EPA 8270 SIM	Y	S	6.20E+00	4.00E+00
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

Table 4
Site-Related Chemicals Analyte List for Soil and Groundwater Samples
Source Area Investigation, Tronox Facility - Henderson, Nevada

Analyte	Method Water/Soil	SRC? Y or N	Class	Water DQL (ug/L)	Soil DQL (mg/kg)
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
Diethylphthalate	EPA 8270	Y	S	2.92E+04	1.00E+05
Dimethylphthalate	EPA 8270	Y	S	2.92E+04	1.00E+05
Di-n-butylphthalate	EPA 8270	Y	S	3.65E+03	2.70E+02
Di-n-octylphthalate	EPA 8270	Y	S	1.46E+03	1.00E+04
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
Naphthalene	EPA 8270 SIM	Y	S	6.00E+00	4.00E+00
Nitrobenzene	EPA 8270	Y	S	3.00E+00	7.00E-03
Octachlorostyrene	EPA 8270	Y	S		
Phenanthrene	EPA 8270 SIM	Y	S	1.83E+03	5.90E+02
Pyrene	EPA 8270 SIM	Y	S	1.80E+02	2.10E+02
Pyridine	EPA 8270	Y	S	3.60E+02	6.16E+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.
O = Organic.
R= Radionuclide.
W = Wet chemistry.
D = Dioxin.

* units = pCi/L. ** units = pCi/g.

Table 5
Proposed Soil Sample Analytical Plan
Source Area Investigation, Tronox Facility - Henderson, Nevada

Boring Location	Sample ID Number	Sample Depths (ft, bgs)	Metals [1] (6010B)	Hexavalent Chromium (7196 or 7199)	VOCs (8260B/5035**)	SVOCs (8270C)	10% SVOCs (8270 SIM)	PCBs (8082)	TPH [2] (8015M/5035** /3550)	Radionuclides (gamma spec for Ra-226 & Ra-228)	10% Radionuclides [3] (alpha spec U & Th isotopes for secular equilibrium)	Perchlorate (314.0)	Organo-Chlorine Pesticides (OCPs) EPA 8081A	Organo-Phosphate Pesticides (OPPs) EPA 8141A	Organo-Chlorine Herbicides (OCHs) EPA 8151	General Chemistry [4]	Fuel Alcohols [5] (8015B)	10% Dioxin/ Furan EPA 8290	Dioxin/Furan immuno-assay EPA 4025	Asbestos EPA/540/R-97/028
SA-1	SA1-0.5	0.5	X	X	X	X		X	X	X		X	X	X		X			X	X
	SA1-05	5	X	X	X	X		X	X	X		X				X				
	SA1-10	10	X	X	X	X		X	X	X		X				X				
SA-2	SA2-0.5	0.5	X	X	X	X	X	X	X	X	X	X	X	X		X			X	X
	SA2-10	10	X	X	X	X		X	X	X		X	hold [6]	hold [6]		X				
	SA2-20	20	X	X	X	X		X	X	X		X				X				
	SA2-30	30	X	X	X	X		X	X	X		X				X				
	SA2-40	40	X	X	X	X		X	X	X		X				X				
	SA2-50	50	X	X	X	X		X	X	X		X				X				
	SA2-60	60	X	X	X	X		X	X	X		X				X				
SA-3	SA3-0.5	0.5	X	X	X	X	X	X	X	X		X	X	X		X	X		X	X
	SA3-0.5D	0.5	X	X	X	X	X	X	X	X		X	X	X		X	X		X	X
	SA3-10	10	X	X	X	X		X	X	X	X	X				X	X			
	SA3-20	20	X	X	X	X		X	X	X		X				X	X			
	SA3-30	30	X	X	X	X		X	X	X		X				X	X			
	SA3-40	40	X	X	X	X		X	X	X		X				X	X			
	SA3-45	45	X	X	X	X		X	X	X		X				X	X			
SA-4	SA4-0.5	0.5	X	X	X	X	X	X	X	X		X	X	X		X		X	X	X
	SA4-10	10	X	X	X	X		X	X	X		X	hold [6]	hold [6]		X				
	SA4-20	20	X	X	X	X		X	X	X	X	X				X				
	SA4-30	30	X	X	X	X		X	X	X		X				X				
	SA4-40	40	X	X	X	X		X	X	X		X				X				
	SA4-45	45	X	X	X	X		X	X	X		X				X				
SA-5	SA5-0.5	0.5	X	X	X	X	X	X		X		X	X	X		X			X	X
	SA5-10	10	X	X	X	X		X		X		X				X				
	SA5-20	20	X	X	X	X		X		X		X				X				
	SA5-30	30	X	X	X	X		X		X	X	X				X				
	SA5-40	40	X	X	X	X		X		X		X				X				
	SA5-50	50	X	X	X	X		X		X		X				X				
SA-6	SA6-0.5	0.5	X	X	X	X	X	X	X	X		X	X	X		X	X		X	X
	SA6-0.5D	0.5	X	X	X	X	X	X	X	X		X	X	X		X	X		X	X
	SA6-10	10	X	X	X	X		X	X	X	X	X				X	X			
	SA6-20	20	X	X	X	X		X	X	X		X				X	X			
	SA6-30	30	X	X	X	X		X	X	X		X				X	X			
	SA6-40	40	X	X	X	X		X	X	X		X				X	X			
	SA6-45	45	X	X	X	X		X	X	X		X				X	X			
SA-7	SA7-0.5	0.5	X	X	X	X	X	X	X	X		X	X	X		X		X	X	X
	SA7-10	10	X	X	X	X		X	X	X		X				X				
	SA7-10D	10	X	X	X	X		X	X	X		X				X				
	SA7-20	20	X	X	X	X		X	X	X	X	X				X				
	SA7-30	30	X	X	X	X		X	X	X		X				X				
	SA7-45	45	X	X	X	X		X	X	X		X				X				
SA-8	SA8-0.5	0.5	X	X	X	X	X	X	X	X		X	X	X		X			X	X
	SA8-0.5D	0.5	X	X	X	X	X	X	X	X		X	X	X		X			X	X
	SA8-10	10	X	X	X	X		X	X	X	X	X				X				
	SA8-20	20	X	X	X	X		X	X	X		X				X				
	SA8-30	30	X	X	X	X		X	X	X		X				X				
	SA8-45	45	X	X	X	X		X	X	X		X				X				
SA-9	SA9-0.5	0.5	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X
	SA9-10	10	X	X	X	X		X	X	X		X				X	X			
	SA9-10D	10	X	X	X	X		X	X	X		X				X	X			
	SA9-20	20	X	X	X	X		X	X	X		X				X	X			
	SA9-30	30	X	X	X	X		X	X	X		X				X	X			
	SA9-40	40	X	X	X	X		X	X	X		X				X	X			
	SA9-45	45	X	X	X	X		X	X	X		X	X	X		X	X			
SA-10	SA10-0.5	0.5	X	X	X	X		X	X	X		X	X	X		X			X	X
	SA10-10	10	X	X	X	X		X	X	X		X				X				
	SA10-10D	10	X	X	X	X		X	X	X		X				X				
	SA10-20	20	X	X	X	X		X	X	X		X				X				
	SA10-30	30	X	X	X	X		X	X	X		X				X				
	SA10-40	40	X	X	X	X		X	X	X		X				X				
	SA10-45	45	X	X	X	X		X	X	X		X				X				
SA-11	SA11-0.5	0.5	X	X	X	X		X	X	X		X	X	X		X			X	X
	SA11-0.5D	0.5	X	X	X	X		X	X	X		X	X	X		X			X	X
	SA11-10	10	X	X	X	X		X	X	X	X	X				X				
	SA11-20	20	X	X	X	X		X	X	X		X				X				
	SA11-30	30	X	X	X	X		X	X	X		X				X				
	SA11-40	40	X	X	X	X		X	X	X		X				X				
	SA11-50	50	X	X	X	X		X	X	X		X				X				

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Source Area Investigation, Tronox Facility - Henderson, Nevada

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SA-12	SA12-0.5	0.5	X	X	X	X		X		X		X	X	X		X			X	X
	SA12-10	10	X	X	X	X		X		X		X				X				
	SA12-20	20	X	X	X	X		X		X		X				X				
	SA12-30	30	X	X	X	X		X		X		X				X				
	SA12-40	40	X	X	X	X		X		X		X				X				
	SA12-50	50	X	X	X	X		X		X		X				X				
SA-13	SA13-0.5	0.5	X	X	X	X	X			X		X	X	X		X			X	X
	SA13-10	10	X	X	X	X				X		X				X				
	SA13-20	20	X	X	X	X				X		X				X				
	SA13-30	30	X	X	X	X				X		X				X				
	SA13-40	40	X	X	X	X				X	X	X				X				
	SA13-45	45	X	X	X	X				X		X				X				
SA-14	SA14-0.5	0.5	X	X	X	X	X	X	X	X		X	X	X		X			X	X
	SA14-10	10	X	X	X	X		X	X	X		X	hold [6]	hold [6]		X				
	SA14-20	20	X	X	X	X		X	X	X		X				X				
	SA14-30	30	X	X	X	X		X	X	X		X				X				
	SA14-35	35	X	X	X	X		X	X	X		X				X				
SA-15	SA15-0.5	0.5	X	X	X	X		X		X		X	X	X		X		X	X	X
	SA15-10	10	X	X	X	X		X		X	X	X				X				
	SA15-10D	10	X	X	X	X		X		X	X	X				X				
	SA15-20	20	X	X	X	X		X		X		X				X				
	SA15-30	30	X	X	X	X		X		X		X				X				
	SA15-35	35	X	X	X	X		X		X		X				X				
SA-16	SA16-0.5	0.5	X	X	X	X		X	X	X		X	X	X		X			X	X
	SA16-10	10	X	X	X	X		X	X	X		X	hold [6]	hold [6]		X				
	SA16-20	20	X	X	X	X		X	X	X		X				X				
	SA16-30	30	X	X	X	X		X	X	X		X				X				
SA-17	SA17-0.5	0.5	X	X	X	X	X	X	X	X		X	X	X		X			X	X
	SA17-0.5D	0.5	X	X	X	X		X	X	X		X	X	X		X			X	X
	SA17-10	10	X	X	X	X		X	X	X		X	hold [6]	hold [6]		X				
	SA17-20	20	X	X	X	X		X	X	X		X				X				
	SA17-30	30	X	X	X	X		X	X	X		X				X				
SA-18	SA18-0.5	0.5	X	X	X	X		X	X	X	X	X	X	X		X			X	X
	SA18-0.5D	0.5	X	X	X	X		X	X	X	X	X	X	X		X			X	X
	SA18-10	10	X	X	X	X		X	X	X		X	hold [6]	hold [6]		X				
	SA18-20	20	X	X	X	X		X	X	X		X				X				
	SA18-30	30	X	X	X	X		X	X	X		X				X				
	SA18-35	35	X	X	X	X		X	X	X		X				X				
SA-19	SA19-0.5	0.5	X	X	X	X		X		X		X	X	X		X			X	X
	SA19-10	10	X	X	X	X		X		X		X				X				
	SA19-20	20	X	X	X	X		X		X		X				X				
	SA19-30	30	X	X	X	X		X		X		X				X				
	SA19-35	35	X	X	X	X		X		X		X				X				
SA-20	SA20-0.5	0.5	X	X	X	X		X		X		X	X	X		X			X	X
	SA20-0.5D	0.5	X	X	X	X		X		X		X	X	X		X			X	X
	SA20-10	10	X	X	X	X		X		X		X				X				
	SA20-20	20	X	X	X	X		X		X		X				X				
	SA20-30	30	X	X	X	X		X		X		X				X				
SA-21	SA21-0.5	0.5	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
	SA21-10	10	X	X	X	X		X	X	X		X	hold [6]	hold [6]	hold [6]	X				
	SA21-20	20	X	X	X	X		X	X	X		X				X				
	SA21-20D	20	X	X	X	X		X	X	X		X				X				
	SA21-30	30	X	X	X	X		X	X	X		X				X				
SA-22	SA22-0.5	0.5	X	X	X	X		X	X	X		X	X	X	X	X			X	X
	SA22-10	10	X	X	X	X		X	X	X		X	hold [6]	hold [6]	hold [6]	X				
	SA22-20	20	X	X	X	X		X	X	X		X				X				
	SA22-30	30	X	X	X	X		X	X	X		X				X				
	SA22-35	35	X	X	X	X		X	X	X		X				X				
SA-23	SA23-0.5	0.5	X	X	X	X		X				X	X	X	X	X			X	X
	SA23-10	10	X	X	X	X		X		X		X	hold [6]	hold [6]	hold [6]	X				
	SA23-20	20	X	X	X	X		X		X		X				X				
	SA23-30	30	X	X	X	X		X		X		X				X				
	SA23-30D	30	X	X	X	X		X		X		X				X				
SA-24	SA24-0.5	0.5	X	X	X	X		X	X	X		X	X	X		X			X	X
	SA24-10	10	X	X	X	X		X	X	X		X				X				
	SA24-20	20	X	X	X	X		X	X	X		X				X				
	SA24-30	30	X	X	X	X		X	X	X		X				X				
SA-25	SA25-0.5	0.5	X	X	X	X		X	X	X		X	X	X		X			X	X
	SA25-10	10	X	X	X	X		X	X	X		X				X				
	SA25-20	20	X	X	X	X		X	X	X		X				X				
	SA25-30	30	X	X	X	X		X	X	X		X				X				

Table 5
Proposed Soil Sample Analytical Plan
Source Area Investigation, Tronox Facility - Henderson, Nevada

Boring Location	Sample ID Number	Sample Depths (ft, bgs)	Metals 1. (6010B)	Hexavalent Chromium (7196 or 7199)	VOCs (8260B/5035**)	SVOCs (8270C)	10% SVOCs (8270 SIM)	PCBs (8082)	TPH 2. (8015M/5035** /3550)	Radionuclides (gamma spec for Ra-226 & Ra-228)	10% Radionuclides 3. (alpha spec U & Th isotopes for secular equilibrium)	Perchlorate (314.0)	Organo-Chlorine Pesticides (OCPs) EPA 8081A	Organo-Phosphate Pesticides (OPPs) EPA 8141A	Organo-Chlorine Herbicides (OCHs) EPA 8151	General Chemistry 4.	Fuel Alcohols 5. (8015B)	10% Dioxin/ Furan EPA 8290	Dioxin/Furan immuno-assay EPA 4025	Asbestos EPA/540/R-97/028
SA-26	SA26-0.5	0.5	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X
	SA26-0.5D	0.5	X	X	X	X		X	X	X	X	X	X	X		X	X		X	X
	SA26-10	10	X	X	X	X		X	X	X		X				X	X			
	SA26-20	20	X	X	X	X		X	X	X		X				X	X			
	SA26-30	30	X	X	X	X		X	X	X		X				X	X			
SA-27	SA27-0.5	0.5	X	X	X	X		X	X	X		X	X	X		X	X		X	X
	SA27-10	10	X	X	X	X		X	X	X		X				X	X			
	SA27-20	20	X	X	X	X		X	X	X		X				X	X			
	SA27-30	30	X	X	X	X		X	X	X		X				X	X			
Grab	MnO2 ore	0	X	X						X										
Grab	MnO2 tailings	0	X	X						X										
Number of Field Samples Subtotal:			**151**	**151**	**149**	**149**	**16**	**143**	**110**	**150**	**17**	**149**	**45**	**45**	**6**	**149**	**30**	**4**	**35**	**35**
QA/QC Blank Samples																				
Field Blank 1			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Field Blank 2			X	X	X	X		X	X	X	X	X	X	X		X	X		X	
Equip Blnk 1			X	X	X		X	X	X	X		X	X	X			X		X	
Equip Blnk 2			X	X	X	X		X	X	X	X	X	X	X			X	X	X	X
Equip Blnk 3			X	X	X	X		X	X	X		X	X	X			X		X	
Equip Blnk 4			X	X	X		X	X	X	X		X	X	X			X		X	
Equip Blnk 5			X	X	X	X		X	X	X		X	X	X					X	
Equip Blnk 6			X	X	X	X		X	X	X		X	X	X					X	
Equip Blnk 7			X	X	X		X	X	X	X		X	X	X				X	X	X
Equip Blnk 8			X	X	X	X		X	X	X	X	X	X	X					X	
Equip Blnk 9			X	X	X	X		X	X	X		X	X	X					X	
Equip Blnk 10			X	X	X	X		X	X	X		X	X	X				X	X	X
Equip Blnk 11			X	X	X	X		X	X	X		X	X	X					X	
Equip Blnk 12			X	X	X	X		X	X	X		X	X	X	X				X	
Equip Blnk 13			X	X	X		X	X	X	X		X	X	X	X				X	
Equip Blnk 14			X	X	X	X		X	X	X	X	X	X	X					X	
Trip Blanks					16				16								16			
No. of Blank Samples Subtotal:			**16**	**16**	**32**	**11**	**5**	**16**	**32**	**16**	**5**	**16**	**16**	**16**	**3**	**2**	**22**	**4**	**16**	**4**
Total Number of Samples:			**167**	**167**	**181**	**160**	**21**	**159**	**142**	**166**	**22**	**165**	**61**	**61**	**9**	**151**	**52**	**8**	**51**	**39**

Notes:

X Sample to be collected and analyzed. Sample will not be collected where cell is blank.

* Soil sample to be collected at a depth just above the capillary fringe.

** Samples for VOC and GRO analyses will be preserved in the field using sodium bisulfate and methanol preservatives.

SA17-0.5D Duplicate soil sample of SA17-0.5.

1. Includes metals listed on Table 4.
2. Total Petroleum Hydrocarbons - includes Gasoline Range Organics (C_6-C_{10}) , Diesel Range Organics (C_{10}-C_{28}) and Oil Range Organics (C_{28}-C_{40}).
3. Analyze with alpha spectrum reporting to demonstrate secular equilibrium/calibration.
4. Includes general chemistry parameters listed on Table 4.
5. Fuel alcohols consist of methanol, ethanol, and ethylene glycol.
6. Sample will be collected and held at the laboratory; sample will only be analyzed if the previous sample above (shallower depth) tests positive.

Table 6
Proposed Groundwater Sample Analytical Plan
Source Area Investigation, Tronox Facility - Henderson, Nevada

Existing Well Number	Sample ID Number	Screened Interval (ft, bgs)	Metals $^{1.}$ (6010B)	Hexavalent Chromium (7196 or 7199)	VOCs $^{2.}$ (8260B)	SVOCs (8270C)	10% SVOCs (8270 SIM)	PCBs (8082)	Radionuclides (gamma spec for Ra-226 & Ra-228)	10% Radionuclides $^{3.}$ (alpha spec U & Th isotopes for secular equilibrium)	Perchlorate (314.0)	Organo-Chlorine Pesticides (OCPs) EPA 8081A	Organo-Phosphate Pesticides (OPPs) EPA 8141A	Organo-Chlorine Herbicides (OCHs) EPA 8151	General Chemistry $^{4.}$	Fuel Alcohols^{5} (8015B)
M-120 (SA-1)	M-120	85 - 105	X	X	X	X		X	X		X	X	X		X	
Grab Sample (SA-2)	GWSA-2	grab (about 65')	X	X	X	X		X	X	X	X	X	X		X	
M-92 (SA-3)	M-92	34 - 45	X	X	X	X		X	X		X	X	X		X	X
	M-92D		X	X	X	X		X	X		X	X	X		X	X
M-97 (SA-4)	M-97	35 - 45	X	X	X	X		X	X		X	X	X		X	
M-13 (SA-5)	M-13	28 - 48	X	X	X	X	X	X	X		X	X	X		X	
M-12A (SA-6)	M-12A	40 - 50	X	X	X	X		X	X		X	X	X		X	X
	M-12A D		X	X	X	X		X	X		X	X	X		X	X
M-11 (SA-7)	M-11	33 - 53	X	X	X	X		X	X		X	X	X		X	
M-29 (SA-8)	M-29	22 - 42	X	X	X	X		X	X		X	X	X		X	
Grab Sample (SA-9)	GWSA-9	grab (about 50')	X	X	X	X		X	X	X	X	X	X		X	X
Grab Sample (SA-10)	GWSA-10	grab (about 50')	X	X	X	X		X	X		X	X	X		X	
M-76 (SA-11)	M-76	34 - 49	X	X	X	X		X	X		X	X	X		X	
M-2A (SA-12)	M-2A	25 - 45	X	X	X	X		X	X		X	X	X		X	
M-31A (SA-13)	M-31A	35 - 55	X	X	X	X	X		X	X	X	X	X		X	
Grab Sample (SA-14)	GWSA-14	grab (about 35')	X	X	X	X		X	X		X	X	X		X	
M-111 (SA-15)	M-111	30 - 40	X	X	X	X		X	X		X	X	X		X	
M-89 (SA-16)	M-89	18 - 38	X	X	X	X		X	X		X	X	X		X	
M-39 (SA-17)	M-39	25 - 40	X	X	X	X		X	X		X	X	X		X	
M-5A (SA-18)	M-5A	25 - 35	X	X	X	X		X	X		X	X	X		X	

Table 6
Proposed Groundwater Sample Analytical Plan
Source Area Investigation, Tronox Facility - Henderson, Nevada

Existing Well Number	Sample ID Number	Screened Interval (ft, bgs)	Metals 1. (6010B)	Hexavalent Chromium (7196 or 7199)	VOCs 2. (8260B)	SVOCs (8270C)	10% SVOCs (8270 SIM)	PCBs (8082)	Radionuclides (gamma spec for Ra-226 & Ra-228)	10% Radionuclides 3. (alpha spec U & Th isotopes for secular equilibrium)	Perchlorate (314.0)	Organo-Chlorine Pesticides (OCPs) EPA 8081A	Organo-Phosphate Pesticides (OPPs) EPA 8141A	Organo-Chlorine Herbicides (OCHs) EPA 8151	General Chemistry 4.	Fuel Alcohols 5 (8015B)
(SA-19)	IAR	21 - 41	X	X	X	X		X	X		X	X	X		X	
(SA-20)	M-55	14 - 44	X	X	X	X	X	X	X		X	X	X		X	
M-6A or M-6B (SA-21)	M-6A or M-6B (depends on recovery)	27 - 42	X	X	X	X		X	X		X	X	X	X	X	
M-98 (SA-22)	M-98	19 - 29	X	X	X	X		X	X		X	X	X	X	X	
M-100 (SA-23)	M-100	19 - 29	X	X	X	X		X	X		X	X	X	X	X	
	M-100D		X	X	X	X		X	X		X	X	X	X	X	
M-48 (SA-24)	M-48	6 - 36	X	X	X	X		X	X		X	X	X		X	
MC-60 (SA-25)	MC-60	24? - 34	X	X	X	X		X	X		X	X	X		X	
M-95 (SA-26)	M-95	12 - 22	X	X	X	X		X	X		X	X	X		X	X
PC-40 (SA-27)	PC-40	15 - 55	X	X	X	X		X	X		X	X	X		X	X
pump blank			X	X	X	X		X	X	X	X	X	X		X	X
Field Blank			X	X	X	X		X	X		X	X	X		X	X
Equip Blnk 1			X	X	X	X		X	X	X	X	X	X		X	
Equip Blnk 2			X	X	X	X	X	X	X		X	X	X		X	X
Equip Blnk 3			X	X	X	X		X	X		X	X	X		X	
Equip Blnk 4			X	X	X	X		X	X		X	X	X		X	X
Equip Blnk 5			X	X	X	X		X	X		X	X	X		X	X
Equip Blnk 6			X	X	X	X		X	X		X	X	X	X	X	
Equip Blnk 7			X	X	X	X	X	X	X	X	X	X	X		X	X
Equip Blnk 8			X	X	X	X		X	X		X	X	X		X	
Equip Blnk 9			X	X	X	X	X	X	X		X	X	X		X	X
Trip Blanks					9											7
No. of water samples collected:			**41**	**41**	**51**	**41**	**6**	**40**	**41**	**6**	**41**	**41**	**41**	**5**	**41**	**22**

Notes:

X	Sample to be collected and analyzed. Sample will not be collected where cell is blank.
M-100D	Duplicate water sample of M-100.
1.	Includes metals listed on Table 4.
2	Total Petroleum Hydrocarbons - are not included in the groundwater analysis because Nevada does not have action levels for TPH.
3.	Analyze with alpha spectrum reporting to demonstrate secular equilibrium/calibration.
4.	Includes general chemistry parameters listed on Table 4.
5.	Fuel alcohols consist of methanol, ethanol, and ethylene glycol.

