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SAMPLING AND ANALYSIS PLAN (UPDATED)

Lackawanna Mill Site
Phase II Site Assessment
APN: 010-420-06 (Portion of)
Ely
Nevada
NDEP Contract #14-008
Task M04-14

Prepared for:

State of Nevada
Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Corrective Actions
901 S. Stewart Street, Suite 4001
Carson City, Nevada 89701-5249

On behalf of:

City of Ely

May 28, 2014

Sampling and Analysis Plan for:

Phase II Environmental Site Assessment for
Lackawanna Mill Site
Ely, Nevada

May 28, 2014

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1. INTRODUCTION

McGinley and Associates, Inc. (MGA) has prepared this Sampling and Analysis Plan (SAP) for assessment activities to be conducted at the former Lackawanna Mill Site located in Ely, Nevada. These assessment activities are being funded by the State of Nevada Brownfields program, Task M04-14. This SAP was prepared in accordance with the Nevada Division of Environmental Protection (NDEP) Quality Assurance Program Plan (QA Program Plan) for the Nevada Brownfields Program (NBP) (NDEP, 2007).

This SAP addresses the drilling, field sampling, analytical, quality control, and data review procedures for the collection and analysis of soil and groundwater samples to evaluate the potential for contamination within or proximal to the former mill site and tailing ponds utilized during historic mine processing activities.

1.1 Site Name

Lackawanna Mill Site (also known as the Egan Mill Site).

1.2 Site Location and Description

The former mill site is located on the western edge of the Georgetown Ranch at the base of Squaw Peak approximately two miles north of the City of Ely, Nevada on Lackawanna Road (Figure 1). Residential homes are located to the north and southwest. Much of the property overlooks Steptoe Valley and has a panoramic view of both the Duck Creek and Schell Creek mountain ranges.

The study area is located on a portion of White Pine County Assessor parcel number (APN) 010-420-06 and covers an area of approximately 40 acres. The study area consists of the mill site and former tailing pond area located within Steptoe Valley. The layout of the site is presented on Figure 2.

1.3 Responsible Agency

This project is being conducted for the NDEP through State of Nevada Brownfields program. The investigation will conform to the NBP's QA Program Plan (NDEP, 2007).

1.4 Project Organization

Title/Responsibility	Name	Phone
City of Ely		
Site Contact	Ross Rivera	(775) 289-6633
NDEP		
Program Coordinator for the Nevada Brownfields Program – Project coordination, liaison with City of Ely	Jeff Collins	(775) 687-9381
Case Officer – Review SAP, quality assurance	David Friedman	(775) 687-9385
Quality Coordinator for the Nevada Brownfields Program – Review SAP, quality assurance	Mary Siders	(775) 687-9496
USEPA		
USEPA Project Manager – Work plan review	Eugenia Chow	(415) 415-972-3160

USEPA QA Manager	Gail Morison	(415) 972-3807
McGinley and Associates, Inc.		
Principal – Senior review, regulatory liaison	Joe McGinley	(775) 829-2245
Project Manager – Project management, regulatory liaison, coordinate field activities, data review, report preparation.	Brett Bottenberg	(702) 260-4961
Quality Manager – Oversee implementation of SAP, review QA/QC procedures, data validation.	Brett Bottenberg	(702) 260-4961
Project Geologist – Log soils, field activity oversight	Justin Fike	(775) 378-8901
Staff Engineer – Conduct sampling activities	Jeri Prante	(702) 260-4961
CAD Operator – CAD support	Tim Dory	(775) 829-2245
Administrative Assistant – Administrative support	Linda Comstock	(775) 829-2245
Contractors/Vendors		
Cascade Drilling	Jeff Townsend	(208) 345-0878
ESC Lab Sciences	Jarred Willis	(615) 773-9678

1.5 Statement of the Specific Problem

The City of Ely has been approached by real estate developers for the purpose of developing residential homes. In addition, with the Lackawanna Hot Springs located proximal to the site, there has been interest from developers in using the land to construct a commercial hotel/lodge with access to the hot springs. Lastly, there has been interest in developing a commercial catfish farm and processing facility on the land above the spring site. All of these potential end uses would generate a large amount of jobs for the community and valuable tax revenues for the City of Ely.

However, based on site conditions observed recently, it appears that the former mill site is in a blighted state. Soil at the site appears to have staining from past mill processing activities or indiscriminate dumping by trespassers and various colored soil and debris piles are scattered throughout the site.