Table 7
Alphabetical Listing of Site-Related Chemicals
Source Area Investigation, Tronox Facility - Henderson, Nevada
September 2004 (revised September 2006)

1,1,1-TCA
1,4-dioxane
2-butanone
2-hexanone
acenaphthene
acenaphthylene
acetone
actinium 228
all organophosphorous pesticides
aluminum
ammonia
ammonium perchlorate
anthracene
anti-foam agent
antimony
argon
aroclor 1016
aroclor 1221
aroclor 1232
aroclor 1242
aroclor 1248
aroclor 1254
aroclor 1260
arsenic
asbestos
barite
barium
barium hydroxide
barium sulfate
barium sulfide
benz(a)anthracene
benzene
benzo(a)pyrene
benzo(b)fluoranthene
benzo(g,h,i)perylene
benzo(k)fluoranthene
beryllium
bismuth 212
boric acid
boron
boron carbide
boron tribromide
boron trichloride
C_{13}-C_{22}
C_{23+}
C_4-C_{12}
cadmium
calcium
calcium carbonate
calcium chloride
calcium hypochlorite
calcium oxide (lime)
calcium sulfate
chelant (Nalco 1745)
chlorate
chloride
chlorinated organics
chlorinated paraffins
chlorine
chlorobenzol (monochlorobenzene, chlorobenzene)
chloroform
chromium (hexavalent)
chromium (total)
chrysene
citric acid
coagulants
coal
cobalt
coke
copper
cyanide
DDD
DDE
DDT
diatomaceous earth
dibenz(a,h)anthracene
dioxins/furans
ethylbenzene
filter aid
flammables
flocculants
fluoranthene
fluorene
glycols
graphite
gross alpha (adjusted)
hexachlorobenzene
hydrochloric acid
hydrogen chloride
hydrogen peroxide
hydrogen sulfide
indeno(1,2,3-cd)pyrene
insecticides
iron
iron oxide
lead
lead (isotopic)
magnesium
magnesium carbonate
magnesium chlorate
magnesium chloride
magnesium perchlorate
manganese
manganese dioxide
manganese oxide
manganese sulfate
mercury
methanol
methyl isobutyl ketone (orthodichlorobenzene, 4-methyl 2-pentanone)
methyl mercury
methyl tert-butyl ether (MTBE)
molybdenum
napthalene
nickel
nitrate
nitrobenzene
octachlorostyrene
orthodichlorobenzene (1,2-dichlorobenzene)
PAHs (polycyclic aromatic hydrocarbons)
paints
paradichlorobenzene
paraffin wax
PCBs
perchlorate
pesticides
pH
phenanthrene
phosphate
phosphorous
platinum
polonium 210
polonium 215
potassium
potassium chlorate
potassium chloride
potassium perchlorate
potassium phosphate
protactinium 231
pyrene
pyridine
radium 226
radium 228
radon 219
radon 222
selenium
silica
silicon tetrabromide
silicon tetrachloride
silver
Silvex
sodium
sodium alpha olefin sulfonate
sodium arsenite
sodium borate
sodium carbonate
sodium chlorate
sodium chloride
sodium dichromate
sodium hexametaphosphate
sodium hydrosulfide
sodium hydroxide
sodium oxide
sodium perchlorate
sodium sulfite
strontium
strontium carbonate
sulfate
sulfide
sulfur dioxide
sulfuric acid
synthetic detergent
tank mud
TDS (total dissolved solids)
tetrachloroethylene
thallium
thorium (isotopic)
tin
titanium
titanium tetrachloride
toluene
TPH (total petroleum hydrocarbons)
tricalcium phosphate
trichloroethylene
TSS (total suspended solids)
tumbleaf defoliant
tungsten
unknowns
uranium (isotopic)
uranium (total)
urea
vanadium
various lab wastes
xylene
zinc

Notes:
(Synonyms) Selected synonyms are shown in parentheses.
The Site Related Chemical list was approved by NDEP on March 9, 2006. The list was revised to include Protactinium 231, Polonium 215, and Radon 219, on February 21, 2006, and 1,4-Dioxin on March 11, 2006. September 2006, selected synonyms were added.

Table 8
Sample Containers, Analytical Methods, and Holding Times for Groundwater Samples
Source Area Investigation 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 7196A or 7199	(1) 250-ml plastic bottle	24 hours
VOCs	EPA 8260B	(3) 40-ml VOA vials	14 days
Fuel alcohols	EPA 8015B	(1) 40-mL VOA vials	14 days
Organochlorinated Pesticides	EPA 8081A	(1) 1-liter amber glass/ no preservative	7 days
Polychlorinated biphenyls	EPA 8082	(1) 1-liter amber glass/ no preservative	7 days
SVOCs	EPA 8270	(1) 1-liter amber glass/ no preservative	7 days
Dioxins/Furans	EPA 8290	(2) 1-liter amber glass/ no preservative	28 days
Organophosphorous Pesticides	EPA 8141	(1) 1-liter amber glass/ no preservative	7 days
General Water Chemistry Ions			
Alkalinity	SM 2320B	500-ml plastic no preservative	14 days
pH	EPA 9040	125-ml plastic no preservative	7 days
TDS	EPA 160.1	125-ml plastic no preservative	28 days
Electrical Conductivity	EPA 9050	125-ml plastic no preservative	28 days
Chlorate	EPA 9056	125-ml plastic bottle/ no preservative	28 days
Chloride	EPA 9056	**(2) liter plastic bottles	28 days
Cyanide	EPA 9012A/9056	(1) 500-ml plastic bottle w/ NaOH	14 days
Nitrate	EPA 9056	**Use same bottles	48 hours
Nitrite as N	EPA 9056	125-ml plastic no preservative	48 hours
Phosphate	EPA 9056	125-ml plastic bottle, no preservative	48 hours
Sulfate	EPA 9056	**Use same bottles	28 days
Radionuclides:			
Uranium (Isotopic)	EML HASL 300 Alpha Spec	(1) 1-liter poly bottle (must be full), Preservative pH <2 HNO3	6 months
Radium-226	EPA 903.1	(1) 1-liter poly bottle (must be full), Preservative pH <2 HNO3	6 months
Radium-228	EML HASL 300 Gamma Spec	(1) 1-liter poly bottle (must be full), Preservative pH <2 HNO3	6 months
Thorium (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 4.

** Chloride, Nitrate, Perchlorate, and Sulfate use same bottle for all these samples. Sample containers are (2) liter plastic bottles.

Table 9

Sample Containers, Analytical Methods, and Holding Times for Soil Samples

Source Area Investigation, 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
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
VOCs	EPA 8260B/5035	4 40-mL VOA vials**	14 days
Fuel Alcohols (Methanol & Ethanol)	EPA 8015B	4-oz. glass jar	14 days
TPH***	EPA 8015B (EPA 5035 for GRO fraction)	(3) Methanol preserved VOA vials for GRO; metal sleeve or glass jar for DRO/ORO.	14 days
Organochlorinated Pesticides and PCBs	EPA Method 8081A and 8082	4-oz. glass jar	14 days
SVOCs	EPA Method 8270	4-oz. glass jar	14 days
Organophosphorous Pesticides	EPA Method 8141	4-oz. glass jar	14 days
Dioxins/Furans	EPA Method 8290	4-oz. glass jar	28 days
Ethylene glycol	EPA 8015B	4-oz. glass jar	14 days
Radionuclides:			
Uranium (Isotopic)	EML HASL 300 Alpha Spec	4-oz. poly jar, no preservative	6-months
Radium-226	EML HASL 300 Gamma Spec	4-oz. poly jar, no preservative	6-months
Radium-228	EML HASL 300 Gamma Spec	4-oz. poly jar, no preservative	6-months
Thorium (Isotopic)	EML HASL 300 Alpha Spec	4-oz. poly jar, no preservative	6-months

Note:

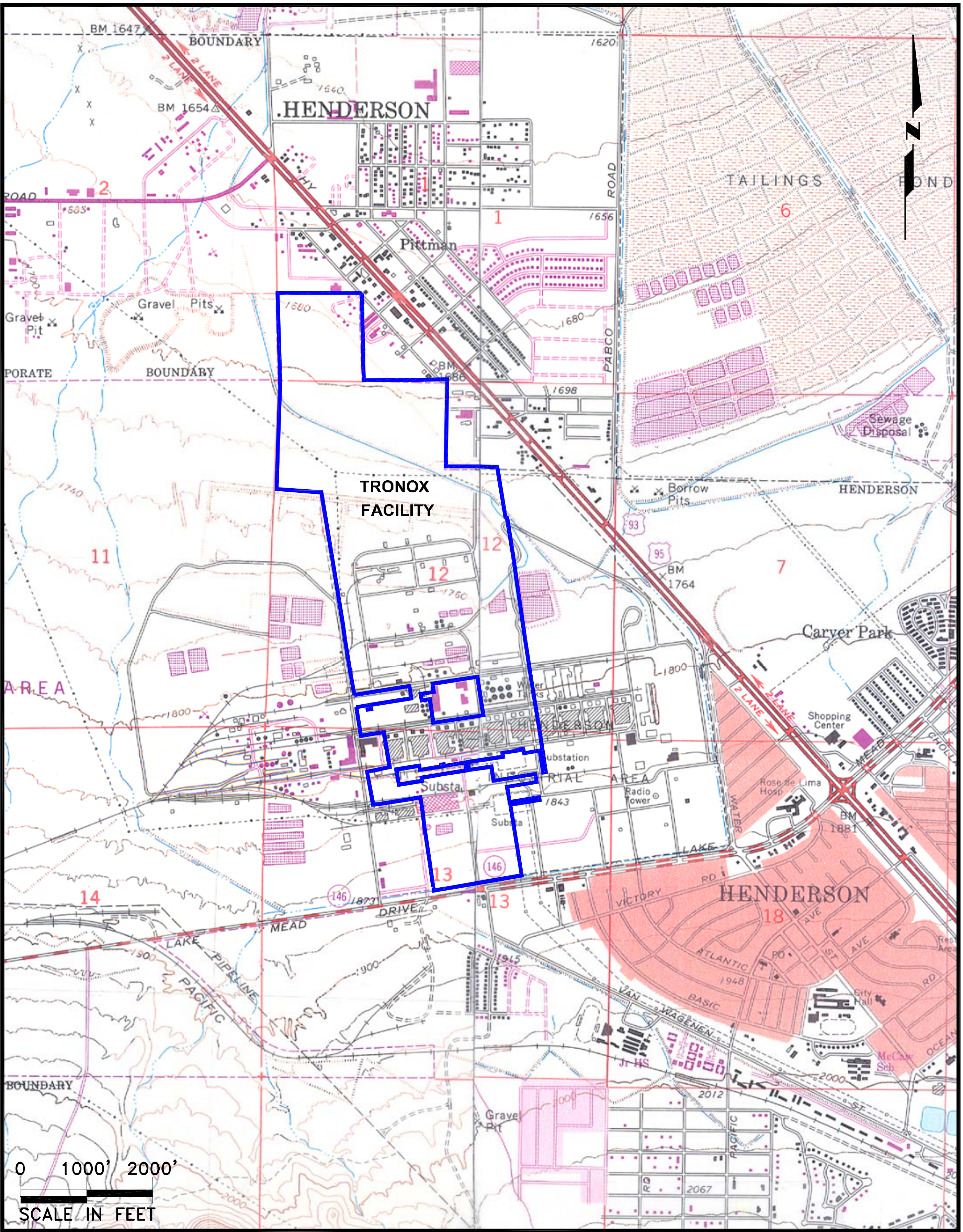
* Includes the metals listed on Table 4.

For samples listing 4-oz. glass jar, one metal sleeve can be substituted.

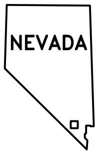
** Three VOA vials preserved with sodium bisulfate and one VOA vial preserved with methanol.

*** TPH includes GRO, DRO, and ORO.

FIGURES



SOURCE: USGS 7.5 Minute Topographic Quadrangle,
Las Vegas SE, Nevada, 1967, Photorevised 1984
Henderson, Nevada, 1970, Photorevised 1983



QUADRANGLE LOCATION

TRONOX

SITE LOCATION MAP

Source Area Investigation
Tronox Facility
Henderson, Nevada

FIGURE NUMBER:
1

DRAWN BY:	DATE:	PROJECT NUMBER:	SHEET NUMBER:
M. Scop	9/18/2006	04020-023-400	

FILENAME: J:\2006 Projects\04020\023-Henderson\151 Upgrad Invest Results\Figures\site location map.dwg

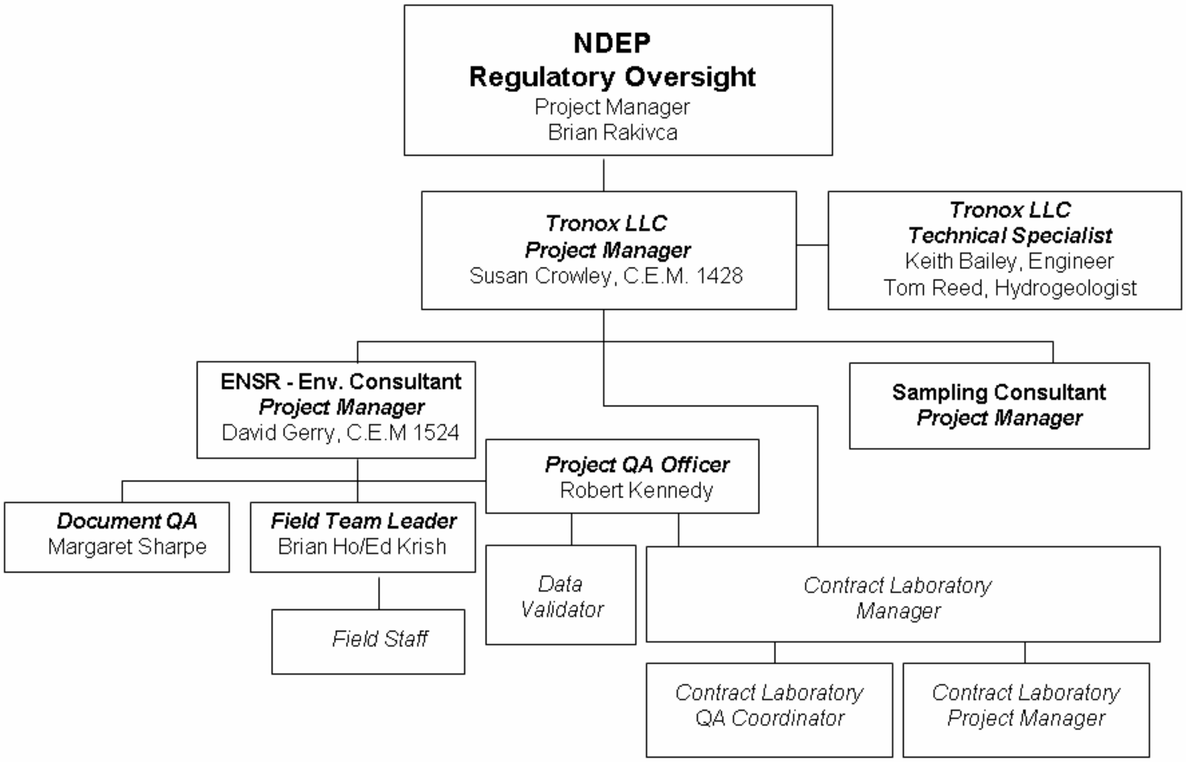


Figure 2 Project Organization Chart

Plates

LOU Number	Name of LOU
1	Trade Effluent Settling Ponds
2	Open Area Due South of "Trade Effluent Disposal Ponds"
3	Air Pollution Emissions Associated with Industrial Processes
4	Hardesty Chemical Company Site (prior to J. B. Kelley Operations)
5	On-Site Portion of Beta Ditch, Including "Small Diversion Ditch" Northwest of Pond C-1
6	Unnamed Drainage Ditch Segment (BMI Landfill)
7	Old P-2 Pond and Associated Conveyance Facilities
8	Old P-3 Pond and Associated Conveyance Facilities
9	New P-2 Pond and Associated Piping
10	On-Site Hazardous Waste Landfill (Closed)
11	Sodium Chlorate Filter Cake Holding Area
12	Hazardous Waste Storage Area
13	Pond S-1
14	Pond P-1, and Associated Conveyance Piping
15	Platinum Drying Unit
16 17	Ponds AP-1, AP-2, and AP-3 and Associated Transfer Lines
18	Pond AP-4
19	Pond AP-5
20	Pond C-1 and Associated Piping
21	Mn-1 and Associated Piping
22	Pond WC-1 and Associated Piping
23	Pond WC-2 and Associate Piping
24	Leach Beds, Associated Conveyance Facilities, and Mn Tailings Area
25	Process Hardware Storage Area
26	Trash Storage Area
27	PCB Storage Area
28	Hazardous Waste Storage Area
29	Solid Waste Dumpster
30	AP Area-Pad 35
31	Drum Recycling Area
32	Ground Water Remediation Unit
33	Sodium Perchlorate Platinum By-Product Filter, Unit 5
34	Former Manganese Tailings Area
35	Truck Emptying/Dumping Site
36	Former Satellite Accumulation Point, Unit 3, Maintenance Shop
37	Former Satellite Accumulation Point, Unit 6, Maintenance Shop
38	Former Satellite Accumulation Point, AP-Laboratory
39	Satellite Accumulation Point-AP Maintenance Shop
40	PCB Transformer Spill
41	Unit 1 Tenant Stains
42	Unit 2 Salt Redler
43	Unit 4 and 5 Basements
44	Unit 6 Basement
45	Diesel Storage Tank
46	Former Old Main Cooling Tower and Recirculation Lines
47	Leach Plant Area Manganese Ore Piles
48	Leach Plant Analyte Tanks
49	Leach Plant Area Sulfuric Acid Storage Tanks
50	Leach Plant Area Leach Tanks
51	Leach Plant Area Transfer Lines
52	AP Plant Area Screening Building, Dryer Building and Associated Sump
53	AP Plant Area Tank Farm
54	AP Plant Area Change House/ Laboratory Septic Tank
55	Area Affected by July 1990 Fire
56	AP Plant Area Old Building D-1- Washdown
57 58	AP Plant Area New Building D-1- Washdown and AP Plant Transfer Lines to Sodium Chlorate Process, AP Plant SI's and Transfer Lines
59	Storm Sewer System
60	Acid Drain System
61	Old Sodium Chlorate Plant Decommissioning
62	State Industries, Inc. Site, Including Impoundments and Catch Basin
63	J. B. Kelley, Inc. Trucking Site
64	Koch Materials Company Site
65	Nevada Precast Concrete Products, Green Ventures International, Buckles Construction Company and Ebony Construction Sites
66	Above-Ground Diesel Storage Tank Leased by Flintkote Co.
67	Delbert Madsen and Estate of Delbert Madsen Site
68	Southern Nevada Auto Parts Site (Pick-a-Part)
69	Dillon Potter Site

LOU = Site identified in letter of understanding dated August 15, 1994

PLATE: 1
POTENTIAL SOURCE AREAS, PROPOSED BORINGS AND GROUNDWATER SAMPLE LOCATIONS

TRONOX FACILITY
HENDERSON, NEVADA

SA-9 ● PROPOSED SOURCE AREA INVESTIGATION BORING
△ WELL TO BE SAMPLED FOR SOURCE AREA INVESTIGATION
☐ GROUNDWATER GRAB SAMPLE
● GROUNDWATER MONITOR WELL
M77 WELL IDENTIFICATION
▲ RECOVERY WELL
KERR–McGEE PROPERTY BOUNDARY
NEIGHBORING PROPERTY LINES
BETA DITCH
RAILROAD TRACKS
▨ POTENTIAL SOURCE AREA (HATCHERED WHERE AREA IS LESS DEFINED)

0 300' 600' 900'
1 INCH = 300 FEET
N

SEPTEMBER 2006

Sampling Plan.dwg

APPENDIX A
Tronox and Regulatory Correspondence

KERR-McGEE CHEMICAL LLC

Susan Crowley
Staff Environmental Specialist

(702) 651-2234
Fax (405) 228-6882
scrowley@kmg.com

September 30, 2005

Mr. Brian Rakvica, P.E.
Nevada Division of Environmental Protection
1771 East Flamingo, Suite 121-A
Las Vegas, NV 89119-0837

Subject: NDEP Facility ID H-000539 – Kerr-McGee ECA – *Source Area Evaluation Work Plan Conceptual Apporach*

Dear Mr. Rakvica:

Kerr-McGee Chemical LLC (Kerr-McGee) has undertaken an Environmental Conditions Assessment (ECA) as directed by Nevada Division of Environmental Protection (NDEP). An element of this ECA is the development of a *Conceptual Site Model,* CSM, for the facility. Preparation of this document has illuminated data gaps and while the CSM is not yet complete and approved by NDEP, Kerr-McGee has discussed with NDEP a conceptual approach for filling these data gaps. The attachment summarizes that approach.

Feel free to call me at (702) 651-2234 if you have any questions regarding this correspondence. Thank you.

Sincerely,

SMCrowley

Susan Crowley
Staff Environmental Specialist, CEM 1428

Hand Carried

CC:
Barry Conaty, COH
Todd Croft, NDEP
Jeff Johnson, NDEP
Mitch Kaplan, EPA Region IX
Val King, NDEP
Jim Najima, NDEP
Jon Palm, NDEP
Brenda Pohlmann, COH

Ron Sahu, BMI
Carrie Stowers, CCCP
Paul Sundberg, Montrose
Al Tinney, NDEP
Craig Wilkinson, TIMET
Keith Bailey, Kerr-McGee
Sally Bilodeau, ENSR
Pat Corbett, Kerr-McGee
John Dixon, Kerr-McGee
Dave Gerry, ENSR
Ed Krish, ENSR
Tom Reed, Kerr-McGee
Don Shandy, Kerr-McGee
Rick Stater, Kerr-McGee
Public Repository

Attachment

smc/KM to NDEP - Delivery of Source Area Work Plan Conceptual Approach - Sept 05.doc

Ron Sahu, BMI
Carrie Stowers, CCCP
Paul Sundberg, Montrose
Al Tinney, NDEP
Craig Wilkinson, TIMET
Keith Bailey, Kerr-McGee
Sally Bilodeau, ENSR
Pat Corbett, Kerr-McGee
John Dixon, Kerr-McGee
Dave Gerry, ENSR
Ed Krish, ENSR
Tom Reed, Kerr-McGee
Don Shandy, Kerr-McGee
Rick Stater, Kerr-McGee
Public Repository

Attachment

smc/KM to NDEP - Delivery of Source Area Work Plan Conceptual Approach - Sept 05.doc

Kerr-McGee Henderson Source Area
Workplan Conceptual Approach
September 30, 2005

As requested by NDEP characterization of the site will be approached as a whole rather than as separate, individual LOU areas. There will, however, be some issues that are LOU specific and these will be addressed individually as needed. A phased approach is planned and to avoid confusion with the previous Phase I and II investigations that have been completed; Phase A, B and C terminology has been used.

Phase A: **Initial Assessment of Site Related Chemicals in Soil and Groundwater**

The objective of Phase A is to determine how many of the site-related chemicals (SRCs) are actually present on-site and to start the screening process to select SRCs applicable to future sampling efforts and to support the selection of chemicals of potential concern (COPCs).

Soil borings (approximately 10) will be drilled to the water table (about 25 to 45 feet below ground surface). Three, discrete soil samples per boring will be collected; at the surface, 10 feet and at approximately 30 feet below ground surface (specifically just above the water table). These samples will be analyzed to assess the presence or absence of the full suite of SRCs. Locations will be selected to represent areas with the greatest potential for impact as well as a few areas expected to have no or low levels of impact. The purpose of sampling areas of low or no expected impact is to achieve low detection levels of the SRCs (and evaluate any matrix effects) and to document if the area does or does not exhibit soil impacts. In addition, a set existing groundwater wells (or groups of wells) will be identified to be sampled for the entire suite of SRC. Again, these will be sited to review areas of greatest potential impact.