Recently, it appears that the site has been utilized by local residents as a gathering spot. In addition, it appears that some of the dilapidated buildings near the mill processing area have been utilized as a sleeping shelter. Further, it appears that former processing equipment, including power capacitors, have been destroyed and have leaked on to the surface of the soil proximal to the mill processing area.

Due to the observations of possible human use of the former mill site and based on chemicals and processes typically utilized in historic milling procedures, it is likely that soils contaminated with mill processing wastes and related contaminants may be hazardous to the health of the residents of the City of Ely.

Lastly, tailing ponds located within Steptoe Valley will be assessed for depth and impacts related to the former mill site activities. Groundwater beneath the tailing ponds will also be assessed as migration of impacts from the tailing ponds may affect downgradient water sources, farmland, and grazing land within the Steptoe Valley.

2. BACKGROUND

Currently, the site is blighted by an abandoned and dilapidated mill site. In 1962, Silver King Mines negotiated the construction of a mill site on the property due to its proximity to a high volume water source known as Lackawanna Springs. At the time, Silver King Mines needed the water for processing large volumes of mine tailings and ore that were discovered nearby. By 1965, the mill was operational. Remnants of a ball crusher, kiln, and other equipment remain on site. Damaged capacitors, abandoned 55-gallon drums, and multi-colored soil and debris piles are scattered throughout the property. The City of Ely has not utilized the property in the past and does not currently utilize the property. There does not appear to be any current uses that are contributing to site contamination issues.

2.1 Sampling Area Description

The study area (the Site) occupies approximately 40 acres in Ely, Nevada (Figure 1). The area is bounded on the east by Steptoe Valley, on the south by vacant land, on the west by Squaw Peak, and on the north by vacant property with residential beyond. As shown on Figure 2, the Site consists of three distinct areas including the Processing Area, the Ore Crushing Area, and the Tailing Pond Area.

2.1.1 Processing Area

The Processing Area consists of multiple structures and a concrete pad that appears to have been utilized as the base for a past structure. Remnants of processing equipment including a smelter can be observed in this area. Evidence of past equipment and processing resources can be seen scattered throughout the site. Multiple PCB-containing capacitors observed in this area appear to have been destroyed and stains have been observed on soil proximal to several of the capacitors. In addition, drums labeled as cyanide exist in a portion of the processing area which indicates the potential use of this chemical for past processing practices. Lastly, soil and debris piles are scattered throughout this portion of the site.

2.1.2 Ore Crushing Area

The Ore Crushing Area consists of remnants of the former ball crusher equipment utilized by the mill. In addition, soil and debris piles are scattered throughout the area and appear to contain various colors. Soils with high concentrations of metals may exist in this portion of the site.

2.1.3 Tailing Pond Area

The Tailing Pond Area is located within Steptoe Valley, across Lackawanna Road to the northeast of the Processing and Ore Crushing areas. The area lies in the drainage path of a small creek which runs from south to north towards the center of Steptoe Valley.

2.2 Operational History

Prior to the mill development in the early 1960s, it appears that the Site was vacant and undeveloped. In 1961, Silver King Mines discovered a silver strike that led to the negotiation for the construction of the mill at the Lackawanna Springs location. From 1962 through 1965, the mill was under construction. The mill was designed to process upwards of 200 tons of ore per day. According to local sources, the mill site was abandoned around 1975. Since 1975, it appears the site has not been utilized.

2.3 Previous Investigations/Regulatory Involvement

In 1980 and after the abandonment of the mill site, the United States Environmental Protection Agency (EPA) designated the site as a possible Superfund location. A preliminary assessment was performed which eventually led to a site inspection in 1987 and an expanded site inspection in 2000. Upon completion of these site activities by the EPA, the site was not placed on the Superfund list. No further investigations or regulatory involvement appears to have been completed at the site. A Phase I Environmental Site Assessment (ESA) will be performed concurrent with the Limited Phase II ESA activities proposed for the site.

2.4 Geological Information

The geology of the Site has been estimated, based on geologic maps in the vicinity of the site, to consist of Quaternary-age Older Aluvium. The Older Alluvium is composed of silt, sand, and gravel with localized, poorly consolidated lake deposits. Surface soils at the site consist mainly of Palinor-Urmafot-Palinor association. This soil unit typically has slopes ranging from four to 50 percent, a very low hydraulic conductivity of saturated soil, and a very low available water capacity. Groundwater beneath the site is estimated to be between 15 and 200 feet below ground surface depending on the location.