Phase B: Develop a series of East-West chemical cross sections to define general site-wide vadose zone impacts and to refine the COPC list

The objective of Phase B is to continue to develop the data needed to support the selection of the COPCs and to compile a generalized site-wide chemical profile of the vadose zone. We will add to the data collected in Phase A by drilling additional boreholes along four east-west traverses that extend across the width of the KM property. For example, the cross section lines could be:

1) Immediately south of Avenue G
2) Through the P-2 Ponds area
3) Immediately south of Beta Ditch
4) Immediately north of WC-1 and GW-11

This sampling effort will be limited to the SRCs that were recognized as significant during the Phase A screening. It will develop additional data to support the selection of COPCs, support area evaluations and identify which source areas need additional investigation under Phase C.

Phase C: Define individual source areas, collect samples as needed to fill data gaps regarding nature and extent of specific chemical impacts

The objective of Phase C is to focus the sample collection efforts on suspected source areas identified during Phase A and B and to refine the understanding of the extent of impacts. This sampling effort will develop the data to complete identification of COPCs, support the source area evaluations (e.g. risk assessments) and assist in the initial identification and screening of remedial alternatives, if appropriate. In this Phase it is anticipated that some individual LOUs (or groups of LOUs) will be evaluated as potential source areas and if impacts are confirmed, step out borings will be drilled to determine the extent of impact.

LEO DROZDOFF, *Administrator*

(775) 687-4670

Administration
Facsimile 687-5856

Water Quality Planning
Water Pollution Control
Facsimile 687-4684

Mining Regulations and Reclamation
Facsimile 684-5259

Las Vegas Office
Facsimile (702) 486-2863

STATE OF NEVADA
KENNY C. GUINN
Governor

ALLEN BIAGGI, *Director*

Air Pollution Control
Air Quality Planning
Facsimile 687-6396

Waste Management
Facsimile 687-6396

Corrective Actions
Facsimile 687-8335

Federal Facilities
Facsimile (702) 486-2863

Webpage http://ndep.nv.gov

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
Las Vegas Office
1771 East Flamingo Road, Suite 121-A
Las Vegas, Nevada 89119-0837
(702) 486-2850

OCT - 6 2005

October 3, 2005

Ms. Susan Crowley
Kerr-McGee Chemical LLC
PO Box 55
Henderson, Nevada 89009

Re: **Kerr-McGee Chemical Corporation LLC (KM)**
NDEP Facility ID #H-000539
Nevada Division of Environmental Protection Response to:
Source Area Evaluation Work Plan Conceptual Approach
dated September 30, 2005

Dear Ms. Crowley,

The NDEP has received and reviewed KM's letter identified above and provides comments below.

1. The NDEP agrees with KM's approach, in concept. Please note that the NDEP may have comments on the individual work plans as they are submitted.
2. Phase A, please note that the NDEP may request that additional borings be completed as part of this round of investigation. KM proposes to screen some chemicals from future analysis between Phases A and B. The NDEP agrees with this approach (in concept), however, KM should note that the NDEP reserves the right to request additional analysis in the future. These requests may be due to the discovery of new or additional information; refinement of the site-wide conceptual site model; findings on an adjacent property or for other reasons not contemplated herein.
3. Phase B, KM should also consider developing cross-sections upgradient of the Unit Buildings and at the northern property boundary.

The NDEP requests that these issues be considered in the development of the future work plans. Please provide a schedule for the submittals of the Phase A Investigation Work Plan

by October 21, 2005. If there is anything further or if there are any questions please do not hesitate to contact me.

Sincerely,

Brian A. Rakvica, P.E.
Staff Engineer III
Bureau of Corrective Actions
NDEP-Las Vegas Office

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

NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION

Kenny C. Guinn, Governor
Allen Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

March 11, 2006

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

Re: **Tronox LLC (Trx)**
NDEP Facility ID #H-000539
Nevada Division of Environmental Protection Response to:
Phase A Source Area Investigation Work Plan
dated February 2006

Dear Ms. Crowley,

The NDEP has received and reviewed Trx's letter identified above and provides comments in Attachment A.

These comments should be addressed in a meeting or telephone call for expediency. Please provide a revised submittal following resolution of the comments. If there are any questions please do not hesitate to contact me.

Sincerely,

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

CC: Jim Najima, NDEP, BCA, Carson City
Jeff Johnson, NDEP, BCA, Carson City
Shannon Harbour, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Barry Conaty, Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1333 New Hampshire Avenue, N.W., Washington, D.C. 20036
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
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Lee Erickson, Stauffer Management Company, 400 Ridge Rd., Golden, CO 80403
Chris Sylvia, Pioneer Americas LLC, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 3846 Estate Drive, Stockton, California 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110

Attachment A

1. It appears that the tone and purpose of the work plan has evolved. Based on the September 30, 2005 letter from Kerr-McGee to the NDEP the purpose of the Phase A work plan was as follows: "to determine how many of the site-related chemicals (SRCs) are actually present on-site and to ***start*** the screening process to select SRCs applicable to future sampling efforts and ***support*** the selection of chemicals of potential concern (COPCs)." Please note that bolding, and italicizing have been added for emphasis (above and below). In the February 2006 work plan, executive summary, page ES-1, Trx states "The activties covered by this work plan…is intended to evaluate the presence or absence of site-related chemicals (SRCs) in areas of highest potential impacts. Further it is intended to support the selection of constituents of potential concern (COPC)." Section 1.0, page 1-1 goes on to stated "this investigation is to assess which SRCs are present or absent at the Site and to identify which of the SRCs would be applicable in future sampling efforts." The NDEP would like to provide the following clarification regarding it's understanding:
    a. Data will be collected in such a manner that it is useful for the selection of COPC selection, however, this work plan *alone* will not support the selection of COPCs.
    b. Additional characterization of the site based on the SRC list may be required after Phase A.
    c. Eight borings and three monitoring wells are not likely to be sufficient to support COPC selection. Additional discussion between the NDEP's risk assessment team and Trx's risk assessment team is likely warranted.
    d. Additional investigation in the soils below the water table and groundwater in the deeper zones of the Muddy creek Formation are likely to be necessary.
2. Executive Summary, page ES-1, the same text is repeated twice in the section starting with the words "The activties covered by this work plan…" In the future, please complete a more rigorous QA/QC process prior to submittal.
3. Section 3.1, page 3-1, the NDEP has the following comments:
    a. Without lithologic cross-sections (showing water table elevations as well as lithologic details) it is not possible for the NDEP to determine if the proposed sampling intervals are adequate. It is suggested that samples be taken every 10' to the water table.
    b. The NDEP is not opposed to groundwater samples being taken from the east and west interceptor well galleries, however, it should be noted that this procedure will mask the high and low concentrations within each well. It is likely that this data will not be useful for COPC selection. Trx may need to consider installation of additional groundwater monitoring wells on the plant site area once the results of the soil analysis are complete.
4. Section 3.3, page 3-3, please note that PCBs are not pesticides.
5. Section 3.3, page 3-3, Trx states "it is anticipated that once the soil and groundwater data are developed, many SRCs and portions of the associated broad suite constituent analysis can be eliminated from future sampling programs." As stated above, the NDEP does not concur.

6. Table 3, please note that the NDEP does not warrant the applicability of the information presented on this table as it is the responsibility of the project CEM.
    a. Please note that asbestos appears to be missing from this table.
    b. Ethylene glycol could be combined with the "Fuel Alcohols" line item
    c. The listing of metals is incomplete versus the presentation on Table 4. For example, silicon, tin, thallium, etc.
7. Tables 4 and 7, it was the NDEP's understanding that this table represents the full list of analytes related to the SRC list. If not, Trx should develop a supplemental list of SRCs that are not proposed for analysis (with justification) and provide this to the NDEP. It is not clear to the NDEP what is intended.
    a. Radionuclides that are proposed to be back quantitated are not presented.
    b. Please discuss if asbestos is proposed to be addressed by the elutriator method or an alternative method.
    c. It is noted that semi-volatile organic compound (SVOC) analysis is proposed but polycyclic aromatic hydrocarbon (PAH) analysis is not. It is noted that the SVOC analysis will not provide adequate detection limits, please include PAH analysis.
    d. Please note that there are some sorting errors on table 4 with regards to alphabetical order.
    e. It has been reported by others that 1,4-dioxane can be analyzed and detected at a sufficiently low level via method 8270 analysis. Please discus this issue with your laboratories and add 1,4-dioxane to the list of analytes, if appropriate.
    f. Table 4, chlorobenzol (as listed on the SRC list, and monochlorobenzene as duplicated on the SRC list) appears to be missing from this table. Please verify that the compound names listed on the SRC list are consistently used in future documents. If synonyms are used a cross-reference should be included. For example, methyl isobutyl ketone and orthodichlorobenzene.
    g. It appears that some of the questions regarding methodology that were evident in the SRC list have been addressed. The NDEP requests that an updated SRC List be provided under separate cover.
8. Table 5, the NDEP has the following comments:
    a. None of the superscripts on this table are defined.
9. Table 6, please note that the NDEP does not warrant the applicability of the information presented on this table as it is the responsibility of the project CEM.
10. Plate 1, the NDEP has the following comments:
    a. Based on Plate 6 of the Trx Conceptual Site Model (CSM) dated February 2005, it appears that boring SA-1 should be located further north. In addition, based on the number of letter of understanding (LOU) areas in the vicinity, it appears that a boring is warranted on the north side of each unit building (units 1 through 6). The specific location of each of these borings should be coordinated between Plate 6 of the CSM and site knowledge.
    b. It would be helpful if the LOU areas from Plate 6 of the CSM were shown on this figure.

c. It is the belief of the NDEP that additional borings are warranted to address the former manganese tailings area, LOU #34, various locations.
d. It is the belief of the NDEP that additional borings are warranted to address ponds C-1 and Mn-1, LOUs #20 and 21, respectively. It is suggested that an additional boring be placed downgradient of these ponds.
e. It is the belief of the NDEP that additional borings are warranted to address ponds AP-1, AP-2, AP-3, and AP-4, LOUs #16, 17 and 18.
f. It is the belief of the NDEP that additional borings are warranted to address ponds WC-1 and WC-2, LOUs # 22 and 23, respectively.
g. It is the belief of the NDEP that additional borings are warranted to address the historic trade effluent settling ponds, LOU #1. It is suggested that a boring be placed downgradient of existing pond GW-11.
h. It is the belief of the NDEP that additional borings are warranted to address ponds P-2 and S-1, LOUs #9 and 13, respectively.
i. It is the belief of the NDEP that additional borings are warranted to address the historic hazardous waste landfill, LOU #10.
j. It is the belief of the NDEP that additional borings are warranted to address the Beta Ditch, Northwest Drainage Ditch and Mystery Ditch.
k. It is likely that additional borings are warranted in the future to address other LOU areas, potential source areas and deeper soils (below the water table).
l. Per the NDEP's previous comments on the *Upgradient Work Plan*, the NDEP requests that samples be collected in the storm ditch upgradient of the plant site area.

TRONOX

Susan Crowley
Staff Environmental Specialist

(702) 651-2234
Fax (405) 302-4607
susan.crowley@tronox.com

September 27, 2006

Mr. Brian Rakvica, P.E.
Nevada Division of Environmental Protection
1771 East Flamingo, Suite 121-A
Las Vegas, NV 89119-0837

Subject: NDEP Facility ID H-000539 – Response to NDEP March 11, 2006 Comments Regarding the Tronox February 2006 *Phase A Source Area Investigation Work Plan*

Dear Mr. Rakvica:

Tronox LLC (Tronox) has undertaken an Environmental Conditions Assessment (ECA) as directed by Nevada Division of Environmental Protection (NDEP). Towards characterization of on-site conditions, Tronox submitted a *Phase A Source Area Investigation Work Plan* (Work Plan) to NDEP in February 2006. NDEP provided comments regarding the Work Plan on March 11, 2006 and the document has been revised to reflect our response to the NDEP comments. Under separate cover, the revised Work Plan will be submitted to your office by October 2, 2006. However, included with this correspondence is Attachment A, which consolidates Tronox's responses, organized in order of the NDEP comments.

Feel free to call either Keith Bailey (405) 775-6526 or me at (702) 651-2234 if you have any questions regarding this correspondence. Thank you.

Sincerely,

SMCrowley

Susan Crowley
Staff Environmental Specialist, CEM 1428 exp 3-8-07

Overnight Mail

CC: See Attached Distribution List

smc/Trx to NDEP - 9-28-06 re Delivery of SA Phase A Work Plan RTC.doc

Tronox Document Distribution List Updated: 26-Sep-06

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Palm	Jon	NDEP		X	
Pohlmann	Brenda	COH		X	
Conaty	Barry	COH Counsel		X	
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Reed	Tom	Tronox	X	X	
Ellington	Toni	Tronox Counsel		X	
Stater	Rick	Tronox		X	
Crowley	Susan	Tronox	2	2	
			& Hard Data		
Krish	Ed	ENSR	X	X	
Bilodeau	Sally	ENSR	X	X	
Gerry	Dave	ENSR		X	
Lambeth	Jeff	Veolia			
Cheung	Mary	Veolia			
Guerriero	Joe	AIG		X	
Giroux	Barry	GEI		X	
Stowers	Kirk	Broadbent			
Quillian	Jill	ERM			
Sahu	Rahnijit	BMI		X	
Crouse	George	Syngenta		X	
Erickson	Lee	Stauffer		X	
Kelly	Joe	Montrose			
Sundberg	Paul	Montrose		X	
Gibson	Jeff	AmPac			
Sylvia	Chris	Pioneer		X	
Wilkinson	Craig	Timet		X	
Mack	Joel	Montrose Counsel			

Attachment A
Tronox Response to NDEP March 11, 2006 Comments on Source Area Investigation Workplan dated February 23, 2006

NDEP Comment

1. It appears that the tone and purpose of the work plan has evolved. Based on the September 30, 2005 letter from Kerr-McGee to the NDEP the purpose of the Phase A work plan was as follows: "to determine how many of the site-related chemicals (SRCs) are actually present on-site and to ***start*** the screening process to select SRCs applicable to future sampling efforts and ***support*** the selection of chemicals of potential concern (COPCs)." Please note that bolding, and italicizing have been added for emphasis (above and below). In the February 2006 work plan, executive summary, page ES-1, Trx states "The activities covered by this work plan...is intended to evaluate the presence or absence of site-related chemicals (SRCs) in areas of highest potential impacts. Further it is intended to support the selection of constituents of potential concern (COPC)." Section 1.0, page 1-1 goes on to stated "this investigation is to assess which SRCs are present or absent at the Site and to identify which of the SRCs would be applicable in future sampling efforts." The NDEP would like to provide the following clarification regarding it's understanding:
    a. Data will be collected in such a manner that it is useful for the selection of COPC selection, however, this work plan *alone* will not support the selection of COPCs.
    b. Additional characterization of the site based on the SRC list may be required after Phase A.
    c. Eight borings and three monitoring wells are not likely to be sufficient to support COPC selection. Additional discussion between the NDEP's risk assessment team and Trx's risk assessment team is likely warranted.
    d. Additional investigation in the soils below the water table and groundwater in the deeper zones of the Muddy creek Formation are likely to be necessary.

Response

1 a. The scope of the Phase A work has been expanded and the text modified.
1 b. The Phase B investigation is specifically for additional characterization.
1 c. Tronox has met with the NDEP and based upon discussions with NDEP, have revised the Work Plan to include 27 Phase A boring locations
1 d. At this time, the Phase A Source Area Investigation will not include soil samples collected below the water table, however, Tronox understands that the NDEP is interested In this information.

NDEP Comment

2. Executive Summary, page ES-1, the same text is repeated twice in the section starting with the words "The activities covered by this work plan..." In the future, please complete a more rigorous QA/QC process prior to submittal.

Response

The text will be corrected and checked more thoroughly in the future.

NDEP Comment

3. Section 3.1, page 3-1, the NDEP has the following comments:
    a. Without lithologic cross-sections (showing water table elevations as well as lithologic details) it is not possible for the NDEP to determine if the proposed sampling intervals are adequate. It is suggested that samples be taken every 10' to the water table.
    b. The NDEP is not opposed to groundwater samples being taken from the east and west interceptor well galleries, however, it should be noted that this procedure will mask the high and low concentrations within each well. It is likely that this data will not be useful for COPC selection. Trx may need to consider installation of additional groundwater monitoring wells on the plant site area once the results of the soil analysis are complete.

Response

3 a. Samples will be collected every 10 feet to the water table.
3 b. The plan will be revised to collect water from individual wells as opposed to the well galleries. Tronox understands that additional wells may be necessary in the future. Tronox is also evaluating if some wells should be removed from the monitoring program.

NDEP Comment

4. Section 3.3, page 3-3, please note that PCBs are not pesticides.

Response

4. PCBs will be discussed separately from pesticides.

NDEP Comment

5. Section 3.3, page 3-3, Trx states "it is anticipated that once the soil and groundwater data are developed, many SRCs and portions of the associated broad suite constituent analysis can be eliminated from future sampling programs." As stated above, the NDEP does not concur.

Response

5. Comment noted and the sentence will be revised.

NDEP Comment

6. Table 3, please note that the NDEP does not warrant the applicability of the information presented on this table as it is the responsibility of the project CEM.
    a. Please note that asbestos appears to be missing from this table.
    b. Ethylene glycol could be combined with the "Fuel Alcohols" line item
    c. The listing of metals is incomplete versus the presentation on Table 4. For example, silicon, tin, thallium, etc.

Response

6. Comment noted and the tables will be revised.

NDEP Comment

7. Tables 4 and 7, it was the NDEP's understanding that this table represents the full list of analytes related to the SRC list. If not, Trx should develop a supplemental list of SRCs that are not proposed for analysis (with justification) and provide this to the NDEP. It is not clear to the NDEP what is intended.

a. Radionuclides that are proposed to be back quantitated are not presented.
b. Please discuss if asbestos is proposed to be addressed by the elutriator method or an alternative method.
c. It is noted that semi-volatile organic compound (SVOC) analysis is proposed but polycyclic aromatic hydrocarbon (PAH) analysis is not. It is noted that the SVOC analysis will not provide adequate detection limits, please include PAH analysis.
d. Please note that there are some sorting errors on table 4 with regards to alphabetical order.
e. It has been reported by others that 1,4-dioxane can be analyzed and detected at a sufficiently low level via method 8270 analysis. Please discus this issue with your laboratories and add 1,4-dioxane to the list of analytes, if appropriate.
f. Table 4, chlorobenzol (as listed on the SRC list, and monochlorobenzene as duplicated on the SRC list) appears to be missing from this table. Please verify that the compound names listed on the SRC list are consistently used in future documents. If synonyms are used a cross-reference should be included. For example, methyl isobutyl ketone and orthodichlorobenzene.
g. It appears that some of the questions regarding methodology that were evident in the SRC list have been addressed. The NDEP requests that an updated SRC List be provided under separate cover.

Response

7 a. Consistent with discussions with the NDEP, the current proposal is to analyze 100% of soil and water samples with gamma spec reporting for Ra^{226} *and* Ra^{228} *and to analyze 10% of samples with alpha spec reporting for* Th^{232}, Th^{230}, U^{238}, U^{235}, *and* U^{234}. *These data will be used to demonstrate secular equilibrium/calibration.*

7 b. Asbestos is intended to be analyzed by the elutriator method, however a chosen lab has not yet been selected and an alternative method may be proposed in the Phase A Source Area Work Plan to be submitted by October 2nd, 2006 if the elutriator method is not available at a reasonable cost.

7 c. SVOCs which are not SRCs or SRC related have been eliminated from the analyte list as discussed with NDEP. The frequency of SIM analysis for PAHs and hexachlorobenzene has been reduced to 10% of the total samples analyzed for SVOCs and should still maintain sufficient sensitivity to detect these SIM analytes in appropriate LOUs. The dichlorobenzenes were eliminated from the SVOC list because they are duplicated in the VOC analyte list.

7 d. The table has been sorted alphabetically.

7 e. 1,4-dioxane has been added.

7 f. Table 4 will be modified

7 g. An updated SRC list is included in the Phase A Source Area Investigation Work Plan as Table 7

NDEP Comment

8. Table 5, the NDEP has the following comments:
   a. None of the superscripts on this table are defined.

Response

8 a. The table will be revised.

NDEP Comment

9. Table 6, please note that the NDEP does not warrant the applicability of the information presented on this table as it is the responsibility of the project CEM.

Response

9. Tronox understands that the content, accuracy and execution of the work plan is their responsibility.

NDEP Comment

10. Plate 1, the NDEP has the following comments:
    a. Based on Plate 6 of the Trx Conceptual Site Model (CSM) dated February 2005, it appears that boring SA-1 should be located further north. In addition, based on the number of letter of understanding (LOU) areas in the vicinity, it appears that a boring is warranted on the north side of each unit building (units 1 through 6). The specific location of each of these borings should be coordinated between Plate 6 of the CSM and site knowledge.
    b. It would be helpful if the LOU areas from Plate 6 of the CSM were shown on this figure.
    c. It is the belief of the NDEP that additional borings are warranted to address the former manganese tailings area, LOU #34, various locations.
    d. It is the belief of the NDEP that additional borings are warranted to address ponds C-1 and Mn-1, LOUs #20 and 21, respectively. It is suggested that an additional boring be placed downgradient of these ponds.
    e. It is the belief of the NDEP that additional borings are warranted to address ponds AP-1, AP-2, AP-3, and AP-4, LOUs #16, 17 and 18.
    f. It is the belief of the NDEP that additional borings are warranted to address ponds WC-1 and WC-2, LOUs # 22 and 23, respectively.
    g. It is the belief of the NDEP that additional borings are warranted to address the historic trade effluent settling ponds, LOU #1. It is suggested that a boring be placed downgradient of existing pond GW-11.
    h. It is the belief of the NDEP that additional borings are warranted to address ponds P-2 and S-1, LOUs #9 and 13, respectively.
    i. It is the belief of the NDEP that additional borings are warranted to address the historic hazardous waste landfill, LOU #10.
    j. It is the belief of the NDEP that additional borings are warranted to address the Beta Ditch, Northwest Drainage Ditch and Mystery Ditch.
    k. It is likely that additional borings are warranted in the future to address other LOU areas, potential source areas and deeper soils (below the water table).
    l. Per the NDEP's previous comments on the *Upgradient Work Plan*, the NDEP requests that samples be collected in the storm ditch upgradient of the plant site area.

Response

10 a. The boring locations will be adjusted as discussed in meetings with the NDEP.
10 b. Plate 1 has been revised to include the LOU areas.

10 c through l. Comments are noted. Tronox has significantly revised the boring locations and sampling intervals. Twenty seven boring locations will be sampled in Phase A. Tronox also plans to address additional sampling during the Phase B Source Area Investigation.