2.5 Environmental and/or Human Impact

No adverse human health effects associated with potential contamination at this site have been reported or documented. However, the potential exists for receptors to interact with the soils if continued use of the site by trespassers occurs.

3. PROJECT DATA QUALITY OBJECTIVES

3.1 Project Task and Problem Definition

The purpose of this investigation is to assess the soil for contamination from historical site use as a mill for processing mining ore. Definitive data will be collected to determine the extent of soil contamination, if any.

3.2 Data Quality Objectives (DQOs)

The DQO process (EPA 2006) is a systematic planning tool that is used to establish performance or acceptance criteria. These criteria, in turn, serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of a study. The DQO process consists of seven iterative steps, as described in the following sections and summarized in Table 1.

3.2.1 Step 1: State the Problem

Historical use of the Site as a mine ore processing mill and indiscriminate dumping by trespassers may have imparted contamination to soils within the study area. However, the nature and extent of contamination in the soils is not known. Additional data are needed to define the nature and extent, if any, of contamination within these soils. In addition, the concentrations of chemicals present in the soils need to be evaluated and compared to Action Levels based on the anticipated future uses of the site.

3.2.2 Step 2: Identify Decisions

Analytical data for collected samples will be evaluated to determine if concentrations of contaminants of concern (COC) exceed Nevada reportable concentrations (RCs). Analytical data will be compared to reportable concentrations (RCs) as published in the State of Nevada Division of Environmental Protection (NDEP) Draft Guidelines for Discovery Events (Soil RCs) document (NAC 445A.345 to 445A.348 as modified by adopted regulation R-189-08). Results of the investigation will be used to determine if additional assessment and/or regulatory notification with subsequent clean-up are required.

3.2.3 Step 3: Identify Inputs

Information required to address project objectives includes historical data, proposed quantitative data to be collected under this study, and soil/groundwater RCs. Analytical testing of soil and groundwater samples shall be conducted by ESC Lab Sciences (ESC) of Mt. Juliet, Tennessee. ESC's DQOs for the analytical testing are provided in Appendix A.

3.2.4 Step 4: Define Study Boundaries

The proposed investigation of soils will be conducted on the surface or via geoprobe borings. Surface samples will be collected between the surface and six inches below ground surface. Geoprobe borings shall extend from the surface to six feet bgs or until the tailings are no longer encountered. Soil samples within borings will be collected at the surface and every two to three feet during advancement. A final sample will be collected at the vertical extent of the boring. Additional samples may be collected if site conditions indicate that contamination may exist at depths greater than anticipated.

Groundwater samples will be collected from six Geoprobe borings that will be converted to temporary monitoring wells. It is anticipated that groundwater at this location will be encountered between 10 and 20 feet bgs.

3.2.5 Step 5: Develop Decision Rules

Decision rules are specified in Table 1, and describe actions based on qualitative and definitive data. Laboratory analytical data for the sampled media (soil) will be compared to soil RCs. For contaminants detected above soil RCs, Nevada statutes require that site-specific action levels be an appropriate level of concentration that is based on the protection of public health and safety and the environment as determined through the use of the Integrated Risk Information System (IRIS) adopted by the USEPA, to be used when inhalation, ingestion, or dermal exposure is the primary exposure pathway; or a background concentration.

3.2.6 Step 6: Specify Tolerable Limits on Decision Errors

This is not a statistically based study; therefore, sampling locations will be selected based on professional judgment and site knowledge.

3.2.7 Step 7: Optimize the Sampling Design

Optimization was completed via discussions with the project team and by reviewing historical information indicating locations of potential contamination. The number of samples selected is believed to be adequate to complete an initial assessment of site conditions.

The DQOs are summarized in Table 1. Analytical testing of soil samples shall be conducted by ESC, as noted above. ESC's DQOs for the analytical testing are provided in Appendix A.