APPENDIX B
Health and Safety Plan

Health and Safety Plan for
Well Installation and Subsurface Investigation of Soils and Groundwater
Tronox LLC
Henderson, Nevada

John Shepard

Prepared by John Shepard, CSP______________ Date: December 3, 2004
ENSR Regional Health and Safety Manager
Rev #1: April 7, 2005
Rev #2 Jan 23, 2006

Approved by: ________________ Date: ______1/23/06___
ENSR Project Manager

Accepted by: ______________________________ Date: ________________
Tronox LLC

Project Number 04020-023

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ATTACHMENTS

EXECUTIVE SUMMARY

Emergency References

For Well Installation and Subsurface Investigation, Tronox LLC, Henderson Nevada

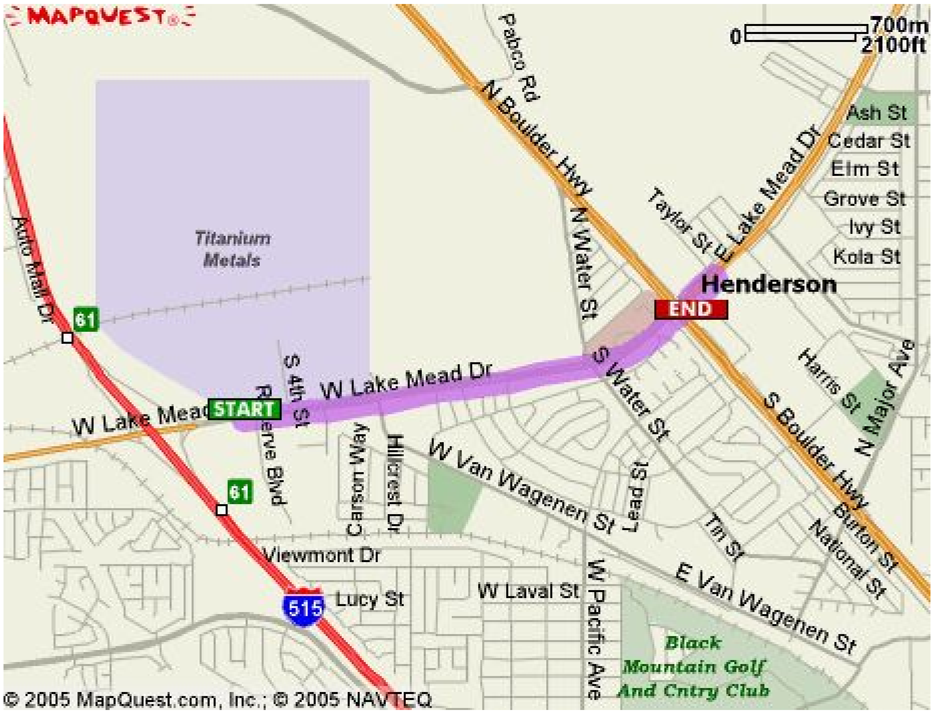
Ambulance:	911
Fire:	911
Police:	911

Medical Services:

St Rose Dominican Hospital	(702) 564-2622 or (702) 616-4560

102 E Lake Mead Pkwy, Henderson, NV 89015

	Directions	Miles
1.	Start out going EAST on **W LAKE MEAD PKWY/NV-146** toward RESERVE BLVD. Continue to follow W LAKE MEAD PKWY.	1.7
2.	Turn left into entrance of **St Rose Dominican Hospital**	0.0
3.	End at **St Rose Dominican Hospital**	0.0



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Tronox Contractor Safety

On-site work shall be performed consistent with the current Tronox Kerr-McGee Contractor's Safety Handbook and Contractor's Safety Orientation handout. Complete copies of these documents are provided in Attachment F. On-site training is required for each contractor. Safety training is held the first and third Wednesday of each month. For information on training contact Laren Luna at 702 651-2308. The contractors' safety checklist shall be completed and signed by ENSR, each subcontractor and Tronox before commencement of work. A sample of this form is in Attachment F.

Emergency Muster Point

In case of a site/facility emergency, please meet at the closest evacuation meeting place to your location (Figure F-1). There are six evacuation meeting places:

Back gate,
West of the Lab and Change House,
South of Unit 6,
West of the Administration Building,
At the intersection of the plant driveway and Lake Mead Parkway and
at the Timet Ball Field.

The escape route from the site and an emergency muster point will be determined and provided to all workers during the project mobilization.

Underground Utility Location Service:

DIG SAFE SYSTEM, INC.
Center # 1-888-DIG-SAFE (1-888-344-7233)

CLIENT CONTACTS:

	Office	Cell
Susan Crowley, Project Manager	702 651-2234	702 592-7727
Karen Luna, Tronox Safety Officer	702 651-2308	
Rick Stater, Tronox Plant Manager	702 651- 2200	
Keith Bailey, Corporate Contact	405-270-2665	405-203-8694

ENSR Project Representatives:

Ed Krish, ENSR	405-760-5777 (cell)
Brian Ho, ENSR	805-338-3775 X 233
John Shepard, Regional Health and Safety Manager (RHSM)	972-509-7644
Joe Sanders (alternate RHSM)	970-493-8878
ENSR/PM (Dave Gerry)	805-338-3775 X 244

Hazard Assessment

Chemical Hazards - Perchlorate Compounds

Common salts of perchloric acid are moderately toxic by ingestion and intraperitoneal routes. As a dry compound perchlorates are powerful oxidizers forming explosive mixtures with acetone, 1,3-butylene glycol, 2,3-butylene glycol, CaH2, charcoal, diaminoethane, dimethyl formamide, ethanolamine, ethylene glycol, formamide, galactose, glycerin, hydrazine, water, NH4NO3, Mg, reducing agents, SrH2, urea. When heated to decomposition it emits toxic fumes of Cl^{-} and Na2O.

Dilute solutions in water should be considered mildly toxic and a minor skin irritant.

Other Chemical Hazards

Chemical Name	PEL[1]	TLV[2]	VP[3]	VD[4]	SG[5]	SOL[6]	FP[7]	LEL[8]	UEL[9]
Inorganic Arsenic	0.01	0.002	NA	NA	?	?	NA	NA	NA
Boron as B_2O_3	15	10	NA	NA	2.5	3	NA	NA	NA
Diborane	0.1	0.1	>1000	0.96	NA	reacts	-130	0.8	88
Chromium	1	0.5	NA	NA	7.2	NA	NA	NA	NA
Manganese Compounds	5 (C)	0.2	NA	NA	NA	<1	NA	NA	NA
Vanadium as V_2O_5	0.5 (C)	0.05	NA	NA	3.4	<1	NA	NA	NA
Petroleum Hydrocarbons	NA	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Organic Compounds	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radionuclides	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorate Compounds	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1] Permissible Exposure Limit in mg/m^3
[2] Threshold Limit Value in mg/m^3
[3] Vapor Pressure in mm Hg
[4] Vapor Density (air = 1)
[5] Specific Gravity (water = 1)
[6] Solubility in Water in %
[7] Flash Point in °F
[8] Lower Explosive Limit in % by volume
[9] Upper Explosive Limit in % by volume
NA = Not Applicable
? = Not known

Physical Hazards

Dust
Falling objects
Flying objects
Heat
Lifting
Noise
Overhead utilities
Radionuclides
Rotating equipment
Traffic
Tripping
Underground utilities

Personal Protective Equipment

PPE Item	General	Drilling	Sample Collection
Hard Hat	1 & 2	✓	1 & 2
Traffic Vests	2	2	2
Steel Toed Safety Shoes	1	✓	✓
Safety Glasses with Sideshields	1	✓	✓
Hearing Protection		✓	3
PVC or Nitrile Gloves		4	✓
Sun Screen	✓	✓	✓

✓ Required PPE

1 All employees must comply with Tronox safety requirements.

2 Traffic vests and hardhats are required within twenty feet of any public road or any private road with active traffic.

3 Hearing protection should be worn soil boring equipment if normal conversation cannot be understood.

4 Note that chemical resistant gloves are only required of those that are likely to come in direct contact with potentially contaminated soils and/or groundwater.

Respiratory Protection

Respiratory protection (half or full face mask respirator with combination organic vapor/HEPA cartridges) should also be donned if odors become objectionable at any time or if respiratory tract irritation is noticed.

Note: Tronox has additional respirator requirements for work conducted on site. These are provided in Attachment F.

I, John Shepard certify that this hazard assessment and evaluation was performed on January 23, 2006.

1.0 INTRODUCTION

1.1 HASP Applicability

This site-specific Health and Safety Plan (HASP) has been developed by ENSR to establish the health and safety procedures required to minimize any potential risk to ENSR and contractor personnel involved subsurface investigations for Tronox in Henderson, Nevada.

The provisions of this plan apply to all ENSR personnel and ENSR subcontractor personnel who may potentially be exposed to safety and/or health hazards related to activities described in Section 2 and 3 of this document.

This HASP has been written to comply with the requirements of the Occupational Safety and Health Administration (OSHA) Personal Protective Equipment Standard (29 CFR 1910.132) for all activities and the OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) for tasks where there are potential exposures to subsurface contaminants. All activities covered by this HASP must be conducted in complete compliance with this HASP and with all applicable federal, state, and local health and safety regulations. Personnel covered by this HASP who cannot or will not comply will be excluded from site activities.

This plan will be distributed to each employee involved with investigation activity at the Site. Each employee must sign a copy of the attached health and safety plan sign-off sheet (see Attachment A).

This HASP only pertains to the tasks, which are listed in Section 3.0. A task specific HASP or addenda to this HASP will be developed at a later date for any other subsequent investigative/remedial activities at the Site.

1.2 Organization/Responsibilities

The implementation of health and safety at the Site will be the shared responsibility of the ENSR Project Manager (PM), the ENSR Regional Health and Safety Manager (RHSM), the ENSR Project Site Safety Officer (SSO) and other ENSR and contractor personnel.

1.2.1 ENSR Project Manager

The ENSR PM (Dave Gerry) is the individual who has the primary responsibility for the overall health and safety of this project. The PM therefore has the primary responsibility for implementing of the requirements of this HASP. Some of the PM's specific responsibilities include:

- Providing the RHSM with updated data regarding the types and extent of contamination at the Site;
- Assuring that all personnel to whom this HASP applies have received a copy and have submitted a completed copy of the HASP sign-off form;
- Assuring that all ENSR and subcontractor personnel submit documentation of the medical surveillance and training requirements specified in Section 10 of this HASP;
- Assuring that all personnel to whom this HASP applies have attended a pre-entry briefing prior to entering an exclusion zone;
- Maintaining a high level of health and safety consciousness among employees at the work site; and
- Maintaining regular communications with the SSO and, if necessary, the RHSM.

1.2.2 ENSR Regional Health and Safety Manager (RHSM)

The ENSR RHSM (John Shepard) is the individual responsible for the preparation, interpretation and where appropriate, modification of this HASP. Modifications to this HASP which may result in less stringent precautions cannot be undertaken by the PM or the SSO without the approval of the RHSM. Specific duties of the RHSM include:

- Writing, approving and amending the HASP for this project;
- Advising the PM and SSO on matters relating to health and safety on this site;
- Recommending appropriate personal protective equipment (PPE) and air monitoring instrumentation to protect personnel from potential site hazards;
- Conducting accident investigations; and,
- Maintaining regular contact with the PM and SSO to evaluate site conditions and new information which might require modifications to the HASP.

1.2.3 ENSR Site Safety Officer (SSO)

The ENSR SSO, (to be determined by the project manager), will be on-site during all the activities covered by this HASP. The SSO is responsible for enforcing the requirements of this HASP once on-site work begins. By design, the SSO has the authority, and the responsibility, to immediately correct all situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. Some of the SSO's specific responsibilities include:

- Procuring and distributing the PPE needed for this project for ENSR employees;
- Verifying that all PPE and health and safety equipment is in good working order;
- Procuring the necessary air monitoring equipment for this project and ensuring the required monitoring is conducted in accordance with this plan;
- Setting up and maintaining the contamination reduction zone adjacent to the exclusion areas and assuring proper decontamination of all site personnel and equipment;

- Notifying the PM and RHSM of all noncompliance situations and stopping work in the event that an immediate danger situation is perceived;
- Conducting on site Job Hazard Assessments if conditions or tasks change and communicating with the Regional Health and Safety Manager the results of the Job Hazard Assessment. See attachment D for an assessment form.
- Assisting with accident/incident investigations and preparing accident/incident investigation reports;
- Conducting the pre-entry briefing in accordance with Section 10 and
- Initiating emergency response procedures in accordance with Section 11 of this HASP.

1.2.4 ENSR Field Personnel and Covered Contractor Personnel

All ENSR field personnel and contractor personnel covered by this HASP are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner. Some of the specific responsibilities of the field personnel are as follows:

- Reading the HASP in its entirety prior to the start of on-site work;
- Submitting a completed HASP Acceptance Form and documentation of medical surveillance and training to the ENSR PM prior to the start of work;
- Attending the required pre-entry briefing prior to beginning on-site work;
- Bringing forth any questions or concerns regarding the content of the HASP to the PM or the RHSM prior to the start of work;
- Reporting all accidents, injuries and illnesses, regardless of their severity, to the ENSR SSO; and
- Complying with the requirements of this HASP and the requests of the SSO.

In addition to other requirements referenced in this HASP, all contractors are required to:

- Provide appropriate PPE for their employees;
- Ensure, via daily inspections, that their equipment is maintained in good working condition;
- Operate their equipment in a safe manner; and
- Appoint an on-site safety coordinator to interface with the ENSR SSO.

1.3 Modification of the HASP

The procedures in this HASP have been developed based on information obtained prior to commencing work at the project site. Should additional information become available regarding potential on-site hazards, it may be necessary to modify this HASP. All proposed modifications to this HASP must be reviewed and approved by the ENSR RHSM before such modifications are implemented.

Any significant modifications must be incorporated into the written document and addenda and the HASP must be reissued. The ENSR PM will ensure that all personnel covered by this

HASP receive copies of all issued addenda. Sign-off forms will accompany each addendum and must be signed by all personnel covered by the addendum. Sign-off forms will be submitted to the ENSR PM. The HASP addenda should be distributed during the daily safety meeting so that they can be reviewed and discussed. Attendance forms will be collected during the meeting.

2.0 SITE HISTORY

2.1 Site Description

The Site is approximately 452 acres in size and is located 13 miles southeast of Las Vegas in an unincorporated section of Clark County, Nevada. Elevations across the Site range from 1,677 to 1,873 feet above mean sea level. The land surface across the Site slopes toward the north at a gradient of approximately 0.023 foot per foot (ft./ft.). The developed portions of the Site have been modified by grading to accommodate building foundations, surface impoundments and access roads.

The BMI complex has been the site of industrial operations since 1942 and was originally sited and operated by the U.S. government as a magnesium production plant in support of the World War II effort. Following the war, a portion of the complex was leased by Western Electrochemical Company (WECCO). By August 1952, WECCO had purchased several portions of the complex, including six of the large unit buildings, and produced manganese dioxide, sodium chlorate and various perchlorates. In addition, in the early 1950s, pursuant to a contract with the U.S. Navy, WECCO constructed and operated a plant to produce ammonium perchlorate on land purchased by the Navy. In 1956, WECCO merged with American Potash and Chemical Company (AP&CC) and continued to operate the processes, with the Navy's continued involvement in the ammonium perchlorate process. In 1962, AP&CC purchased the ammonium perchlorate plant from the Navy, but continued to supply the Navy, and its contractors, material from the operating process. AP&CC merged with Kerr-McGee Corporation (Kerr-McGee) in 1967. This merger included boron production processes in California, which were moved to Henderson and began operation in the early 1970s. These included elemental boron, boron trichloride and boron tribromide. In 1994, the boron tribromide process was shut down and dismantled. In 1997, the sodium chlorate process was shut down and in 1998, production of commercial ammonium perchlorate ended as well. The ammonium perchlorate production equipment was used to reclaim perchlorate from on-site materials until early 2002, when the equipment was permanently shut down. In 2005, Kerr-McGee Chemical LLC's name was changed to Tronox LLC. Processes currently operated by Tronox at the Henderson facility are for production of manganese dioxide, boron trichloride and elemental boron. Additional companies operate within the BMI complex; details regarding ownership and leases within the BMI complex are described in the 1993 Phase I ECA report (Kleinfelder, 1993).

During the 1970s, the USEPA, the State of Nevada and Clark County investigated potential environmental impacts from the BMI companies' operations including atmospheric emissions, groundwater and surface water discharges and soil impacts (Ecology and Environment, 1982). From 1971 to 1976, Tronox, then Kerr-McGee, modified their manufacturing process and constructed lined surface impoundments to recycle and evaporate industrial wastewater. In 1976, the facility achieved zero discharge status regarding industrial wastewater management. In 1980, the USEPA requested specific information from the BMI companies regarding their manufacturing processes and their waste management practices by issuing section 308 letters. In 1994, the NDEP issued a Letter of Understanding (LOU) that identified 69 specific areas or items of interest and indicated the level of environmental investigation they wanted Tronox to conduct.

Soil and groundwater have been impacted with ammonium perchlorate (AP) and hexavalent chromium as a result of current and historic business operations at this facility. Groundwater beneath the Site is impacted with perchlorate compounds in concentrations of 300 - 400 mg/l. More than 100 groundwater-monitoring wells have been installed onsite. KMCC has constructed a groundwater barrier-wall on the facility and installed roughly 22 groundwater interceptor wells to remove impacted groundwater and send the groundwater to an onsite groundwater treatment system where AP and hexavalent chromium are removed.

3.0 SCOPE OF WORK

3.1 Scope of Work

The scope of work consists of an evaluation of soil and groundwater conditions at the Site. To assess soil conditions, the completion of 10 soil borings are proposed on the Site. During drilling, soil samples would be collected for geologic description and laboratory analyses.

To evaluate groundwater conditions at the Site, monitoring wells and influent from groups of extraction wells will be sampled.

Selected soil samples and groundwater samples will be analyzed for the site related chemical list (see workplan Table 4).

A report summarizing the results of the fieldwork and analyses will be prepared and submitted to the NDEP.

4.0 CHEMICAL HAZARD ASSESSMENT AND CONTROLS

4.1 Potential Chemical Contaminants

The potential chemical contaminants at this site are:

- Perchlorate compounds
- Arsenic
- Chromium
- Vanadium
- Manganese
- Boron Compounds
- Chlorate compounds
- Volatile Organic Carbons (VOCs)
- Petroleum Hydrocarbons
- Hexavalent Chromium
- Radionuclides

4.1.1 Volatile Organic Compounds (VOCs)

Organic solvents refer to a group of volatile compounds or mixtures that are relatively stable chemically and that exists in the liquid state at temperatures of approximately 32° to 82°F.

Organic solvents are used for extracting, dissolving, or suspending materials such as fats, waxes, and resins that are not soluble in water. The removal of the solvent from a solution permits the recovery of the solute intact with its original properties. Solvents are used in paints, adhesives, glues coatings, and degreasing/ cleaning agents.

Inhalation and percutaneous absorption are the primary routes of solvent uptake into the peripheral blood, which begins within minutes of the onset of exposure. Organic solvents undergo biotransformation or they accumulate in the lipid-rich tissues such as those of the nervous system.

Solvent inhalation by workers may cause effects ranging from an alcohol-like intoxication to narcosis and death from respiratory failure, with a spectrum of intermediate symptoms that include drowsiness, headache, dizziness, dyspepsia, and nausea. The acute effects of solvent inhalation include narcosis, anesthesia, CNS depression, respiratory arrest, unconscious, and death.

4.1.2 Petroleum Hydrocarbons

Petroleum hydrocarbons are generally considered to be of moderate to low toxicity. Federal or recommended airborne exposure limits have not been established for the vapors of petroleum hydrocarbons. However, inhalation of low concentrations of the vapor may cause mucous membrane irritation. Inhalation of high concentrations of the vapor (which would only be likely to occur in confined spaces where the liquid had been significantly heated) may cause extensive pulmonary edema. Chronic direct skin contact with the liquid may produce skin irritation as a result of defatting.

4.1.3 Perchlorate Compounds

Common salts of perchloric acid are moderately toxic by ingestion and intraperitoneal routes. As a dry compound perchlorates are powerful oxidizers forming explosive mixtures with acetone, 1,3-butylene glycol, 2,3-butylene glycol, CaH2, charcoal, diaminoethane, dimethyl formamide, ethanolamine, ethylene glycol, formamide, galactose, glycerin, hydrazine, water, NH4NO3, Mg, reducing agents, SrH2, urea. When heated to decomposition it emits toxic fumes of Cl^{-} and Na2O.

Dilute solutions in water should be considered mildly toxic and a minor skin irritant.

4.1.4 Chlorates

Inorganic chlorate compounds are used as an herbicide demonstrating a ten fold increase in plant toxicity over sodium chloride. No exposure limits have been established for chlorate compounds and dusts containing chlorates should be considered irritants.

4.1.5 Inorganic Arsenic

Arsenic enters the body principally through the mouth, either in food or in water. Most ingested arsenic is quickly absorbed through the stomach and intestines and enters the bloodstream, although this varies somewhat for different chemical forms of arsenic. Arsenic, which is inhaled, is also well absorbed through the lungs into the blood stream. Small amounts of arsenic may enter the body through the skin, but this is not usually an important consideration.

Most arsenic that is absorbed into the body is converted by the liver to a less-toxic form that is efficiently excreted in the urine. Consequently, arsenic does not have a strong tendency to accumulate in the body except at high exposure levels.

Inorganic arsenic has been recognized as a human poison since ancient times, and large doses can produce death. Lower levels of exposure may produce injury in a number of different body tissues or systems: these are called "systemic" effects. When taken by mouth, a common effect is irritation of the digestive tract, leading to pain, nausea, vomiting, and diarrhea. Other effects typical of exposure by mouth include decreased production of red and white blood cells, abnormal heart function, blood vessel damage, liver and/or kidney injury, and impaired nerve function causing a "pins-and-needles" feeling in the feet and hands. There is evidence from animal studies that high oral doses during pregnancy may be damaging to the fetus, but this has not been well studied in humans.

Inhalation exposure to inorganic arsenic dusts or fumes sometimes produces the same types of systemic health effects produced by oral exposure. However, this is not common, and the effects are usually mild.

Direct dermal contact with arsenic compounds, frequently from inorganic arsenic dusts in air, may result in mild to severe irritation of the skin, eyes, or throat.

4.1.6 Boron & Borates

Boron oxide and boric acid salts of sodium and potassium are commonly found in nature. Dusts of these chemicals can be eye and respiratory tract irritants. Borates are generally considered to be of low human toxicity.

4.1.7 Boranes

Borane compounds include a series of boron-hydrogen compounds or a derivative of such a compound. As a general rule the smaller the borane molecule the higher the toxicity and the more reactive the molecule is in the environment. Most borane compounds oxidize in air or hydrolyze in water to form borates and hydrogen. Borane (BH_3) rapidly converts to the Diborane (B_2H_4) which reacts immediately on contact with air or water. Higher boranes, i.e., penta-, deca, etc., are formed by condensation reactions of the lower boranes. This series progresses through a number of well-characterized crystalline compounds. Hydrides up to $B_{20}H_{26}$ exist. Most are not very stable and readily react with water to yield hydrogen. Many react violently with air. As a rule, they are highly toxic. There are also a number of organoboranes used as reducing agents in electroless nickel-plating of metals and plastics. Some compounds used are di- and tri-ethlylamine borane and pyridine borane. Organic boranes such as triehtylborane also react on contact with air or water. It is very unlikely that borane compounds will be encountered in the environment. The most likely potential exposures would be found in industrial chemical storage and processing areas.

4.1.8 Chromium

Chromium compounds vary greatly in toxicity. Chrome metal, the di-valent (chromous), and the tri-valent (chromic) compounds have low to moderate toxicities. They are poorly absorbed through the skin and mucous membranes, but may cause irritation. Chrome metal, unlike nickel, does not cause allergic contact dermatitis. Nor is it known to cause pulmonary fibrosis or cancer.

Hexavalent chrome compounds (e.g. chromic acid and chromates) are corrosive to the skin and mucous membranes. They cause extreme irritation to the nose, throat, and lungs, and may produce chrome sores, ulcers, nasal septum perforations, and pulmonary edema. Hexavalent chrome can cause allergic sensitization, bronchitis, and kidney damage. Cancers of the lung and nasopharynx are associated with heavy exposures.

The PEL for chrome metal, di-valent, and tri-valent chrome compounds is 0.5 mg/m^3. For hexavalent chrome, the PEL is 0.05 mg/m^3.

4.1.9 Manganese Compounds

Manganese is an essential trace element. In excess, it is of medium toxicity to humans. Manganese poisoning is rare and is limited to those exposed occupationally, in the manufacture of manganese compounds and in the pottery manufacturing. It is a respiratory irritant when inhaled and long-term exposure produces symptoms similar to those of Parkinson's disease

Manganese can exist as compounds in up to eight different valence states, which may be cations or anions. It appears that cationic manganese compounds are more toxic than anionic compounds, and that $Mn2^+$ is more toxic than $Mn3^+$. Manganese and its compounds are usually absorbed into the body by oral and respiratory routes, in the form of dust.

In excess amounts, manganese can cause irreversible nervous system damage. Studies have shown that the effects of manganese in the brain are due to the presence of lesions and degeneration in the basal ganglia. The metal is also known to block calcium channels, and with chronic intoxication the levels of dopamine in the CNS are depleted, which causes the Parkinson's-like symptoms.

4.1.10 Vanadium Compounds

Everyone is exposed to low levels of vanadium in air, water, and food. Vanadium is typically encountered as the pentoxide in nature. As a pure powder, vanadium oxide is yellow to orange and is easily dispersed in air. Exposure to the dust of vanadium oxide causes irritation of the eyes and upper respiratory tract. Breathing high levels of vanadium may cause lung irritation, chest pain, coughing, and other effects. Ingestion or high exposures by inhalation cause the tongue to become green and a strong metallic taste.

4.1.11 Radionuclides

A radionuclide is an isotope of an element that exhibits radioactivity. Radionuclides can be man made, naturally occurring, or the product of the decay of another radioactive isotope.

Naturally occurring radionuclides including Radium, Radon, Thorium, and Uranium is present in virtually all soil, rock and water. These radionuclides are distributed throughout the environment by wind, rain and geologic processes. Rocks weather and break down to form soil, and soil can be washed by water and blown by wind, moving uranium into streams and lakes, and ultimately settling out and reforming as rock

The radionuclides of lead are produces by the decay of thorium and uranium.

A person can be exposed to radionuclides by inhaling dust in air, or ingesting water and food. The general population is exposed primarily through food and water. The greatest health risk from large intakes of radionuclides is toxic damage to the kidneys, because, in addition to being weakly radioactive, uranium, thorium and radium are toxic metals.

There is little exposure hazard when working around naturally occurring radionuclides and their decay products. If these materials are enriched or refined, exposure hazards can be created.

Radon gas can pose an exposure hazard if it is allowed to accumulate in closed areas such as vaults, cellars, and wells.

4.2 Summary of Hazardous Properties of Potential Contaminants

Chemical Name	PEL[1]	TLV[2]	VP[3]	VD[4]	SG[5]	SOL[6]	FP[7]	LEL[8]	UEL[9]
Inorganic Arsenic	0.01	0.002	NA	NA	?	?	NA	NA	NA
Boron as B_2O_3	15	10	NA	NA	2.5	3	NA	NA	NA
Diborane	0.1	0.1	>1000	0.96	NA	reacts	-130	0.8	88
Chromium	1	0.5	NA	NA	7.2	NA	NA	NA	NA
Manganese Compounds	5 (C)	0.2	NA	NA	NA	<1	NA	NA	NA
Vanadium as V_2O_5	0.5 (C)	0.05	NA	NA	3.4	<1	NA	NA	NA
Petroleum Hydrocarbons	NA	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Organic Compounds	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radionuclides	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorate Compounds	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1] Permissible Exposure Limit in mg/m^3
[2] Threshold Limit Value in mg/m^3
[3] Vapor Pressure in mm Hg
[4] Vapor Density (air = 1)
[5] Specific Gravity (water = 1)
[6] Solubility in Water in %
[7] Flash Point in °F
[8] Lower Explosive Limit in % by volume
[9] Upper Explosive Limit in % by volume
NA = Not Applicable
? = Not known

4.3 Chemical Exposure Potential/Control

4.3.1 Potential Routes of Exposure

The potential routes of exposure to the contaminants of concern include:

- Dermal contact with contaminated soils during soil boring and soil sample collection;
- Dermal contact with contaminated groundwater during well installation and groundwater sampling;
- Inhalation of vapors during soil boring and soil sampling; and
- Inhalation of vapors during well installation and groundwater sampling.

4.3.2 Exposure Control

As a precaution, ENSR will be conducting air monitoring in the worker's breathing zone to determine exposures to vapors during the subsurface investigations. If exposures exceed the action levels as defined in Section 4, respiratory protection as discussed in Section 7 will be donned.

To avoid direct dermal contact with contaminated media, protective clothing as described in Section 7 will be required when collecting samples and decontaminating sampling equipment.

Although highly unlikely, exposure to all of the contaminants of concern may occur via ingestion (hand-to-mouth transfer). The decontamination procedures described in Section 9 address personal hygiene issues that will limit the potential for contaminant ingestion.

4.4 Hazardous Substances Brought On-Site by ENSR

A material safety data sheet (MSDS) must be available for each hazardous substance that ENSR bring on the property. This includes solutions/chemicals that will be used to decontaminate sampling equipment. Containers of hazardous materials must be properly labeled in accordance with OSHA's Hazard Communication Standard.

4.5 Physical Hazards and Controls

4.5.1 Drilling Hazards

Use of a drill rig to advance soil borings and install monitoring wells will require personnel in the vicinity of the operating rig to wear steel-toed boots, hard hats, hearing protection and safety eyewear. Personnel shall not remain in the vicinity of operating equipment unless it is required for their work responsibilities.

Additionally, the following safety requirements must be adhered to:

- Drill rigs and other machinery with exposed moving parts must be equipped with an operational emergency stop device. Drillers and geologists must be aware of the location of this device. This device must be tested prior to job initiation and periodically thereafter. The driller and helper shall not simultaneously handle augers unless there is a standby person to activate the emergency stop.

- The driller must not leave the controls while the tools are rotating unless all personnel are kept clear of rotating equipment.

- A long-handled shovel or equivalent must be used to clear drill cuttings away from the hole and from rotating tools. Hands and/or feet are not to be used for this purpose.

- A remote sampling device must be used to sample drill cuttings if the tools are rotating or if the tools are readily capable of rotating. Samplers must not reach into or near the rotating equipment. If personnel must work near any tools, which could rotate, the driller must shut down the rig prior to initiating such work.

- Driller's, helpers and geologists must secure loose clothing when in the vicinity of drilling operations.

- Only equipment, which has been approved by the manufacturer, may be used in conjunction with site equipment and specifically to attach sections of drilling tools together. Pins that protrude excessively from augers shall not be allowed

- No person shall climb the drill mast while tools are rotating.

  - No person shall climb beyond 6 feet above ground on the drill mast without the use of ANSI-approved fall protection (approved belts, lanyards and a fall protection slide rail) or portable ladder which meets the requirements of OSHA standards.

4.5.2 Heat Stress

Types of Heat Stress

Heat related problems include **heat rash, fainting, heat cramps, heat exhaustion and heat stroke**. **Heat rash** can occur when sweat isn't allowed to evaporate; leaving the skin wet most of the time and making it subject to irritation. **Fainting** may occur when blood pools to lower parts of the body and as a result, does not return to the heart to be pumped to the brain. Heat related fainting often occurs during activities that require standing erect and immobile in the heat for long periods of time. **Heat cramps** are painful spasms of the muscles due to excessive salt loss associated with profuse sweating.

Heat exhaustion results from the loss of large amounts of fluid and excessive loss of salt from profuse sweating. The skin will be clammy and moist and the affected individual may exhibit giddiness, nausea and headache.

Heat stroke occurs when the body's temperature regulatory system has failed. The skin is hot, dry, red and spotted. The affected person may be mentally confused and delirious. Convulsions could occur. EARLY RECOGNITION AND TREATMENT OF HEAT STROKE ARE THE ONLY MEANS OF PREVENTING BRAIN DAMAGE OR DEATH. A person exhibiting signs of heat stroke should be removed from the work area to a shaded area. The person should be soaked with water to promote evaporation. Fan the person's body to increase cooling.

Increased body temperature and physical discomfort also promote irritability and a decreased attention to the performance of hazardous tasks.

Early Symptoms of Heat-Related Health Problems:

decline in task performance
incoordination
decline in alertness
unsteady walk
excessive fatigue
reduced vigilance
muscle cramps
dizziness

Susceptibility to Heat Stress Increases due to:

lack of physical fitness
lack of acclimation
increased age
dehydration
obesity
drug or alcohol use
sunburn
infection

People unaccustomed to heat are particularly susceptible to heat fatigue. First timers in PPE need to gradually adjust to the heat.

The Effect of Personal Protective Equipment

Sweating normally cools the body as moisture is removed from the skin by evaporation. However, the wearing of certain personal protective equipment (PPE), particularly chemical protective coveralls (e.g., Tyvek), reduces the body's ability to evaporate sweat and thereby regulate heat buildup. The body's efforts to maintain an acceptable temperature can therefore become significantly impaired by the wearing of PPE.

Measures to Avoid Heat Stress:

The following guidelines should be adhered to when working in hot environments:

Establish work-rest cycles (short and frequent are more beneficial than long and seldom).

- Identify a shaded, cool rest area.
- Rotate personnel, alternative job functions.
- Water intake should be equal to the sweat produced. Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst. **DO NOT DEPEND ON THIRST TO SIGNAL WHEN AND HOW MUCH TO DRINK**. For an 8-hour work day, 50 ounces of fluids should be drunk.
- Eat lightly salted foods or drink salted drinks such as Gatorade to replace lost salt.
- Save most strenuous tasks for non-peak heat hours such as the early morning or at night.
- Avoid alcohol during prolonged periods of heat. Alcohol will cause additional dehydration.
- Avoid double shifts and/or overtime.

The implementation and enforcement of the above mentioned measures will be the joint responsibility of the project manager, on-site field coordinator, and health and safety officer. Potable water and fruit juices should be made available each day for the field team.

Heat Stress Monitoring Techniques

Site personnel should regularly monitor their heart rate as an indicator of heat strain by the following method:

Radial pulse rates should be checked by using fore-and middle fingers and applying light pressure top the pulse in the wrist for one minute at the beginning of each rest cycle. If the pulse rate exceeds 110 beats/minute, the next work cycle will be shortened by one-third and the rest period will be kept the same. If, after the next rest period, the pulse rate still exceeds 110 beats/minute, the work cycle will be shortened again by one-third.

4.5.3 Noise Exposure

The use of the drilling rig will generate noise levels that will require the use of hearing protection in the immediate vicinity. Appropriate earmuff or earplugs (i.e., with an NRR greater than 25 dB) should be worn to prevent overexposure. The general rule of thumb is that if you have to raise your voice to be understood by someone who is standing 3 to 5 feet away from you, the noise levels are likely to be above 85 dB and therefore require the use of hearing protection.

4.5.4 Underground Utility Hazards

Law requires that a utility clearance survey must be performed before any subsurface activities are performed. The utility clearance survey must be requested from:

DIG SAFE SYSTEM, INC.
Center # 1-888-DIG-SAFE (1-888-344-7233)

The survey must be requested at least 72 hours (i.e., 3 full business days) prior to conducting the subsurface activities. The Digsafe ticket should be updated by requesting a remark every 30 days. Remember that digging outside of your originally specified boundaries requires that a new survey be performed.

Be aware that utility companies often can not identify the exact location of their underground services once they cross onto private property. (Note: Utility clearance survey requests are still required on private property). Private property owners may have rerouted these services or installed their own.

4.5.5 Overhead Utility Hazards

Any vehicle or mechanical equipment, particularly the mast of the drilling rig, that is capable of having parts of its structure elevated near energized overhead lines shall be operated so that a minimum clearance of 10 feet is maintained at all times.

4.5.6 Back Safety

Using the proper techniques to lift and move heavy pieces of equipment, such as drums of investigation-derived wastes, is important to reduce the potential for back injury. The following precautions should be implemented when lifting or moving heavy objects.

- Bend at the knees, not the waist. Let your legs do the lifting.
- Do not twist while lifting
- Bring the load as close to you as possible before lifting
- Be sure the path you are taking while carrying a heavy object is free of obstructions and slip, trip and fall hazards
- Use mechanical devices to move objects, such as drums of investigation derived wastes or generators, that are too heavy to be moved manually
- If mechanical devices are not available, ask another person to assist you.

4.5.7 Traffic Safety

The following precautions should be followed to draw attention to you and to warn other people of your presence in high traffic areas.

- Notify the property representative of your work location, dates of work and the anticipated work times and suggest the possibility of a detour around the work area.
- Wear an orange safety vest. If work is being performed at dawn, dusk or evening, the vests must have reflective tape.
- Set up traffic cones 50 feet in front of the work area. "Men at Work" signs should also be placed in a conspicuous area to warn others of your presence.
- Use an employee to direct traffic in high traffic areas where the hazard may increase.

5.0 AIR MONITORING

ENSR will not conduct air monitoring to since the expected contaminants are inorganic and not volatile.

Personal air sampling will not be conducted by ENSR during the activities covered by this HASP.

6.0 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) will be worn during these activities to prevent on-site personnel from being injured by the safety hazards posed by the site and/or the activities being performed. In addition, chemical protective clothing will be worn to prevent direct dermal contact with the site's chemical contaminants. The following table describes the PPE and chemical protective clothing to be worn for general site activities and for certain specific tasks.

6.1 Protective Clothing

PPE Item	General	Drilling	Sample Collection
Hard Hat	1 & 2	✓	1 & 2
Traffic Vests	2	2	2
Steel Toed Safety Shoes	1	✓	✓
Safety Glasses with Sideshields	1	✓	✓
Hearing Protection		✓	3
PVC or Nitrile Gloves		4	✓
Sun Screen	✓	✓	✓

✓ Required PPE

1 All employees must comply with Tronox safety requirements.

2 Traffic vests and hardhats are required within twenty feet of any public road or any private road with active traffic.

3 Hearing protection should be worn soil boring equipment if normal conversation cannot be understood.

4 Note that chemical resistant gloves are only required of those that are likely to come in direct contact with potentially contaminated soils and/or groundwater.

6.2 Respiratory Protection

Respiratory protection (half or full face mask respirator with combination organic vapor/HEPA cartridges) should also be donned if odors become objectionable at any time or if respiratory tract irritation is noticed.

6.3 Other Protective Equipment

The following additional safety items should be available at the site:

- Portable, hand-held eyewash bottles
- First aid kit

7.0 SITE CONTROL

To prevent both exposure of unprotected personnel and migration of contamination due to tracking by personnel or equipment, work areas along with personal protective equipment requirements will be clearly identified.

7.1 Designation of Zones

If it is determined that there is contamination in the subsurface soil or groundwater, ENSR will designate work areas or zones as suggested in the "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," NIOSH/OSHA/USCG/EPA, November 1985. They recommend the areas surrounding each of the work areas to be divided into three zones:

- Exclusion or "hot" Zone
- Contamination Reduction Zone (CRZ)
- Support Zone

7.1.1 Exclusion Zone

The exclusion zone will include the area that immediately surrounds the drilling activities. This zone should be sufficiently large to protect unprotected personnel from contact with vapors or dusts that may arise from these operations as well as the physical hazards associated with the operation of heavy equipment. As a minimum, the exclusion zone should include the area scribed by the shadow of the mast of the drilling rig. All personnel entering the exclusion zone must be trained in accordance with the requirements defined in Sections 10 and 11 of this HASP and must wear the level of personal protective equipment prescribed in section 7.

7.1.2 Contamination Reduction Zone

The Contamination Reduction Zone or decontamination area will be established adjacent to the exclusion zone. Personnel will remove contaminated gloves, Tyvek and other disposable items in this area and place them in a plastic bag until they can be properly disposed of in accordance with the work plan requirements.

7.1.3 Support Zone

At this site the support zone will include the area outside of the exclusion and contamination reduction zones.

7.2 Safety Practices

The following measures are designed to augment the specific health and safety guidelines provided in this plan.

- The "buddy system" will be used at all times by all field personnel. No one is to perform fieldwork alone. Standby team member must be intimately familiar with the procedures for initiating an emergency response.

- Eating, drinking, chewing gum or tobacco, smoking or any practice that increases the probability of hand-to-mouth transfer and ingestion of materials is prohibited in the immediate work area and the decontamination zone.

- Smoking is prohibited in all work areas. Matches and lighters are not allowed in these areas.

- Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking or any other activities.

- Beards or other facial hair that interfere with respirator fit are prohibited.

- The use of alcohol or illicit drugs is prohibited during the conduct of field operations.

- All equipment must be decontaminated or properly discarded before leaving the site in accordance with the project work plan.

8.0 DECONTAMINATION

8.1 Personal Decontamination

Proper decontamination is required of all personnel before leaving the site. Decontamination will occur within the contamination reduction zone.

Regardless of the type of decontamination system required, a container of potable water and liquid soap should be made available so employees can wash their hands and face before leaving the site for lunch or for the day.

After leaving the work area and before eating, smoking or drinking, employees must wash their face and hands with soap and water.

8.2 PPE Decontamination

Disposable PPE, such as Tyvek coveralls, gloves, etc. will be removed and placed in garbage bags. Final disposal of contaminated PPE will be in accordance with the work plan.

If worn, respirators will be cleaned after each use with respirator wipe pads and will be stored in plastic bags after cleaning. Respirators will be thoroughly cleaned using disinfectant material within one week following any respirator use. Refer to the cleaning instructions provided with the respirator or specified by the OSHA regulations at 29 CFR 1910.134.

8.3 Equipment Decontamination

Equipment will be decontaminated prior to being moved to other locations. Decontamination procedures will be specified by the Project Manager.

9.0 MEDICAL MONITORING AND TRAINING REQUIREMENTS

9.1 Medical Monitoring

All personnel performing activities covered by this HASP must be active participants in ENSR's Medical Monitoring Program or in a similar program which complies with 29 CFR 1910.120(f). Each individual must have completed an annual surveillance examination and/or an initial baseline examination within the last year prior to performing any work on the site covered by this HASP.

9.2 Health and Safety Training

If it is determined that there is contamination in the subsurface soil or groundwater, all personnel performing activities covered by this HASP must have completed the appropriate training requirements specified in 29 CFR 1910.120(e). Each individual must have completed an annual 8-hour refresher-training course and/or initial 40-hour training course within the last year prior to performing any work on the sites covered by this HASP. All workers will have completed three days of supervised work on hazardous waste sites before being allowed to work unsupervised. Also, on-site managers and supervisors directly responsible for supervising individuals engaged in hazardous waste operations must have completed the specified 8-hour managers training course. (Note that ENSR corporate policy requires that whenever three or more ENSR employees are performing work on the same site, at least one of these individuals must have completed the manager's training course.)

9.3 Pre-Entry Briefing

Prior to the commencement of on-site activities, a pre-entry briefing will be conducted by the ENSR SSO to review the specific requirements of this HASP. HASP sign-off sheets will be collected at this meeting. Short safety refresher meetings will be conducted, as needed, throughout the duration of the project. Attendance of the pre-entry meeting is mandatory and will be documented by the ENSR SSO. An attendance form is presented in Attachment B.

10.0 EMERGENCY RESPONSE

OSHA defines emergency response as any "response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual-aid groups, local fire departments, etc.) to an occurrence that results, or is likely to result in an uncontrolled release of a hazardous substance." According to ENSR policy, ENSR personnel shall not participate in any emergency response where there are potential safety or health hazards (i.e., fire, explosion, or chemical exposure). ENSR response actions will be limited to evacuation and medical/first aid as described within this section below. As such this section is written to comply with the requirements of 29 CFR 1910.38 (a).

The basic elements of an emergency evacuation plan include:

- employee training,
- alarm systems,
- escape routes,
- escape procedures,
- critical operations or equipment,
- rescue and medical duty assignments,
- designation of responsible parties,
- emergency reporting procedures and
- methods to account for all employees after evacuation.

10.1 Employee Training

Employees must be instructed in the specific aspects of emergency evacuation applicable to the site as part of the site safety meeting prior to the commencement of all on-site activities. On-site refresher or update training is required anytime escape routes or procedures are modified or personnel assignments are changed.

10.2 Alarm Systems/Emergency Signals

An emergency communication system must be in effect at all sites. The most simple and effective emergency communication system in many situations will be direct verbal communications. Each site must be assessed at the time of initial site activity and periodically as the work progresses. Verbal communications must be supplemented anytime voices can not be clearly perceived above ambient noise levels (i.e., noise from heavy equipment; drilling rigs, backhoes, etc.) and anytime a clear line-of-sight can not be easily maintained amongst all ENSR personnel because of distance, terrain or other obstructions.

Verbal communications will be adequate to warn employees of hazards associated with the immediate work area. However, it may be difficult to maintain a clear line-of-sight with employees because of the size and remoteness of the site. Walkie-talkies or an emergency air horn must be carried by employees who are working in out of sight locations to enhance their communication with employees working on the site proper. If telephone service is not immediately available upon arrival to the site, a portable phone must be made available to facilitate emergency communications.

10.3 Escape Routes and Procedures

The escape route from the site and an emergency muster point will be determined and provided to all workers during the project mobilization.

10.4 Employee Accounting Method

The SSO is responsible for identifying all ENSR personnel on-site at all times. On small, short duration jobs this can be done informally as long as accurate accounting is possible. On all other sites a formal log-in and log-out procedure must be implemented.

10.5 Rescue and Medical Duty Assignments

The phone numbers of the police and fire departments, ambulance service, local hospital, and ENSR representatives are provided in the emergency reference sheet. This sheet will be posted in the site vehicle and on-site office trailer.

In the event an injury or illness requires more than first aid treatment, the SSO will accompany the injured person to the medical facility and will remain with the person until release or admittance is determined. The escort will relay all appropriate medical information to the on-site project manager and the RHSM.

If the injured employee can be moved from the accident area, he or she will be brought to the CRZ where their PPE will be removed. If the person is suffering from a back or neck injury the person will not be moved and the requirements for decontamination do not apply. The SSO must familiarize the responding emergency personnel about the nature of the site and the injury. If the responder feels that the PPE can be cut away from the injured person's body, this will be done on-site. If this not feasible, decontamination will be performed after the injured person has been stabilized.

10.6 Designation of Responsible Parties

The SSO is responsible for initiating emergency response. In the event the SSO cannot fulfill this duty, the alternate SSO will take charge. All personnel on site are responsible for knowing the escape route from the site and where to assemble after evacuation.

10.7 Incident Reporting

All incidents must be reported to the ENSR Project Manager Dave Gerry (805-388-3775) and then to the ENSR Regional Health and Safety Manager, John Shepard (972-509-7644).

10.8 Accident Investigation

Any incident (other than minor first aid treatment) resulting in injury, illness or property damage requires an accident investigation and report. The investigation should be conducted as soon as emergency conditions are under control. The purpose of the investigation is not to attribute blame but to determine the pertinent facts so that repeat or similar occurrences can be avoided. An ENSR accident investigation form is presented in Attachment C of this HASP. The injured ENSR employee's supervisor and the RHSM should be notified immediately of the injury. If a subcontractor employee is injured, they are required to notify the ENSR SSO. Once the incident is under control, the subcontractor will submit a copy of their company's accident investigation report to the ENSR SSO.

Attachment A

Health and Safety Plan Acceptance Form

Health and Safety Plan Receipt and Acceptance Form

Subsurface Investigation of Soils and Groundwater
Tronox
Henderson, Nevada

I, as an employee of ENSR Corporation or its contractors have received a copy of the Health and Safety Plan prepared for the above-referenced site and activities. I have read and understood its contents and I agree that I will abide by its requirements.

Name (Print) ____

Signature ______________________________________ Date: ___________________

Representing (Print) ___________________________________
Company Name

Attachment B

Health and Safety Pre-Entry Briefing Attendance

Health and Safety Pre-Entry Briefing Attendance

Subsurface Investigation of Soils and Groundwater

Tronox

Henderson, Nevada

Date Performed: ______________________________

Printed Name	Signature	Representing

Attachment C

Supervisor's Accident Investigation Report

SUPERVISOR'S ACCIDENT INVESTIGATION REPORT

Injured Employee _____________________________ Job Title

Home Office _____________________________ Division/Department

Date/Time of Accident

Location of Accident

Witnesses to the Accident

Injury Incurred? _______ Nature of Injury

Engaged in What Task When Injured? ____

Will Lost Time Occur? _______ How Long? _________ Date Lost Time Began _________________

Were Other Persons Involved/Injured?

How Did the Accident Occur?

What Could Be Done to Prevent Recurrence of the Accident? _______________________________

What Actions Have You Taken Thus Far to Prevent Recurrence? ____________________________

Supervisor's Signature ________________________ Title __________________ Date

Reviewer's Signature _________________________ Title __________________ Date

Note: If the space provided on this form is insufficient, provide additional information on a separate page and attach. The completed accident investigation report must be submitted to the Regional Health and Safety Manager within two days of the occurrence of the accident.