3.3 Data Quality Indicators (DQIs)

Data quality indicators (precision, accuracy, representativeness, completeness, comparability and sensitivity [i.e., PARCCS parameters]) refer to quality control criteria established for various aspects of data gathering, sampling, and/or analyses. Precision is the degree of mutual agreement between or among independent measurements of a similar property (usually reported as standard deviation (SD) or relative percent difference) and relates to the analysis of duplicate laboratory or field samples. Accuracy is the degree of agreement of a measurement with a known or true value and is determined by comparing the reported laboratory value for a sample to a known or true concentration (i.e. matrix spikes, surrogate spikes, laboratory control samples and performance samples). Representativeness is the expression of the degree to which data accurately and precisely represent a characteristic of an environmental condition or population and relates to the method of collecting samples and determining sampling locations. Completeness is expressed as the percent of valid usable data obtained compared to the amount that was expected. Comparability expresses the degree of confidence with which one data set can be compared to another. Sensitivity is defined by the laboratory detection limits and are generally expressed in terms of method detection limits (MDLs) or reporting limits (RLs).

Precision and Accuracy: The measurement quality objectives (MQOs) for precision and accuracy for the analyses of the specific COCs are summarized in Table 3.

Representativeness: Sample locations will be selected using professional judgment and knowledge of site history. Sample locations will adequately represent site conditions in the area being investigated.

Completeness: Data collection may be inhibited by geologic conditions and/or underground utilities. The project goal is to obtain at least 90% of the soil samples outlined in this SAP.

Comparability: The laboratory that will be used for analytical testing of soil samples collected during this investigation (ESC) is certified by the State of Nevada for standard analyses under the Clean Water Act and the Safe Drinking Water Act as described in Appendix A of the NBP QA Program Plan (NDEP, 2007). Relevant SOPs from ESC for the analyses to be conducted during this investigation are provided in Appendix B.

Sensitivity: The laboratory reporting limit for each analyte is summarized in Table 2. The reporting limits are well below the action levels and provisional action levels and are adequate for this investigation

3.4 Data Review and Validation

Data verification is the process of evaluating the completeness, correctness, conformance, and compliance of a specific data set against the method, procedural, or contractual requirements. Data verification evaluates whether sampling protocols, SOPs, and analytical methods were followed during data generation. Verification also involves examining the data for errors or omissions. Field and laboratory staff will verify that the work is producing appropriate outputs.

Data validation is a systematic process for reviewing a body of data against a pre-established set of acceptance criteria defined in this plan. Data validation is an analyte- and sample-specific process that extends the evaluation of data beyond data verification and is performed to determine the analytical quality of a specific data set. Validation involves a detailed examination of the data package to determine whether MQOs for precision, accuracy, and sensitivity have been met. For this environmental assessment, the intent of the data review and validation process is to verify that the specified levels of precision, accuracy, reproducibility, completeness, comparability, and analytical sensitivity of the final results are achieved, with respect to the project MQOs, and that the data fulfill project DQOs.

MGA’s QA officer will supervise or perform data quality assessment tasks. MGA will consistently evaluate and document measurement data to monitor consistency with MQOs, to quantitatively assess data quality, and to identify potential limitations to data use. MGA will review field and analytical laboratory data generated for this project, including the following:

- Chain of custody documentation;
- Laboratory batch QC frequency; and,
- Results of batch and field QC analyses;

Laboratory Data: The laboratory will generate and review all laboratory data. Each data point will be assessed as non-qualified or qualified based upon the acceptance criteria. Data may be qualified as “estimated” (J-qualified); these data are used as is. Some data may be qualified as “rejected” (R-qualified) if critical QC parameters are not met; these data are unusable for any purpose. Sample re-analysis, for data not meeting MQOs, will be considered as a possible corrective action. Third-party data validation will not be performed.

3.5 Data Management

Sampling will be conducted in accordance with MGA’s standard operating procedures (SOPs). A unique identification number will be assigned to each sample. The number will be an alphanumeric sequence that serves as an acronym to identify the sample. The following format will be used for the sample designation:

Soil Samples**:**

Sample ID: BRN023-SS-01-1.0
BRN023 - MGA Project Number
SS-01 – Soil Sample Number (i.e., #1)
1.0 – Depth of Soil Sample (feet below ground surface)

Groundwater Samples**:**

Sample ID: BRN023-GW-01
BRN023 - MGA Project Number
GW-01 – Groundwater Sample Number (i.e., #1)

Field logs shall be maintained throughout the project. The following information shall be included on the field logs: description of activities conducted, dates and times, field observations, deviations from sampling program, names of onsite personnel, sampling locations.

Soil samples shall be preserved or cooled as required for each laboratory analysis. Samples shall be delivered or shipped to the laboratory under chain-of-custody protocol.