Attachment D

Job Hazard Assessment

Job Hazard Assessment Form

Subsurface Investigation of Soils and Groundwater

Tronox

Henderson, Nevada

To be used for field assessments of new hazards

PRINCIPAL STEPS	**POTENTIAL HAZARDS**	**RECOMMENDED CONTROLS**
SAFETY EQUIPMENT	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**

Attachment E

Material Safety Data Sheets

Alconox® Material Safety Data Sheet

Alconox, Inc.
30 Glenn Street, Suite 309
White Plains, NY 10603

24 Hour Emergency Number - Chem-Tel (800) 255-3924

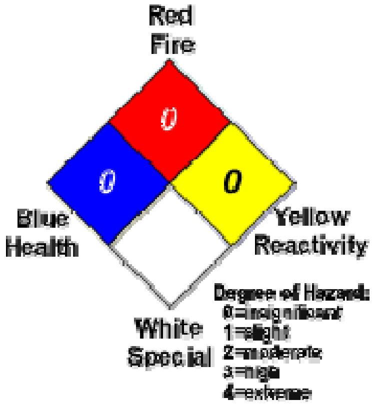
I. Identification

Product Name (shown on label):	ALCONOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 1999
Chemical Family:	Anionic Powdered Detergent
Mfr. Catalog #s for Sizes:	1104, 1125, 1150, 1101, 1103, 1112

II. Hazardous Ingredients/Identity Information

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

National Fire Protection Association 704 Labeling:



NJTSRN: 1100

III. Physical/Chemical Characteristics

Boiling Point (F):	Not Applicable
Vapor Pressure (mm Hg):	Not Applicable
Vapor Density (AIR=1):	Not Applicable
Specific Gravity (Water=1):	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Not Applicable
Melting Point:	Not Applicable
Solubility in Water:	Appreciable-Soluble to 10% at ambient conditions
Appearance:	White powder interspersed with cream colored flakes.

IV. Fire and Explosion Data

Flash Point (Method Used):	None
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO2, foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.

Unusual Fire and Explosion Hazards:	None

V. Reactivity Data

Stability:	Stable
Hazardous Polymerization:	Will not occur
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition or Byproducts:	May release CO_2 on burning

VI. Health Hazard Data

Route(s) of Entry:	Inhalation? Yes Skin? No Ingestion? Yes
Health Hazards (Acute and Chronic):	Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Exposure may irritate mucous membranes. May cause sneezing.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

VII. Precautions for Safe Handling and Use

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	Material should be stored in a dry area to prevent caking.

Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VII. Control Measures

Respiratory Protection (Specify Type):	Dust mask - Recommended
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are useful but not required.
Eye Protection:	Goggles are recommended when handling solutions.
Other Protective Clothing or Equipment:	None
Work/Hygienic Practices:	No special practices required

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.

Attachment F

Contractors’ Safety Handbook and Contractors’ Safety Orientation

TRONOX

Henderson Facility
Training Department

Contractors' Safety Orientation

Revised 03/2006

Welcome to Tronox!

We believe in doing the right things right.

TRONOX HENDERSON FACILITY
MISSION STATEMENT

The Mission of the Tronox Henderson employees is to be the recognized leader in the manufacture of selected chemicals that meet/exceed customer quality expectations

- * While maintaining the highest standards of safety and environmental responsibility
- * At the lowest possible cost

Purpose of Training:

At Tronox, we feel that safety is an important part of our business. Today's training is to help you as a contractor, understand our commitment to safety and our "policies and rules" that you are required to follow while in our facility.

We hope that you will share this safety commitment, and practice it each day as you work with us.

Objectives:

At the conclusion of this training you will be able to:

1. Describe basic safety procedures related to:
    - Security
    - Workplace Violence Prevention
    - Driving and Parking
    - Making the Work Area Safe
    - Excavations
    - Ladders
    - Housekeeping
    - Welding and Burning - Hot Work
    - Fire Protection
    - Hazard Communication
    - Personal Protection
    - Lockout Tagout
    - Employee/Contractor Conduct
2. Understand the Contractors Role in "Process Safety Management"
    - Defining PSM
    - Chemicals involved in PSM

BMI COMPLEX - HISTORY

The industrial complex now known as BMI was started as with the ground breaking of a monumental facility two miles long and one mile wide between Boulder City and Las Vegas on September 15, 1941. Japan's surprise attack on Pearl Harbor three months later gave the project an even greater urgency.

The construction required:

6,000,000 pounds of copper
30,000,000 tons of lumber
20,000,000 bricks
50, 000 tons of structural steel -*which was more then the Empire State Building*
18 Miles of railroad track inside the plant

plus,

A 16 mile, 40-inch pipeline built to bring 30,000,000 gallons per day of Lake Mead water to BMI and 141 tons of pure silver were "loaned" to BMI by the federal government for electrical bus bar to free up copper for other war purposes.

On August 31, 1942 production began. After producing more that 166,000,000 pounds of magnesium - more than was needed for the war effort - the plant was closed in 1944.

With the end of World War II in 1945, the plant was declared a surplus, with the Federal Government ready to dismantle the complex completely and sell for scrap that which could not be reclaimed. Some Nevada leaders including Charles Henderson (who the city is named after) and a far-sighted State Government purchased the plant in 1949 for a cost of $24 million; it was then sold off to private industry.

The acronym "BMI" has stood for various names for the industrial complex through the years – initially, it was "Basic Magnesium Inc". This was followed by "Basic Management Inc" and, later, "Black Mountain Inc."

KERR-McGEE purchased this portion of the property in 1967. **KERR-McGEE spun off the Chemical Division in 2005 as a separate company called TRONOX LLC.**

Chemicals currently manufactured at the Henderson facility are:

Manganese Dioxide

Elemental Boron

Boron Trichloride

KERR-McGEE CHEMICAL LLC

CONTRACTOR SAFETY CHECKLIST KM-7121 (5/02)

DATE

THE CONTRACTOR SUPERVISOR IS TO BE GIVEN A COPY OF THIS FORM FOR REVIEW WITH CONTRACTOR EMPLOYEES AT THE JOB SITE.

KERR-McGEE REPRESENTATIVE:	CONTRACTOR:	
JOB LOCATION:	JOB DESCRIPTION:	
MWA/FSA/ESA NUMBER:	NUMBER OF EMPLOYEES:	ESTIMATED DAYS IN THE PLANT:

COMPLETE THE FOLLOWING: The Contractor/Contractor Employee:	**YES**	**NO**
1. has attended and understood the KM contractor safety orientation?		
2. is responsible for assuring that the contractor employees follow the facility safety rules and work practices?		
3. has proper personal protective equipment required for the work area?		
4. equipment has been inspected and meets KM standards (PPE, hot work equipment, etc.)?		
5. is responsible for assuring the contractor employees are trained in the safe work practices needed to perform the job?		

including as checked for this job:

a. ☐ lockout/tagout
b. ☐ confined space entry
c. ☐ oxy-acetylene safety
d. ☐ fire extinguisher
e. ☐ fall protection
f. ☐ crane
g. ☐ forklift
h. ☐ Other (list):

Note: contractor will be required to provide documentation of training if requested.

6. knows plant safe work procedure?		
7. has MSDSs for chemicals brought on site?		
8. knows all known potential hazards of fire or explosion in work area?		
9. knows all known potential exposure to toxic substances in work area?		
10. knows restroom location in work area?		
11. knows changehouse location?		
12. knows designated smoking area?		
13. knows where safety showers and eyewash stations are located?		
14. knows restricted areas?		
15. knows how to contact Kerr-McGee representative?		
16. knows to inform the KM representative of any unique hazards presented or found by the contractor's work?		
17. knows emergency procedures (evacuation routes) for the area?		
18. knows the locations of the windsocks in the area?		

PLEASE CHECK EACH BOX IN THE "PRESENT" COLUMN FOR CHEMICALS THE CONTRACTOR AND CONTRACTOR'S EMPLOYEES MAY BE EXPOSED TO ON THE JOB SITE.

NOTES: T = THERMAL C = CHEMICAL

KM COMPANY REPRESENTATIVE MATERIALS SAFETY CHECKLIST

CHEMICAL	SYMBOL	PRESENT	HAZARDS (PRIMARY)
AMMONIA	NH_3		BURN (C&T), INHALATION
ANOLYTE	$H_2SO_4 + MnSO_4$		BURN (C&T)
BORON TRICHLORIDE	BCl_3		INHALATION, BURN (C)
CALCINE	MnO		IRRITANT, BURN (C&T)
CARBON MONOXIDE	CO		ASPHYXIATION
CHLORINE	Cl_2		BURN (C), INHALATION
FREON	-Cl-C-F-		BURN (T), INHALATION
HYDROCHLORIC ACID	HCl		BURN (C), INHALATION
HYDROGEN	H_2		FIRE, EXPLOSION
HYDROGEN SULFIDE	H_2S		POISON, INHALATION, FIRE
LIME	CaO.MgO		IRRITANT
MAGNESIUM METAL	Mg		FIRE
MANGANESE DIOXIDE	MnO_2		IRRITANT, WOUND CONTAMINANT
NATURAL GAS	CH_4		FIRE, EXPLOSION
NITROGEN	N_2		ASPHYXIATION, BURN (T)
PERCHLORATE	ClO_4		FIRE, IRRITANT
SODIUM HYDROXIDE (Caustic)	NaOH		BURN (C)
STEAM/CONDENSATE	H_2O		BURN (T), INHALATION
SULFURIC ACID	H_2SO_4		BURN (C), INHALATION
OTHER, LIST:			

I understand the above information as explained by the Kerr-McGee Representative. I understand that it is my responsibility to ensure that all contractor's employees and any subcontractors working on this job have also been trained on the above information.

CONTRACTOR SUPERVISOR'S SIGNATURE	KM REPRESENTATIVE'S SIGNATURE

When to Fight a Fire with a Portable Fire Extinguisher

It is critical to understand the circumstances under which it is appropriate to attempt to extinguish a fire with an extinguisher. This important "fight-or-flight" decision must include consideration for **all** of the following factors.

- **You know the building is being evacuated**. This is accomplished when you alert everyone within your immediate area to immediately evacuate the building.

- **You know that the fire department is being called**. Call **3333** or contact a Tronox employee.

- **The fire is small and contained**. Do not consider fighting a fire unless it is confined to a small area, such as a wastebasket, and it is not spreading. A portable fire extinguisher should only be used for incipient-stage firefighting. An extinguisher is no match for a large or rapidly-advancing fire.

- **The exit for your escape is clear and you can fight the fire with your back to the exit**. You must always assume that you may not be able to extinguish the fire you are fighting. If the fire does not diminish with your first attack or if any thing goes wrong, immediately leave the building and do not return.

- **The proper type of extinguisher is available.** Fire extinguishers are designed to fight specific classes of fires. Your selection of an extinguisher to use depends on what is burning.

- **You are trained in the extinguisher's use and feel confident about using it**. This is accomplished by being familiar with the different types of fires, fire extinguishers and extinguishing agents. In addition, you must be familiar with the general principles of fire extinguisher use and with incipient- stage firefighting.

- **You can stay low and avoid breathing smoke.** Do not delay your personal evacuation by fighting a fire in an area filled with smoke. Without protective breathing equipment, you could quickly find yourself unable to breathe or see. Smoke can also obscure your exit path.

PROCESS SAFETY MANAGEMENT

The purpose of this OSHA standard is to reduce the frequency and severity of potentially catastrophic chemical accidents. It is largely performance-based and establishes minimum requirements for the operation of facilities and processes involving highly hazardous chemicals.

The Henderson Facility has three chemicals that are covered by PSM:

1. Chlorine (Cl_2)
2. Hydrogen Sulfide (H_2S)
3. Boron Trichloride (BCl_3)

ELEMENT REQUIREMENTS

Employee Participation	Requires a written plan of action to involve employees in the development of the PSM program.
Process Safety Information	Requires compiling written process safety information associated with a covered process and its technology.
Operating Procedures	Requires written operating procedures be available to employees operating affected equipment.
Process Hazard Analysis	Requires hazard analysis for each affected process.
Training	Mandates training for equipment operators and maintenance workers regarding the hazards associated within the process.
Pre-Start-Up Safety Reviews	Mandates safety review be performed on new and modified facilities to ensure all aspects of the PSM standard have been considered before operation.
Hot Work Permits	Requires a permit system to be used for welding and other spark-producing equipment.
Mechanical Integrity	Requires written procedures, training, and inspection criteria be developed for process equipment.
Management Of Change	Requires a written program be used to manage changes within the PSM process.
Compliance Audits	Requires employers to certify compliance with the standard every three years.
Incident Investigation	Requires employers to investigate incidents which resulted or could have resulted in a catastrophic release.
Emergency Planning & Response	Requires an emergence plan be developed for the facility.
Contractor Safety	Specifies responsibilities of both employer and contractor regarding proper safety training and demonstration of safe work practices
Trade Secrets	Hazards and safety information must be made available to employees and auditors

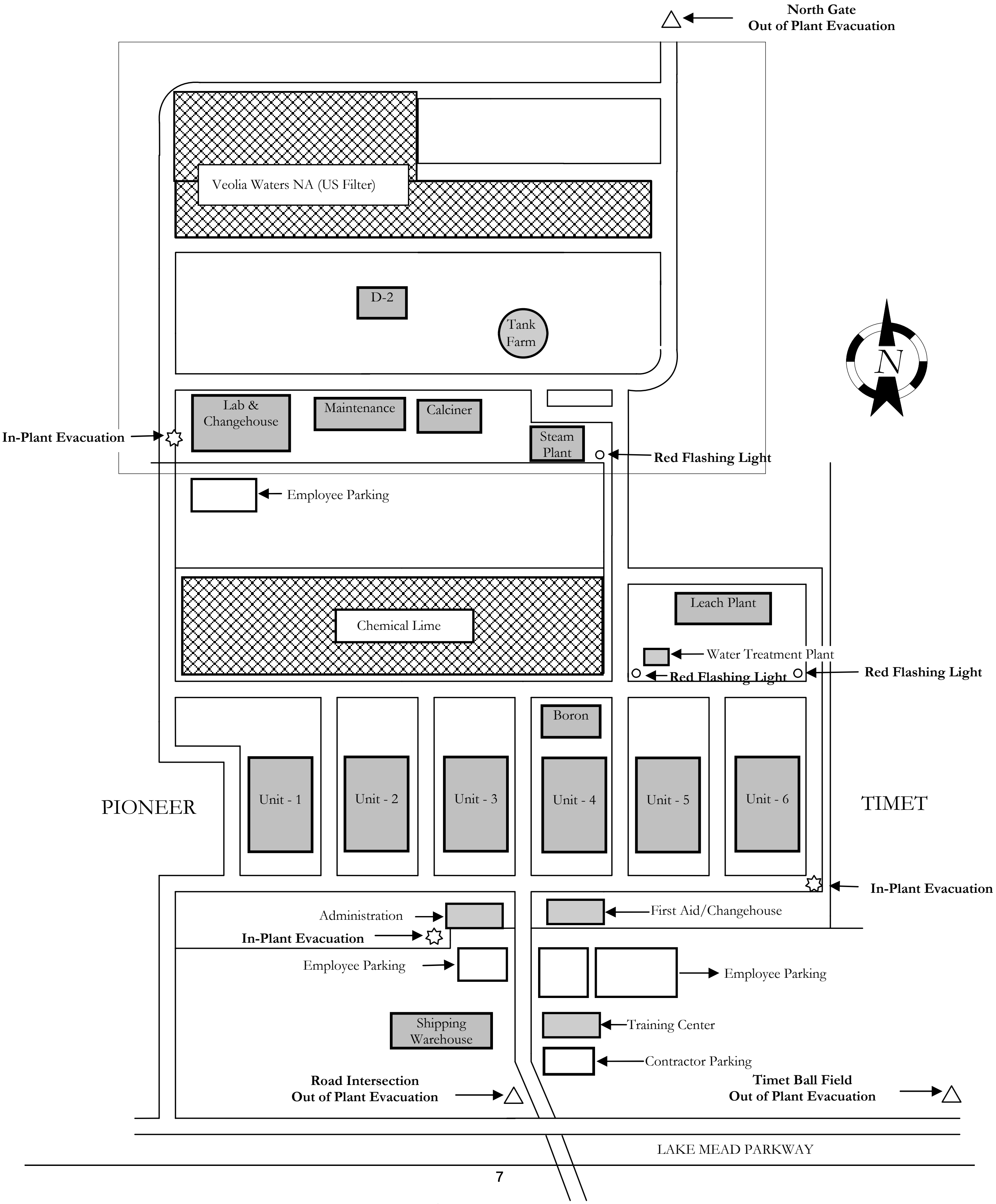
The standard also requires the contractor to:

1. Assure that each contract employee is trained in the work practices necessary to safely perform his/her job.
2. Assure that each contract employee is instructed in the known potential fire, explosion, or toxic release hazards related to his/her job and the process, and the applicable provisions of the emergency action plan.
3. Shall document that each contract employee has received and understood the training required.
4. Assure that each contract employee follows the safety rules of the facility including the safe work practices.
5. Advise the employer of any unique hazards presented by the contract employer's work, or of any hazards found by the contract employer's work.

PSM Chemicals

- **Boron Trichloride**
- **Chlorine**
- **Hydrogen Sulfide**

HENDERSON FACILITY LAYOUT



Not to scale

DRUG AND ALCOHOL TESTING

FOR PERSONNEL

Consistent with the Company’s ongoing effort to provide a safe work environment and to minimize the risk of personal injury, drug tests are conducted for the following:

- **Pre-employment**
- **Return to work from after being off more than 30 consecutive calendar days**
- **Random**

Drug test and/or alcohol test are conducted for the following:

- **Reasonable suspicion**
- **Accident/near miss**

A drug test consists of a chemical analysis of a urine or hair specimen for prohibited drugs. An alcohol test consists of a saliva test, a breath test or a blood test to determine the alcohol concentration in the body. The specimens will be collected by the Corporate Medical Director’s designee and tested by an independent laboratory. Any positive employee drug test or alcohol test will be reviewed by the Corporate Medical Director. A company employee is subject to discharge if a urine or hair specimen is confirmed positive for illegal or unauthorized drugs, if an alcohol test indicates a concentration level of 0.04% or greater, if the employee refuses to provide a specimen, or if the employee refuses to sign a form authorizing the test(s).

CONTRACTORS

Any contractor suspected of being under the influence of drugs or alcohol will be subject to immediate expulsion from the premises. Tronox will notify the contract company for further actions as needed.

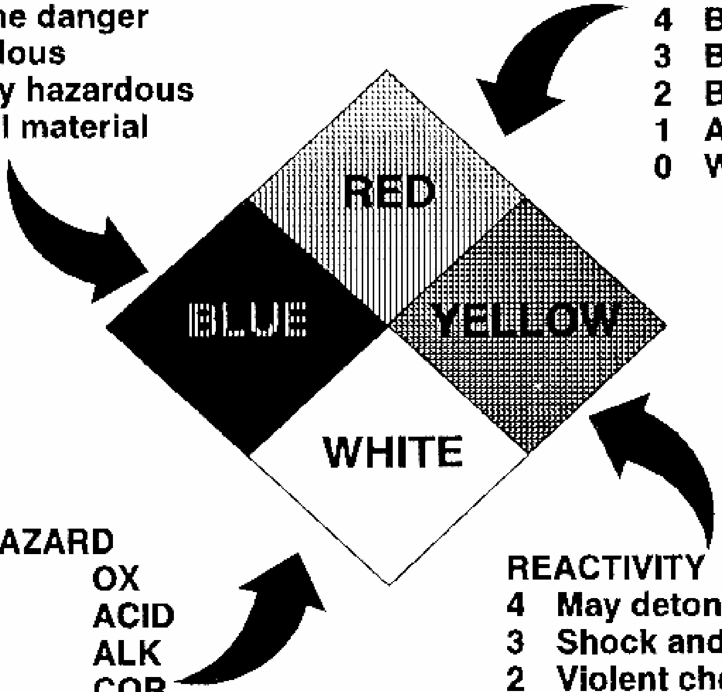
NFPA LABEL
(National Fire Protection Association)

HEALTH HAZARD

4 Deadly
3 Extreme danger
2 Hazardous
1 Slightly hazardous
0 Normal material

FIRE HAZARD
Flash Points

4 Below 73° F
3 Below 100° F
2 Below 200° F
1 Above 200° F
0 Will not burn



SPECIFIC HAZARD

Oxidizer	OX
Acid	ACID
Alkali	ALK
Corrosive	COR
Use NO WATER	~~W~~
Radioactive	☢

REACTIVITY

4 May detonate
3 Shock and heat may detonate
2 Violent chemical change
1 Unstable if heated
0 Stable

SAFETY PRACTICES

GENERAL

Safety Philosophy - The safety and health of all persons in the facility, as well as protection of the environment, will be given prime consideration in all operations and activities.

Responsibility for preventing incidents extends from the manager to the worker. Safety and environmental responsibilities, as assigned by management, must be fulfilled at all levels.

Infractions of established safety rules, failure to follow safety instructions, actions that endanger anyone, disregard for company property or property of others, failure to comply with posted signs or any failure to take appropriate action where such action may be reasonably expected, are subject to disciplinary measures up to and including exclusion from the facility, whether or not an injury results. Situations like those just described may also result in testing for the presence of drugs or alcohol depending on your company's policies.

Foolish acts done without apparent regard for reasonable safety considerations, whether prohibited by these rules or not, may result in exclusion actions.

You should take every opportunity to understand our plant conditions and learn the safe way to do your job.

Your supervisor will explain your duties but will not be able to explain every single detail of each of these duties in advance of each job; consequently, you will encounter situations, from time-to-time, where you will need advice. Never hesitate to ask for such advice. To proceed with an unfamiliar task without adequate knowledge of all factors involved could result in an incident that might injure you or a fellow worker.

Applicable local, state and federal codes and your safe work responsibilities are the minimum requirements. You are also required to follow all facility policies and procedures.

The BMI complex was built in the 1940s to manufacture the magnesium needed during World War II. After the war, BMI was sold to private industries. Some areas of the facility are no longer in use and are not maintained. Contractors should not enter these gated areas without an escort. This includes the upper floors of units 3, 4, and 5. When re-entering, the same route must be followed. Exploring unmaintained areas is not allowed. Older construction materials, such as lead-based paint and asbestos insulation, were used in the construction of the facility.

GENERAL SAFETY

Fighting on company premises is expressly forbidden.

Horseplay and practical jokes are not allowed; these acts frequently cause injuries.

Intoxicating alcohols, illegal drugs, and narcotics are prohibited in the facility. Reporting to work under the influence of liquor, or narcotics, or carrying these into the facility, is sufficient cause for exclusion from the plant.

It should also be understood that prescription or non-prescription drugs can sometimes make you unfit for work. Drugs which produce dizziness, drowsiness or affect your vision, for instance, *should not be used during work or taken within the active period of the medication prior to coming to work.*

Clean Shaven Policy - A clean shaven policy is required, based on the possibility of rescue from a toxic environment by means of a full-face type self-contained breathing apparatus. This unit must have a good positive seal on the wearer to prevent harm from outside toxic gases. The only allowable facial hair is a moustache or “soul patch” which does not extend into the sealing area of a face mask or a half-mask respirator. Generally this means that moustaches must be trimmed to the corners of the mouth. Beards or sideburns that enter the mask seal area of the face are prohibited. Exceptions to this rule can only be made by the Plant Manager or designee.

Be Alert! Avoid daydreaming. Keep your mind on your job.

Cameras or other photographic equipment are not permitted on the property without plant manager's approval.

PROTECTIVE EQUIPMENT AND CLOTHING

Personal protective equipment (PPE) is an important part of our safety and health program and must be worn while in the facility. **At Henderson, controlled areas are marked with red lines on the pavement.** PPE must be worn when crossing a red line to enter a controlled area. All PPE required for our facility must be supplied by the contractor.

Hard Hats of non-conductive material meeting ANSI standards must be worn by *all* persons entering the controlled area of the plant.

Safety Glasses with attached side shields must be worn at all times by persons in plant areas and laboratories; some office locations are exempt. Remember, these glasses offer only minimum eye protection. If approved by the Safety Department, safety glasses may be tinted but must also have side shields. Darkly tinted safety glasses must not be used indoors.

Special Eye Protection over and above conventional safety glasses is required for jobs when the eye hazard potential is high. Proper goggles, full-face shields or a combination monogoggle must be worn, as appropriate, when:

1. grinding, chipping, working with/around welding equipment
2. handling acids or caustics

3. working on equipment (tanks, pipelines, valves, etc.) that contains or has contained corrosive chemicals
4. doing any other work subject to flying particles, sparks or harmful materials or hazardous chemicals
5. entering yellow-chained areas.

Consult your supervisor for exact requirements for any job with potential eye hazards.