3.6 Assessment Oversight

Prior to commencing with field activities, the SAP will be reviewed by the Project Team. The MGA QA Officer will oversee QC of all field activities. If modifications to the proposed sampling program are required due to field conditions, the Project Manager shall be notified for direction. Any modifications to the sampling plan will be documented in the field logs and in the project report as “deviations from the sampling plan.”

4. SAMPLING RATIONALE

Soil samples shall be collected from locations where contaminants are suspected to be present, based on visual observations. An adequate number of samples shall be collected to initially assess site conditions. Professional judgment shall be used to select sampling locations that are likely to provide data to address project DQOs (Table 1). Decision statements formulated in the project DQOs are largely concerned with delineating the extent and magnitude of contamination.

4.1 Soil Sampling – Mine Processing Area

If visual evidence of staining is present, a designated sampling location will be moved to collect a sample at the stained location. If no staining is evident, judgmental sampling locations will be used. Samples will be collected between the surface and six inches below ground surface.

4.2 Soil Sampling – Tailing Ponds

Prior to boring advancement, utility clearance activities will be conducted on the study area. Stakes will be placed at the proposed boring locations and a private utility location service will be contracted to clear all potential utilities within a radius of feet of each boring location.

Thirteen borings are proposed to be advanced via track-mounted geoprobe equipment. Of these thirteen borings, six will be developed as temporary monitoring wells for collection of groundwater samples. All thirteen borings will be advanced until the tailing material is no longer encountered. The borings will then be advanced an additional two feet beyond the tailing material and into native soil. It is anticipated that the tailing material will have a vertical extent of approximately four to six feet below ground surface (bgs). However, if deeper than expected, the borings will continue to be advanced until the depth of the tailings is determined. Continuous cores will be collected and boring logs will be created for all thirteen borings.

Soil samples will be collected at the surface and every two to three feet during advancement. A final sample will be collected at the vertical extent of the boring. It should be noted that additional samples may be collected if site conditions indicate that contamination may exist at depths greater than anticipated. Two soil sample duplicates may be collected during field activities.

4.3 Sediment Sampling

Sampling of sediments is not included in the scope of this investigation.

4.4 Water Sampling

Of the thirteen Geoprobe borings, six will be converted to temporary monitoring wells. Groundwater borings will be advanced until groundwater is encountered. Once groundwater is encountered, temporary wells will be developed and a sample will be collected from each utilizing a peristaltic pump and tubing. It is anticipated that groundwater will be encountered between 10 and 20 feet below ground surface. One groundwater sample duplicate may be collected during field activities.

If groundwater is not encountered within 25 feet bgs, the Geoprobe boring may be halted at that point and a temporary monitoring well may not be developed. If this occurs, a groundwater sample will not be collected at that location.

4.5 Biological Sampling

Biological sampling is not included in the scope of this investigation.

5. REQUEST FOR ANALYSIS

Laboratory analyses are discussed in Section 5.1 below.

5.1 Analyses Narrative

5.1.1 Soil Samples

It is anticipated that approximately 75 soil samples will be collected for analytical testing. The soil samples will be collected as described in Section 4 and analyzed for the following:

- Poly-chlorinated biphenyls (PCBs): EPA Method SW8082;
- CAM 17 metals: EPA Method 6020;
- Semi-volatile organic compounds (SVOCs): EPA Method 8270C;
- Volatile organic compounds (VOCs): EPA Method 8260B;
- Soil pH: EPA Method SW9045D;
- Total Cyanide: EPA Method SW9012; and
- Dioxins/Furans: EPA Method 1613B/8290 (if chosen)

5.1.2 Groundwater Samples

It is anticipated that approximately seven groundwater samples will be collected for analytical testing. The groundwater samples will be collected as described in Section 4 and analyzed for the following:

- Poly-chlorinated biphenyls (PCBs): EPA Method SW8082;
- CAM 17 metals: EPA Method 6020;
- Semi-volatile organic compounds (SVOCs): EPA Method 8270C (low volume);
- Volatile organic compounds (VOCs): EPA Method 8260B;
- Soil pH: EPA Method SW9045D;
- Total Cyanide: EPA Method SW9012; and
- Dioxins/Furans: EPA Method 1613B/8290 (if chosen)

5.2 Analytical Laboratory

All analytical testing shall be conducted by ESC Lab Sciences. Analytical testing and sample handling shall be conducted in accordance with ESC's SOPs (Appendices A and B).