Hearing Protection appropriate for the job and the exposure must be worn. There are areas where hearing protection is required at all times, plus occasional jobs, such as operating a jackhammer, where this protection is also necessary. The type of protection and locations where hearing protection is needed will be specified by the supervisor in charge.

Clothing appropriate to the job shall be worn and shall include a shirt with sleeves (shoulders must be covered) and full-length trousers or coveralls. Loose sleeves, open jackets and flying shirttails must not be worn where such drapery may be caught in machinery, waved into flame, or dribbled in chemical or process solutions. Wearing jewelry should be avoided and some types of jewelry may be prohibited in certain areas, per supervisory discretion. Shorts are not allowed.

Protective Footwear is mandatory for persons performing work within the controlled area of the facility. At a minimum, protective footwear must meet ANSI Class 75 Safety Toe.

Contractors need to evaluate each job and provide protective footwear to meet the hazards of each job (i.e. electrical hazards, puncture resistant). Additionally, work involving flooded sumps, basements, acid, caustics, chlorates, perchlorate, etc. requires the use of *rubberized* protective footwear, through the use of a rubber boot with integral safety toe or rubberized over

Gloves - Suitable protective gloves must be worn when handling rough or hot materials. Impervious gloves must be worn when handling corrosive, caustic or otherwise hazardous materials. Gloves must not be worn at or around power machines where they are apt to be wound around or caught on moving parts.

Fitted Cartridge Respirators appropriate to the job and exposure must be worn for protection against dust, gas, or fumes. The type of respirator, cartridges, and locations where they should be worn will be specified by the supervisor in charge. *Each contract employee who uses a respirator must pass a medical certification exam, attend and pass a respirator training class and then successfully be fit-tested. Tronox does not provide the medical certification training or respiratory fit testing for contractors.*

Respirators should be cleaned after each use and stored in a clean, sanitary container. The type of respirator will be specified by your supervisor after consultation with the safety department.

Do not use a cartridge respirator in areas of major gas concentrations or where an oxygen deficiency exists. A self-contained breathing apparatus (SCBA) must be worn in these areas. If in doubt, check with your supervisor.

Self-Contained Breathing Apparatus (SCBA) units are located throughout the plant where toxic gas exposure is most likely to occur. These are to be used by trained personnel for entry, inspection, emergency and rescue work in contaminated areas. Emergency repair or shutdown work involving SCBAs must only be performed by persons with current training of these functions, per Hazwoper regulations. Yellow SCBA units have approximately 20 minutes of air supply. Green SCBAs contain approximately 45 minutes of air. Other five-minute type units (LSAs) are provided for escape purposes only.

Escape Respirators (mouthpiece or mouthbit) must be carried at all times by all persons when entering the Henderson facility inside the controlled areas. The only exception is carrying a half-mask respirator equipped with acid gas cartridges or a five-minute escape LSA. Escape respirators should be inspected at least monthly.

It is important to know the proper use and care of all available respirators. Make sure you have received the correct instructions from your supervisor. **Before using any protective device, make certain it's adequate and safe and that you thoroughly understand its use.** If in doubt, consult your supervisor.

EQUIPMENT

Contractors are not allowed to use company equipment. When using your own equipment, it must be operated properly. If you have not been trained to operate a piece of equipment, DON'T operate it! Avoid mishaps which could result should you try to operate machinery you don't understand.

Machine Guards have been installed on moving machine parts for your safety. The guard is useless unless it is in its proper place. Keep it there. If you must remove a guard to service a machine, have the machine shut down, locked out, and tested first. Remember to replace the guard before removing your locks.

Conveyors, belt conveyors, material hoists, forklift trucks and other material handling equipment are not to be used for passenger service.

Hand Tools must be right for the job, in good condition and used properly. Improper use of a good tool or use of a defective tool is a frequent cause of injury. Maintain your tools in good condition and turn in defective tools to your supervisor for repairs or replacement. ***All powered hand tools must be equipped with functional guards and/or protective devices, as recommended by the manufacturer. The company reserves the right to reject specific tools used by the contractor if they are not correct or are in poor condition.***

Even the right tool can cause injury when improperly used. Anytime it is necessary to apply force to a tool, place your hands properly and brace yourself to avoid injury in the event the tool slips or turns suddenly. ***Do not use a cheater or extension.***

Ladders must be in sound condition and securely placed. Inspect ladders before use. Do not use ladders with cracked or split side rails, cracked or broken rungs, or missing or defective feet. Defective ladders must be turned in to your supervisor for repair or discarded. Always face the ladder and maintain three points of contact when ascending or descending. Don't carry materials or tools up a ladder, use a hand line or other means and use both hands when climbing a ladder.

Metal ladders are not allowed in our facility due to multiple locations of possible shock hazards; only fiberglass or wood ladders are acceptable

Straight ladders must always be tied off. Have someone hold the ladder when first climbing to tie it off. Straight ladders must be equipped with traction feet and must be secured against slipping. When in use, the foot of a straight ladder should be one quarter of the ladder's length away from the vertical plane of the support. If using a ladder for access, the side rails must extend three feet above the access point. Be certain the object supporting the top of the ladder is strong enough to bear your weight.

Do not use a stepladder as a straight ladder. Always open a stepladder to its fullest extension and latch the spreaders before use. Do not stand on the top plate, top step or the step nearest the top of the stepladder.

REMEMBER! Unless specifically designed for this purpose, only one person at a time may use a portable ladder. A ladder is not intended to replace a platform or scaffold. Any work that is done from a ladder should be within easy reach. If you can't reach the work without moving your belt buckle beyond the edge of the ladder, move the ladder closer to the work.

Scaffolds must be adequately strong and located to provide safe access to the work. Do not store materials on a scaffold except those items currently in use. Scaffolds should be left in a safe condition at the end of each work day. Scaffold platforms must be accessed by integral or added ladders only. All scaffolds must have standard guardrails and toe boards. Scaffolds must be inspected by a competent person each day.

Manlifts are fixed vertical conveyor belts used by facility personnel. ***Contractors are not allowed to use manlifts. Note: these are not the same as aerial lift platforms such a "cherry pickers", manbaskets, or other mobile basket type lift equipment.***

PROCESS SAFETY MANAGEMENT (PSM)

The purpose of the OSHA PSM standard is to reduce the frequency and severity of potentially catastrophic chemical accidents involving certain highly hazardous chemicals.

The Henderson Facility has three chemicals that are covered by PSM:

1. Chlorine (Cl_2)
2. Hydrogen Sulfide (H_2S)
3. Boron Trichloride (BCl_3)

PSM ELEMENTS

EMPLOYEE PARTICIPATION: Requires a written plan of action to involve employees in the development of the PSM program.

PROCESS SAFETY INFORMATION: Requires compiling written process safety information to indicate hazards associated with a process and its technology.

OPERATING PROCEDURES: Requires written operating procedures be available to employees operating affected equipment.

PROCESS HAZARD ANALYSIS: Requires hazard analysis for each affected process.

TRAINING: Mandates training for equipment operators and maintenance workers regarding the hazards associated within the process.

PRE-START-UP SAFETY REVIEWS: Mandates safety review be performed on new and modified facilities to ensure all aspects of the PSM standard have been considered before operation.

HOT WORK PERMITS: Requires a permit system to be used for proper operation of welding and other spark-producing activities.

MECHANICAL INTEGRITY: Requires written procedures, training and inspection criteria be developed for process equipment.

MANAGEMENT OF CHANGE: Specifies a written program be used to manage changes within the PSM processes.

COMPLIANCE PSM AUDITS: Requires employers to certify compliance with the standard every three years.

INCIDENT INVESTIGATION: Requires employers to investigate incidents which resulted or could have resulted in a catastrophic release.

EMERGENCY PLANNING AND RESPONSE: Requires an emergence plan be developed for the facility.

CONTRACTOR SAFETY: Specifies responsibilities of both employer and contractor regarding proper safety training and demonstration of safe work practices.

TRADE SECRETS: PSM information must be made available to employees and auditors

The standard requires the contractor to:

1. Assure that each contract employee is trained in the work practices necessary to safely perform his/her job.
2. Assure that each contract employee is instructed in the known potential fire, explosion, or toxic release hazards related to his/her job and the process, and the applicable provisions of the emergency action plan.
3. Document that each contract employee has received and understood the training required.
4. Assure that each contract employee follows the safety rules of the facility including the safe work practices.

5. Advise the employer of any unique hazards presented by the contract employer's work, or of any hazards found by the contract employer's work.

SAFE WORK PERMITS

Confined Spaces - DO NOT enter a confined area, tank, vessel, manhole, etc., without first obtaining a Confined Space Entry Permit from a Tronox representative. A permit will only be issued for contractors who can provide proof of training for each entrant/attendant, approved safety equipment and a trained attendant. A Confined Space Entry Permit must be prepared in advance and posted at the job site. If, you are acting as an attendant for a confined space activity and you observe the entrant become unconscious or injured, ***do not enter the tank***. Contact the Confined Space Rescue Team.

Ground Breaking must not be done before the Ground Breaking Permit is obtained from a Tronox representative. Barricades must be provided for fencing off the work area. Concrete or asphalt breaking at ground level or breaking into walls also requires this permit. Some types of excavation must be inspected by a competent person. The contractor must provide this daily inspection for excavation as required by their contract.

Line Breaking - No opening pipelines or disconnecting pumps will be done without first obtaining Line Breaking Permit from a Tronox representative.

Sandblasting will not be done without first obtaining a Sandblasting Permit from a Tronox representative.

WORK METHODS

The Supervisor in charge of the job carries the responsibility of ensuring that safe work procedure instructions are given before a job starts. Your supervisor should also identify nearby chemicals, hazards and safety equipment. Be sure that you understand these instructions. Let your supervisor know that you understand. **If you are not sure, *ask your supervisor.*** If you feel that a procedure is not safe, check with the supervisor before you start the job. If you still feel the procedure is not safe after discussing it with the supervisor, use the chain of command for further consultation or contact the Tronox contract representative, Safety Department, Production Manager, or Plant Manager.

Before and during the job, consider the safety standpoint to help eliminate any hazards that might be present. "TAKE TWO" minutes to think the job through before starting.

Housekeeping is the duty of each contractor. Keep work areas orderly and clean so you can work safely and efficiently. Put items away when you are finished using them. Keep floors, stairs and passages free of product, water, oil, waste materials, pipe, hose, welding rods, etc. Clean any spillage as soon as possible in accordance with plant environmental procedures. Good housekeeping and safety go hand in hand. Do not run electrical cords through doorways unless the cord is protected, the door is securely blocked open, and the cord does not present a tripping hazard. All spills must be reported to the contract representative immediately.

Keep Passages Clear. Place materials and equipment clear of aisles, exits and stairs. Observe aisle markings. Adequate passageway ensures efficiency and safety. Safe exits from work stations must be maintained by all employees. DO NOT BLOCK safety equipment, such as eyewashes, safety showers, SCBAs, etc.

Warning Signs, danger tags, barricades and red lights are placed for your safety. Observe them. When equipment controls bear "*Do Not Operate*" tags, the equipment must not be operated. Do not remove warning notices or devices such as protective locks, tagout signs, etc., unless you are authorized to do so. Signs "*Tank Car Connected*" or "*STOP - Man Working*" must be placed on or ahead of all tank cars being loaded or unloaded, and a chock must be placed on a rail immediately in front of one wheel when the car is parked on a grade. Derails are required ahead of rail cars being unloaded.

Two types of barricade tape - yellow "CAUTION" and red "DANGER" tape - are used in the plant. The rules for barricade tape are the same as for traffic lights: yellow cautions you to slow down as you cross, and red indicates don't cross at all, unless accompanied by a person conducting the work inside the barricaded area.

Stairs are walkways, not runways. They are provided with handrails. Walk both up and down using the handrail and watch your step. Do not drag heavy items down the stairs. This abuses them and makes them defective. Report defective stairways to your supervisor. Remember, an inclined ladder is not a stairway; you must face the ladder when going up or going down.

Unsafe Conditions need to be corrected promptly. If you cannot correct the condition, report it to your supervisor at once. Be careful where conditions are unfavorable. Use whatever precautions are necessary to avoid injury to yourself, your fellow workers or the equipment.

Caution! Use extra caution when entering areas of the plant that are not maintained. Do not enter these areas without the express permission of your supervisor. This includes, the upper floors of units 3, 4, and 5.

Heat - In hot weather, drink plenty of water, even if you don't feel thirsty. This will help prevent heat exhaustion. Attempt to schedule strenuous outdoor work during early morning hours. Cool down, if needed, during hot jobs. Dizziness, headache or lack of concentration are signs that you may be too hot and need to take a break.

Smoking in the facility is restricted and allowed only in designated areas, within three feet of a cigarette receptacle (“butt can).

Short Cuts must be avoided until you *know* they are safe. Always check with your supervisor first. Use the proven and safe work method.

Lifting shall be done properly to avoid injury. Don't overestimate your strength. If the load is too heavy, get help. Use mechanical hoisting equipment where needed.

If you must lift manually, follow these procedures:

1. Face the object squarely and get as close to it as you can.
2. Balance yourself solidly, with one foot slightly forward.
3. Squat, bending your knees
4. Keep your back straight and as upright as possible, and keep your head up.
5. Grip the object firmly.
6. Take a breath, hold it, then tighten your abdomen.
7. Keep your back straight and use your legs to come to a standing position.
8. Make the lift smoothly and under control. Never jerk an object, handle or valve in an attempt to move it.

Carry Tools Safely in a tool box, bag or bucket, as needed. Do not overload pockets. Do not carry sharp-edged tools in pockets or where they can scratch you or anyone else. Use both hands to climb a ladder and pull tools up in a container with a hand line. Keep them secure from falling.

Working Aloft. Any job requiring working aloft must be reviewed first with the Tronox contract representative. Before you go aloft, see that you have a safe way to get up and down. Provide for a work station aloft that is safe and adequate for the task. Keep tools and materials secured against falling or blowing off. Hoist them safely - do not throw them up. Materials shall not be thrown down.

Remove barricades as quickly as the need for them has passed. Failure to remove idle barricades creates a disrespect for all barricades.

Fall protection must be worn according to OSHA regulations. When fall protection is worn, the life line must be securely fastened to the building, structure or safety cable designed for that purpose. The life line should be the shortest length that will permit the work to be performed so that in event of a fall, the fall shall be as short as possible. Work from an aerial lift whenever possible, as opposed to climbing on structures or pipe racks. A full-body harness is required for fall protection.

When working aloft from an aerial lift, you must use a full body harness and lanyard secured to a basket. You may exit an aerial lift device only after securing your safety lanyard or life belt to the structure you are stepping onto. Double lanyards are designed for this purpose. This may be done *only* if this is the last resort for safe access to the area. You may climb over handrails *only* after attaching the safety lanyard to the rail or nearby equipment. Handrails are not to be used as work platforms.

Never walk under the raised forks of a forktruck or the load of a crane. Where rigging is in progress, avoid the bight of the line; that is, stay away from any area which could be subject to the violent snap back resulting when a line under tension fails. Always watch where you are going. Use tag lines whenever possible to maneuver loads

Welding, cutting, grinding, or other spark-producing activities will not be done outside of designed maintenance shop areas without having been issued a “hot work permit” and having a charged water hose at the job site that is manned by a "fire watch" person. Note: If other fire-extinguisher is used instead of a water hose, the fire watch must be trained in that equipment. Eye protection, as specified by the supervisor, must be worn for *all* welding, cutting or burning operations. When any burning, cutting or welding is to be done overhead, employee exposure below the work area should be prevented by barricade tape. Pant legs should cover boot tops to prevent slag from entering the boot.

Electric Welding must be done with shield(s) in place to avoid possible injury to the eyes of personnel in the area. Occasionally, there may be unshielded areas in overhead locations where shielding is impossible; in these cases, avoid looking at the arc and try to stay at least twenty feet away. Mechanics or others who must work close to a welder's arc must wear special colored goggles. Continued exposure to the ultraviolet rays from arc welding can result in "sunburn."

Check all welding cables for worn or cracked insulation. Replace or make adequate repairs to defective cables immediately. Welding leads should be covered with boots or a hinged cover when they are attached to welding machine.

Keep welding cables from contacting steel wire or slings used in hoisting operations. Electric current from a defective welding cable can seriously damage steel wire cable, causing it to fail. ***Active welding cables must never be allowed to run through water.***

Gas Welding cylinders must be stored away from heat sources and properly secured at all times to prevent falling. Valve protection caps must always be in place, hand tight, except when cylinders are in use or connected for use. Cylinder valves must be closed after the job is finished and regulator adjustments backed out. If cylinders which are not secured in a cart must be moved, the cylinder valves must first be closed, regulators removed, and *valve caps put in place*, hand tight. Valves of empty cylinders must be closed. Handle cylinders carefully. Don't drop or otherwise damage the cylinder. A rupture might result and a ruptured gas cylinder will act much like a high-powered rocket. Keep all gas cylinders secured with chains in an upright position and separated when stored. Oxygen cylinders must be kept twenty feet from flammables. All cylinders must be stored well clear of traffic pathways.

Keep cylinders far enough away from the welding operation so sparks, slag or flame will not reach them. Be careful not to place cylinders where they may become part of an electrical circuit. Never use a gas cylinder for any purpose other than that for which it was intended; they are not rollers or supports. Defective or leaking cylinders should be removed to an isolated outdoor area, tagged and the supplier notified. Keep oxygen cylinders, valves, couplings, regulators, hoses and apparatus away from oily or greasy substances. Oil or grease can ignite violently on exposure to high concentrations of oxygen. Do not handle the cylinders or apparatus with greasy hands or gloves. Do not allow a jet of oxygen to strike an oily surface or oily clothing. Oxygen, acetylene, propane bottles are never allowed inside a confined space.

All hoses and hose couplings must meet industry standards. No homemade or non-standard hose couplings are allowed in the facility.

Anti-backflow and anti-flashback devices are required at both the torch and regulator connections.

Oxygen/acetylene is the only fuel gas combination allowed without permission from the Safety Department..

Switch Boxes are for electrical gear exclusively, and are not typically operated by contract personnel. They are not cabinets to store lunch, tools, notes, etc. Keep switch box covers closed except when necessary to renew fuses or make repairs. Replace covers at once! Only authorized persons with proper tools shall change fuses.

Circuit breakers or switchbox doors will be kept closed when the circuit is closed. When operating a knife breaker handle to open or close a circuit, stand well to the right of the box with your face turned away from the box and operate the handle with your left hand. Avoid arcing within the box by throwing the handle quickly into either the open or closed position. Never operate switch handles while standing on a wet floor or while holding any grounded object. Do not change blown fuses unless you are an authorized maintenance person or otherwise authorized.

Keep the floor area within thirty inches of electrical boxes and breakers clear of obstacles. All boxes and switches should be marked as to function. All active conduit openings should be covered.

Portable Electric Tools and Equipment - Unless definitely identified as being the double-insulated type, portable electric tools and equipment must be provided with three prong grounded plugs. When working with one of these tools, be sure it is properly grounded. Never use a "cheater" to plug into two-wire extension cords (three-wire extensions are provided). Avoid standing in water or grounding yourself on a pipe or other metal. Electric tools must be unplugged when left unattended. Always tag out any damaged or frayed electrical power tools.

Use of grounded portable equipment may create additional hazards in the Unit 5 and Unit 6 cell floors. Portable equipment used in these areas is preferred to be pneumatic, cordless, or double-insulated. Consult the Tronox electrical department if you have questions.

Steam, Hot Condensate, or Other Hoses must always be attended or firmly secured when running. Turn on and off carefully; the kickback from a high pressure hose can cause a fall. Tie or wire hoses in place (laying a wrench, hammer, etc. on a hose does not secure it firmly). *Never use a water or air hose for steam use.* All Chicago fittings must be secured with safety clips. NEVER RUN OVER A HOSE; this will damage and weaken the hose.

Compressed Air above 30 psi must not be used for cleaning. A pressure relief blow tip must always be used. Do not use compressed air to clean skin or clothing.

Valve Injuries may be avoided if you take a few simple precautions:

1. Never operate any valve unless you are specially authorized to do so by a Tronox company representative.

2. Never operate any valve unless you know what is contained in the line and where the line goes.
3. If the valve is stuck or difficult to turn after reasonable effort, inform your supervisor to ensure that the valve is serviced.
4. Use the correct size of wrench and one that is in good condition.
5. Position yourself properly so that you will not fall if the wrench slips or the valve turns suddenly. Don't reach out. Get a ladder, if needed. Use lifting principles, avoid back strains.
6. Be alert to close clearances so that your hands will not be injured if the valve turns suddenly.
7. When using a wheel wrench on a valve wheel, engage the wrench at the wheel's spoke so that the wrench cannot slip.
8. Whenever possible, stand to one side of the valve in case it should spray liquid from around its stem.
9. Prepare the valve. Ensure that plug valves (grease type) are adequately lubricated. Wash out the bonnet and seat on gate valves and brush them with compatible penetrating oil, where necessary. Gate valves must also be turned back slightly from the full open position to prevent them from future seizing.
10. The threads of the stem of a rising-stem gate valve are very sharp. When operating this type of valve, move your hands in a short arc so your forearm does not come into contact with the stem. Do not spin the wheel with one hand as you may cut your wrist on the rising stem.
11. Never shut off the inlet or outlet valves on a pump that will continue to run or could start with both valves closed. The overheating caused by this action could cause a rupture.

Emergencies - Keep a cool head in an emergency. Know the locations of safety shower/eyewash stations, escape respirators, first aid stations and fire extinguishers. Dial **3333** on any in-plant phone or contact a Tronox employee to report an emergency to Security Control.

VEHICLES

Contractors are not allowed to use any Tronox vehicle unless authorized by a Tronox representative.

Vehicle Checklists - Check any motorized vehicle you may be using each day before operating the equipment. Report any defective equipment to your supervisor at once. All vehicles must be maintained in good operating condition with clean windshields.   Security will inspect all vehicles prior to plant entry.

Contractors should minimize the number of vehicles entering the facility.

Right-of-Way must be yielded to pedestrians. Pedestrians cannot always hear your horn or back-up bell. Never back up without first checking to be sure the area behind you is clear.

Traffic Signs - STOP, one-way and other traffic signs must be observed. Stay within established speed limits. The maximum speed limit is 20 MPH, but many areas are posted at a slower speed.

Approach railroad tracks cautiously; give the trains the right-of-way since they cannot stop quickly. Be on the lookout for switch engines and cars which are moving independently of the engine. Park clear of railroad tracks, roadways, building entrances and passages. Never park on railroad tracks.

Drive into or out of buildings or blind corners with extreme caution, stopping at entrances or exits and sounding your horn before proceeding.

Tie, block or otherwise firmly secure moveable freight you are carrying. If you carry long lengths of pipe, steel stock, lumber, etc., tie a red flag on the outboard end of the load and proceed with caution. *Stay within the load limits of your vehicle!*

Always set the brakes of your vehicle and/or leave it in gear and turn off the engine before leaving it unattended. If necessary, block the wheels. Lower forks to the ground.

Fork trucks should be run with the forks or pallet about six to eight inches off the floor. When carrying a load, go up-grade with the load ahead of you and down-grade in reverse so the load is on the uphill side. Never travel with the forks or load in the raised position. Passengers must not ride on the forklift or forks.

Passengers in trucks are restricted to these positions:

1. In the cab, seat belts must be worn at all times
2. Sitting down in the bed of a pickup with the tailgate closed. Do not lean against the tailgate!
3. On seats firmly attached and adequately railed. No riding on loads, on top of side rails, on top of the cab, on top of the wheel wells, on the running boards, fenders or hood or with legs hanging over the end or sides.

Smoking is not allowed in any vehicle.

ACCIDENTS/INJURIES

Accidents or near misses will be investigated to determine the cause and to make recommendations to minimize chance of recurrence.

Injuries - All on-the-job injures, however minor, ***must be reported to your supervisor immediately***. It is in your interest to report injuries promptly in order to secure proper treatment and to prevent infection or other complications. *As a courtesy, Tronox medical responders will provide initial first aid, if desired. Referrals for further medical care may be given.*

If you should be splashed with acid, caustic or any other harmful chemical, wash it off immediately! Use plenty of water for at least fifteen minutes, removing any contaminated clothing. This action is very important because it can greatly reduce the seriousness of a chemical burn. Seconds count - DO NOT WAIT!