6. FIELD METHODS AND PROCEDURES

6.1 Field Equipment

6.1.1 List of Equipment Needed

- Track-mounted Geoprobe and associated tooling;
- ¾" PVC risers, well screen, end caps, tubing, and peristaltic pump;
- Brass tubes;
- Field logbook and field data sheets;
- Personal protective equipment (Level D);
- Tape measure;

- Camera;
- Survey-grade or mapping-grade GPS unit;
- Sample containers appropriate to each analysis requirements;
- Cooler and ice;
- Sample labels;
- Pick axe;
- Shovel;
- Hand auger and/or power auger;
- Stainless steel bowls and scoops; and
- Decontamination supplies;

6.1.2 Calibration of Field Equipment

All field equipment will be calibrated according to the manufacturer's guidelines and specifications.

6.2 Field Screening

Field screening will not be utilized in this investigation.

6.3 Soil Sampling

6.3.1 Surface Samples

Surface soil sampling will be conducted in accordance with MGA's SOP in Appendix C.

6.3.2 Sub-surface Samples

Sub-surface soil sampling will be conducted in accordance with MGA's SOP in Appendix C.

6.4 Sediment Sampling

Not applicable, sediment sampling is not included in the scope of this investigation.

6.5 Groundwater Sampling

Groundwater sampling will be conducted in accordance with MGA's SOP in Appendix C.

6.6 Decontamination Procedures

All field equipment which comes in contact with potentially contaminated soil or groundwater will be decontaminated in accordance with MGA's SOP (Appendix C). Decontamination will occur prior to and after each use of a piece of equipment.

7. SAMPLE CONTAINERS, PRESERVATION AND STORAGE

7.1 Sample Containers

Soil and groundwater samples will be collected in dedicated sample containers provided by the analytical laboratory. The samples will be delivered to the laboratory within required hold times or an acceptable period of time, whichever is shorter. Appendix C provides MGA's SOPs for sampling.

7.2 Sample Preservation and Storage

Collected soil samples will be chilled to 4°C within a laboratory supplied cooler upon collection and during transport to the laboratory.

8. DISPOSAL OF RESIDUAL MATERIALS

All investigation-derived waste generated during this investigation will remain within the bermed walls of the tailing ponds.

9. SAMPLE DOCUMENTATION AND SHIPMENT

9.1 Field Notes

9.1.1 Field Logbooks

Field logs will be completed describing all field activities. The following information will be included in the field logs:

- Project name and location;
- Sampling location and description utilizing a survey- or mapping-grade GPS unit;
- Site plan showing sample locations;
- Sampler's name (s);
- Date and time of sample collection;
- Type of sample (e.g., soil);
- Type of sampling equipment used;
- Field instrument readings and calibration;
- Field observations and details related to analysis or integrity of samples (e.g., noticeable odors, colors, etc.);
- Sample preservation;
- Lot number of the sample containers, sample identification numbers and explanatory codes, and chain-of-custody form numbers; and
- Name of recipient laboratory.

9.1.2 Photographs

Photographs will be taken at select sampling locations. They will serve to verify information entered in the field logbook. For each photograph taken, the following information, at a minimum, will be written in the logbook:

- Time, date, location, and weather conditions;
- Description of the subject photographed; and
- Name of person taking the photograph.

9.2 Labeling

All samples collected will be labeled in a clear and precise manner for proper identification in the field and for tracking in the laboratory. The samples will have pre-assigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information:

- Sample location;
- Date and time of collection;
- Analytical parameter(s) requested; and

- Method of preservation.

9.3 Sample Chain-of-Custody Forms and Custody Seals

All samples shall be delivered to the laboratory under chain-of-custody protocol. A copy of ESC's chain-of-custody form is provided in Appendix D. Laboratory supplied custody seals shall be used to seal the screw lid of each sample container.

9.4 Packaging and Shipment

Samples shall be placed in a sturdy cooler. Bubble wrap shall be placed in the bottom of the cooler. Sample containers shall be placed in containers provided by the laboratory. Ice shall be packed in zipper locked, double plastic bags. Empty space in the cooler shall be filled with bubble wrap. Appendix C provides MGA's SOP for sample packaging and shipping.