Treat thermal burns in the same manner. Wash burned areas with cool water for fifteen minutes or until medical treatment is obtained. *Never put ointment on the burned area regardless of whether it is a chemical or thermal burn!*

Incidents - Near miss incidents (close calls) or incidents with property damage must be reported for investigation. As with injury incidents, the goal of the investigation is the find causes so as to minimize the chance for recurrence. You will further the cause of your own safety by honest and intelligent answers to questions.

INCIPIENT FIRE FIGHTING, FIRST AID EQUIPMENT & RESCUE WORK

An efficient fire prevention program must be maintained in order to prevent personal injury and property damage resulting from fire. Good housekeeping is vital. Keep rubbish, rags, etc. cleaned up. Remember, nearly all fires start small. They usually become serious only if they go unnoticed or are not responded to properly and promptly. Contractors are not asked to respond to fires unless they have received proper fire extinguisher training.

Equipment for incipient fire fighting, first aid, and self rescue is available and you should learn where the equipment is located and how it is used. You should also know how to sound a fire or other emergency alarm. First aid should not be attempted unless you have been properly trained.

Safety equipment must be kept in proper condition and accessible for instant use. Be sure to report to your supervisor the use of any of this equipment so that it can be serviced and ready for use in the next emergency. Rescue should only be conducted by trained personnel.

Fire fighting equipment shall not be used for any purpose other than for fighting incipient stage fires, and shall not be removed or changed without proper authority.

Be sure you know how to use the fire extinguisher, but remember, it's only a handy tool to help control an incipient fire **after** you've sounded the fire alarm and evacuated others to safety.

1. Never use water or water-type extinguishers to fight an electrical fire or you may receive a fatal electrical shock. Halotron, carbon dioxide or dry chemical extinguishers should be used for electrical fires or for fires with flammable liquids, oils, gasoline, grease, paints or similar materials.

2. Never use water or water-type extinguishers on boron trichloride (BCl_3) leaks or on magnesium or titanium fires (see the section on magnesium).

When an emergency arises, stay away from the site. Do not add to the problem by increasing congestion in the affected area or by placing yourself in a position where you may be injured. The Security Officer/EMT will be in charge of medical care. SEE THE BACK OF THIS BOOKLET FOR INSTRUCTIONS ON HOW TO CALL THE FIRE DEPARTMENT, MEDICAL EMERGENCY RESPONSE TEAM OR AMBULANCE.

PLANT CONDITIONS & CHEMICALS

Hazardous Substances are handled SAFELY in our plant because we insist on strict adherence to safety rules and procedures that have been established for the handling of such materials.

Hazardous substances which should be treated with caution, care and respect and which exist in the plant in quantities are: manganese dioxide, boron trichloride, sulfuric acid, caustic soda, hydrogen sulfide, chlorine, soda ash, hydrated lime and magnesium powder. Other materials which you may encounter in the plant and are hazardous under certain conditions are: natural gas, silica sand, filter aid, manganese sulfate solution, anolyte solution, cell feed, nitrogen and carbon monoxide. Small quantities of a large number of potentially hazardous chemicals are stored and used in our laboratory. These, too, should be treated with total respect and care.

Under no circumstances shall an individual work with any chemical without training on proper safety and handling requirements. Should your work involve handling any of these materials, their containers or piping, make sure you know the hazards involved and the proper handling methods by referring to the MSDS for that chemical. Check with your supervisor for proper instructions if you're not sure. The Tronox contract representative will advise the contract supervisor of the chemicals in the work area.

WEAR PROTECTIVE EQUIPMENT! Always wear chemical splash goggles when there is potential for splashing chemicals. Your regular safety glasses are not enough. If the eyes are exposed to corrosive or caustic chemicals, wash them with large quantities of water for at least fifteen minutes and then notify your supervisor and obtain first aid or medical care at once.

Chemical cartridge respirators are worn by anyone who might be exposed to low concentrations of objectionable gases. For heavy concentrations or for emergency use, self-contained breathing apparatus are available for trained individuals only. Like any equipment, respirators need good care and maintenance if they are to be serviceable when needed. Such care is the responsibility of the person to whom the chemical cartridge respirator is issued. Use the proper respirator for the conditions. *Don't use dust masks to filter out gases or fumes. Don’t use disposable dust masks where tight fitting respirators are required.*

Emergency showers and eyewash fountains have been located in areas where hazardous materials are stored or used in quantity. Knowing the location of showers and fountains will save valuable time if they are needed.

Safety devices such as safety valves and rupture discs must be kept in proper working condition. Have broken rupture discs replaced immediately.

When handling, transferring, disconnecting lines, cleaning tanks, repairing leaks or otherwise exposing yourself to hazardous chemicals, be sure you use the proper safety equipment. Your supervisor can give you specific instructions as to what safety precautions to take.

Do not wash your hands in flammable solvents. Absorption of these liquids though the skin can cause illness or industrial dermatitis. Do not add other solvents to parts washer vats. Consult a Tronox employee before using parts washer.

Chemical Releases and Environmental Spills must be reported immediately. Hazardous chemicals are handled in this facility and acts resulting in the release of any of these to the environment may result in the injury of an individual, a member of the surrounding community and/or an environmental impact. It is the responsibility of each person completing a task in this facility, to understand what the impact or result will be of the task. If there is any question the contractor should contact their company representative or the company environmental department.

In addition, this facility operates as a zero discharge facility. There will be no unauthorized releases of material into the air, ground, water, or sewer (including storm drains and the sanitary drains). Please contact the company environmental department immediately if a release does occur. EPA can hold an individual (either a company employee or a contractor) personally liable for damages resulting from a release that is not reported.

SPECIFIC CHEMICAL INFORMATION
*** Denotes a PSM Chemicals

***** BORON TRICHLORIDE (BCl_3)** - reacts violently with water. The liberated fumes are highly corrosive and irritating. Personnel handling or exposed to this chemical should wear eye, face, hand and body protection. Personnel exposed to the concentrated fumes should shower immediately and change into fresh clothing since clothing absorbs the fumes rapidly. Clothing contaminated with BCl_3 liquid should be removed immediately. Skin contaminated with BCl_3 liquid should be wiped dry before attempting to rinse the skin.

If even a very small quantity of this chemical comes into contact with the eyes, irrigation with large quantities of water should be initiated immediately and continued for at least fifteen minutes. DO NOT ATTEMPT TO DISPOSE OF THIS CHEMICAL BY POURING INTO WATER OR INTO A SINK DRAIN. THIS MAY CAUSE AN EXPLOSION! DO

NOT SPRAY WATER ON BCl3 EVEN THOUGH IT APPEARS TO BE SMOKING.

CARBON MONOXIDE (CO) - is a poisonous gas and its mixtures with air can be flammable and possibly explosive. It is odorless and tasteless and ordinary cartridge respirators are not good protection. Self-contained breathing apparatus (SCBAs) will provide protection.

Symptoms of mild carbon monoxide poisoning include headache, unconsciousness, convulsions, accelerated breathing and discoloration of the skin, usually a bright red.

For carbon monoxide poisoning victims, immediate first aid is important. Remove the victim to fresh air, keep lying down and reasonably warm with blankets. Trained personnel may begin artificial respiration or may administer oxygen as dictated by the patient's condition. Call **3333** as soon as possible.

CAUSTIC SODA (sodium hydroxide, NaOH) - causes severe burns to skin and eyes. Avoid any contact. Harmful if swallowed.

Wear all necessary personal protective equipment. Caustic dust will burn if it settles on the skin when perspiring. Mists, vapors and dusts of caustic soda cause skin burns and severe damage to delicate eye tissues. Inhalation can cause damage to the upper respiratory tract and lung tissue. If any form of the chemical comes into contact with the body, wash immediately with large amounts of water. If the eyes are involved, wash them *at once* (seconds count) with large quantities of water for a minimum of fifteen minutes. Hold or have someone hold the eyelids open so that water can reach the eyes. Again, what you do in the first few seconds in getting water to the eyes counts. Get medical attention immediately after eyes have been washed. *Chemical splash goggles must be worn inside all yellow-chained areas.*

***** CHLORINE** (Cl_2) **-** is a hazardous liquid and gas under pressure. Chlorine vapors (gas) are irritating to eyes, mucous membranes and respiratory system. Upon contact, liquid chlorine will produce "burns" to the skin. Wear all necessary personal protective equipment when working with chlorine, including suitable respiratory protection.

If chlorine comes in contact with the skin, the emergency shower should be used immediately. Remove clothing while showering and continue washing. If chlorine has contacted the eyes, flush eyes continuously with large quantities of water for at least fifteen minutes. Hold eyelids open so water may get to the eyes. Get medical attention.

For repsiratory exposure, trained personnel may begin artificial respiration or may administer oxygen as dictated by the patient's condition. Call **3333** as soon as possible.

FILTER AID (perlite or diatomaceous earth) - when inhaled over long periods of time may be harmful. A respirator must be worn when this material is handled.

LIME (calcium oxide, CaO) - is caustic and can cause dermatitis. Fine dust is irritating to the eyes, mucous membranes and upper respiratory tract. Use the same precautions as for caustic soda.

***** HYDROGEN SULFIDE** (H_2S) - is a potentially deadly gas with a characteristic rotten egg odor at low concentrations. The characteristic odor is not a reliable warning since it is not possible to judge the concentration by the odor. Hydrogen sulfide has a paralyzing effect on the sense of smell so the dulled olfactory nerves will not register the presence of this gas after prolonged exposure or in higher concentrations.

Explosive limits of the gas are 4.3 to 46% by volume in air. Hydrogen sulfide is fatal in low concentrations and the established working procedures must be observed. A concentration as low as 0.025% (250 ppm) will produce perceptible effects in two to fifteen minutes and a concentration of 0.1% (1,000 ppm) can be fatal with a single breath..

In case of collapse due to hydrogen sulfide, remove the victim to fresh air but do not expose yourself to the gas. Trained persons should wear a self-contained breathing apparatus (SCBA) before attempting rescue and have a back-up person also with an SCBA. Immediately secure additional help and begin mouth-to-mouth resuscitation if trained. If breathing has stopped call **3333** immediately and advise them that a resuscitator is needed. Mouth-to-mouth resuscitation should be continued until the mechanical resuscitator is ready for use.

Those working in and around the sulfiding area of the manganese dioxide leach plant must be aware of the dangers of hydrogen sulfide and understand the alarm system which calls attention to unusual conditions. All but routine operations in this area require special precautions and training. Personal H_2S monitors are required in some parts of the leach plant. If the H_2S evacuation siren sounds while in the leach plant, use your mouthpiece-type escape respirator and proceed cross wind out of the area IMMEDIATELY.

LPG (Liquefied Petroleum Gases) are used to power fork trucks and other equipment in our facility. LPG is heavier then air, so leaks can travel long distances on the ground to an ignition source. Contractors are not allowed to fill their tanks or vehicles at our LPG filling stations. Only persons with specific training may operate these fill stations.

MAGNESIUM METAL (Mg) - is highly flammable when exposed to flame. Magnesium fires burn with a sputtering hot flame and may eject burning particles. The material must be kept away from water and moisture. Water and CO_2 extinguishers MUST NOT be used on magnesium fires. Metal-X powder, dry sand or soda ash should be used. These dry materials should be spread over the fire until it is completely blanketed. Smoking is prohibited in areas where magnesium is stored or used.

MANGANSE DIOXIDE (MnO_2) **-** Most dusts in the plant present no significant health hazard; manganese dioxide dust is an exception. It can be harmful if higher than acceptable limits are breathed or swallowed. In most MnO_2 locations, the occasional small amount of dust presents no health hazard; however, it should be stressed that while performing certain operational or maintenance jobs, use of a fitted respirator with particulate cartridges is mandatory. These locations will be pointed out by your supervisor. Sweeping or shoveling manganese materials requires the use of a tight fitting respirator. Personal cleanliness is also important in all plant areas. Wash your hands before eating or smoking. Wear sufficient clean clothes to protect your skin from dust which, in some cases, may mildly irritate the skin. Bathe after each shift. Lunch areas must be kept clean to protect your health. Open wounds must be protected from manganese dioxide dust to minimize chance of infection.

NATURAL GAS - is highly flammable and a dangerous fire hazard. In heavy concentrations it will displace the oxygen (air) you breathe and may cause suffocation. Our gas is odorized! Any leakage must be corrected promptly. **CAUTION: Natural gas is lighter than air. Hot tapping of gas lines is not allowed, except with special authorization from the Plant Manager or designee.**

NITROGEN (N_2) - is used in the plant. The air you breathe consists of about 79% nitrogen by volume and 21% oxygen by volume. The only danger from inhaling or absorbing nitrogen lies in diluting the oxygen of the air to a point so low that it can no longer sustain life and, in effect, causes asphyxiation (suffocation). Therefore, in any area of the plant or in a tank, vessel or enclosed space where nitrogen has been introduced (e.g. purging tanks of hazardous gases), care must be exercised to ensure the area contains air fit to breathe. The Confined Space Entry Permit must be effected before entering a confined space. Liquid nitrogen will cause severe "freeze burns" if it contacts the skin. Nitrogen gas has no odor and cannot be detected by sense of smell.

SILICA SAND (Hi-Sil) - when inhaled over long periods of time may be harmful. A fitted respirator with P100 (cartridges) or SCBA must be worn when this material is used..

SODA ASH (sodium carbonate, Na_2CO_3) - primarily is a skin irritant and dusts are moderately irritating to the nasal membranes. Solutions of soda ash are caustic. To be on the safe side, treat as if you were handling caustic soda (sodium hydroxide).

SOLVENTS - Various selected solvents may be used for particular equipment cleaning functions. Chlorinated solvents are often chosen because they are nonflammable and have low toxicity ratings. Some solvents (such as kerosene and paint base spirits) are flammable and therefore are fire hazards. For fighting this type of fire, use dry chemical or CO_2 extinguishers. Nearly all solvents are toxic to some degree and you should avoid prolonged contact with the skin or breathing vapors. Solvents should only be used in well ventilated areas. When required, use proper personal protective equipment. After handling, wash skin thoroughly. For eye contact, wash very thoroughly with water for at least fifteen minutes and get medical attention. Obtain instructions from your supervisor prior to solvent use. Do not use gasoline as a solvent.

SULFURIC ACID 70-98% (H_2SO_4) - is received in tank trucks and transferred to tanks. It may react with certain metal to generate hydrogen, a highly flammable and potentially explosive gas.

Avoid smoking or striking a spark in the immediate area of sulfuric acid trucks, tanks and equipment. Do not weld on sulfuric acid tanks or pipelines without specific approval and instructions from your supervisor.

Wear all necessary personal protective equipment when there is potential exposure. Avoid contact with sulfuric acid, especially to the eyes. When sulfuric acid is being transferred, as from a tank truck to storage, extra protective equipment must be worn. Follow established procedures. Consult your supervisor when in doubt.

In the event sulfuric acid comes in contact with the body, immediately wash it off with large quantities of water. Remove contaminated clothing under running water and continue washing. If the eyes have been exposed, wash immediately with large quantities of water for at least 15 minutes. Hold eyelids open so water may get to the eyes. *What you do in the first few seconds is important!* Obtain medical attention after exposed areas have been thoroughly washed.

TITANIUM METAL - if ignited, cannot be extinguished by water. Metal X (Class D) extinguishers, salt or sand may be used to contain titanium fires. If beyond incipient stage, prevent fire from spreading to nearby materials

OTHER CHEMICALS not specifically mentioned here, must be handled safely. Again, if you do not know the hazards involved, consult your supervisor or the MSDS.

COMMON HAZARDS - Make every effort to avoid the common hazards which you will encounter in day-to-day operations: burns from steam and hot water (condensate) can cause painful annoying injuries; air and nitrogen under high pressure from jets or valves can be dangerous; and water, oil, grease or ice on the floor makes it slippery and could result in serious injury - remove and eliminate the cause of ice formation wherever possible.

FINAL NOTE

If in doubt of any safety rule or plant procedure, ask your supervisor , contract representative, or the Safety Department *before* proceeding with the job!

HENDERSON
EMERGENCY NOTIFICATION

IN CASE OF FIRE

A. Ensure a safe route of escape for yourself and others.
B. Dial **3333** to contact Security Control and state the plant location of the fire or emergency
C. The Security Officer will call the Clark County Fire Department at 911.
D. Try to extinguish or keep the incipient fire from spreading by using water hoses and/or extinguishers if trained. Remember - never use water on electrical equipment or on fires involving magnesium or titanium.

IT IS BETTER THAT THE FIRE DEPARTMENT BE CALLED AND THEIR SERVICES NOT NEEDED THAN TO CALL THEM TOO LATE FOR WHAT APPEARS TO BE A SMALL FIRE THAT GETS OUT OF CONTROL.

To escape gas in an outdoor area, use your escape respirator and walk, don't run, cross wind away from the source. It is difficult to avoid gas by walking downwind because the wind will carry the gas along with you. If you encounter an obstacle when going cross wind, then turn upwind until you can go cross wind again.

Go up to escape gases that are heavier than air and down to escape gases that are lighter than air. Chlorine, for example, is much heavier than air; however, strong drafts and air currents can affect the course of gas. Indoors, it is sometimes necessary to go up or down to escape gas. It is well to understand the nature of the chemicals even though they may not be used in your work area

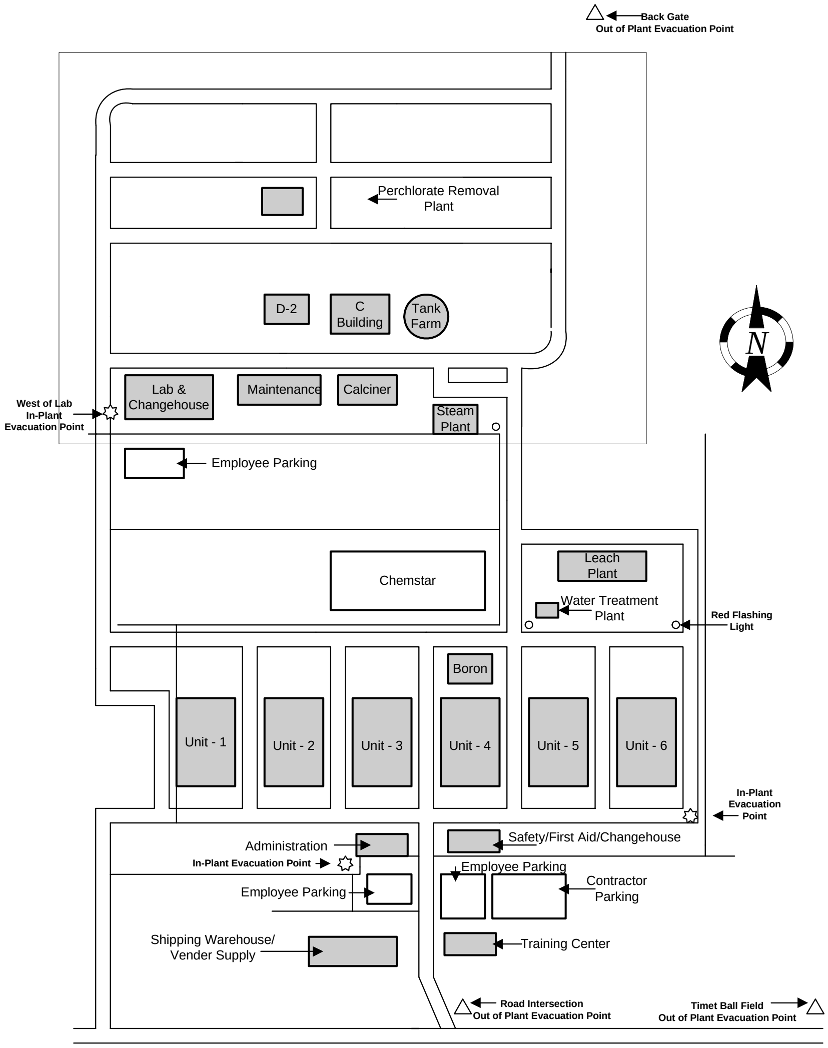
HENDERSON
EMERGENCY ALARM CODES

Test
1-1 * * , * * , * * , * * , * * , * * , * * , * * , * * , * *
Test and all clear (may be sounded at any time).

Stage 1
3-3 *** *** , *** *** , *** *** , *** *** , *** *** , ***
ALERT! Locate a Tronox employee with a radio for information. No evacuation at this time.

Stage 2
Rapid ***
Conduct emergency shutdown of anything that could produce a spark or flame and evacuate to in-plant meeting points.

Stage 3
Steady ————————————————————————————
Do not delay. Evacuate to out-of-plant meeting points per instructions or wind direction.



Henderson Facility Layout

NOTES

APPENDIX C
Examples of Field Forms

ENSR

Client:

Project Number:

Site Location:

BORING ID:

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

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																					TURN-AROUND TIME
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	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	

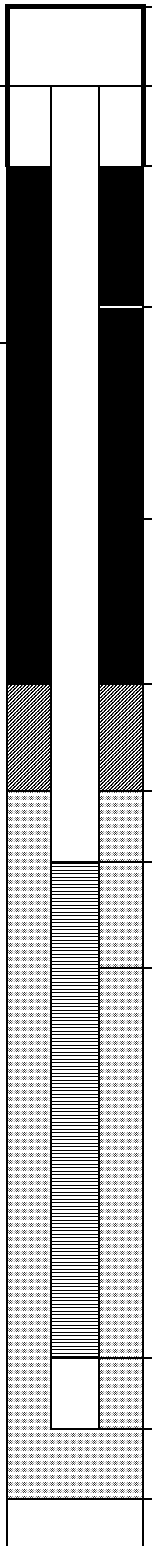
DISTRIBUTION: White and Canary = Laboratory **Pink = ENSR International**

Serial No. 2626

Client:
Project Number:
Site Location:
Well Location: Coords:
Method:

WELL ID:
Date Installed:
Inspector:
Contractor:

MONITORING WELL CONSTRUCTION DETAIL



Measuring Point for Surveying & Water Levels

Cement, Bentonite, Bentonite Slurry Grout, or Native Materials

_____ % Cement

_____ % Bentonite

_____ % Native Materials

	Depth from G.S. (feet)	Elevation(feet) Datum __________
Top of Steel Guard Pipe		
Top of Riser Pipe		
Ground Surface (G.S.)	0.0	
Riser Pipe:		
Length ______		
Inside Diameter (ID) ______		
Type of Material ______		
Bottom of Steel Guard Pipe		
Top of Bentonite		
Bentonite Seal Thickness ______		
Top of Sand		
Top of Screen		
▲ Stabilized Water Level		
Screen:		
Length ______		
Inside Diameter (ID) ______		
Slot Size ______		
Type of Material ______		
Type/Size of Sand ______		
Sand Pack Thickness ______		
Bottom of Screen		
Bottom of Tail Pipe:		
Bottom of Borehole		

Borehole Diameter:______

Approved:

Describe Measuring Point:

Signature

Date

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 ____________________

Geology at Screen Interval (if known) ____________________

Depth to Top of Screen (ft.) ____________________

Depth to Bottom of Screen (ft.) ____________________

Time of Water Level Measurement __________

Total Well Depth (ft.) ____________________

Calculate Purge Volume (gal.) __________

Depth to Static Water Level (ft.) ____________________

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
Project No: Finish am/pm
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

d. Acceptance criteria pass/fail	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

(continued on back)

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

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: ______________________________

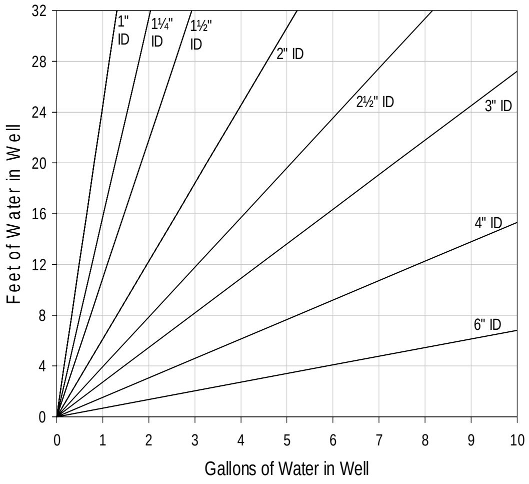
Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time

Comments ____

____

Signature ______________________________ Date ______________________________

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