10. QUALITY CONTROL

10.1 Field Quality Control Samples

Samples will be collected in accordance with industry standard procedures. No equipment blanks will be collected during this investigation.

10.2 Background Samples

Background samples will be collected during this investigation and their proposed locations are part of the 13 planned Geoprobe borings.

10.3 Field Screening and Confirmation Samples

No confirmation samples will be collected during this investigation.

10.4 Assessment of Field Variability (Field Duplicates or Co-located Samples)

One duplicate soil sample per 20 targeted samples will be collected for laboratory quality control purposes. When collecting a duplicate soil sample, the sample containers with the two different sample identification numbers will alternate in the filling sequence. The duplicate samples will be preserved, packaged, and sealed in the same manner as the other samples of the same matrix. A separate sample number and station number will be assigned to the duplicate sample such that it is blind to the laboratory.

10.5 Laboratory Quality Control Samples

Laboratory QC (e.g., matrix spike/matrix spike duplicate samples) samples will be analyzed to monitor the precision and accuracy of its analytical procedures.

11. FIELD VARIANCES

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this SAP. Modifications to the approved SAP will be documented in the sampling project report.

12. FIELD HEALTH AND SAFETY PROCEDURES

A site-specific Health and Safety Plan is provided in Appendix E. The HASP shall be reviewed by all onsite personnel prior to commencing with field activities.

13. SCHEDULE FOR SAMPLING ACTIVITIES

MGA will commence with the activities proposed herein upon receiving NDEP approval of this SAP. It is anticipated that field activities will take approximately two to three days to be completed. It is anticipated that a draft report of findings will be submitted prior to June 30, 2014.

14. REFERENCES

Final Nevada Brownfields Program Quality Assurance Program Plan, May 20, 2007, Nevada Division of Environmental Protection.

US EPA. 2006. *Guidance on Systematic Planning using the Data Quality Objectives Process*. February. EPA QA/G-4, EPA/240/B-06/001

Table 1. DQO Summary Table for Environmental Sampling, Lackawanna Mill Site, Ely, Nevada

STEP 1

State the Problem

Historical use of the Site as a mine ore processing mill and indiscriminate dumping by trespassers may have imparted contamination to soils within the study area. However, the nature and extent of contamination in the soils and/or groundwater is not known. Additional data are needed to define the nature and extent, if any, of contamination within these soils and the groundwater beneath. In addition, the concentrations of chemicals present in the soils or groundwater need to be evaluated and compared to Action Levels based on the anticipated future uses of the site.

STEP 2

Identify the Decisions

1) Do contaminants of concern (COC) concentrations in the soil or groundwater exceed Nevada reportable concentrations (RCs)?

2) Does the extent of the concentration of the COCs within soil appear to be greater than three cubic yards?

3) Is further assessment required to determine the nature and extent of contamination within the study area?

4) Is regulatory notification required?

STEP 3

Identify the Inputs to the Decisions

- Analytical data for collected samples (quantitative data)

- Soil and groundwater RCs as published in the State of Nevada Division of Environmental Protection (NDEP) Draft Guidelines for Discover Events (Soil RCs) document (NAC 445A.345 to 445A.348 as modified by adopted regulation R-189-08)

STEP 4

Define Study Boundaries

The proposed investigation of soils will be conducted on the surface or via geoprobe borings. Surface samples will be collected between the surface and six inches below ground surface. Geoprobe borings shall extend from the surface to six feet bgs or until the tailings are no longer encountered. Soil samples within borings will be collected at the surface and every two to three feet during advancement. A final sample will be collected at the vertical extent of the boring. Additional samples may be collected if site conditions indicate that contamination may exist at depths greater than anticipated.

Groundwater samples will be collected from six Geoprobe borings that will be converted to temporary monitoring wells. It is anticipated that groundwater at this location will be encountered between 10 and 20 feet bgs.

STEP 5

Develop Decision Rules

1) If specific COCs are reported by the analytical laboratory to be greater than State of Nevada RCs for that analyte, the appropriate RC will be used to screen the data;

2) If the concentration exceeds the RC, then a calculation to determine an approximate volume of contaminated soil will be performed.

3) If data received from the analytical laboratory suggests that the extent of contamination within the study area is still not determined, another round of sampling shall be proposed.

4) If groundwater contaminants are found at concentrations above the RC and/or contaminated soil quantities exceed 3 cubic yards, the discovery will be reported to the NDEP.

STEP 6

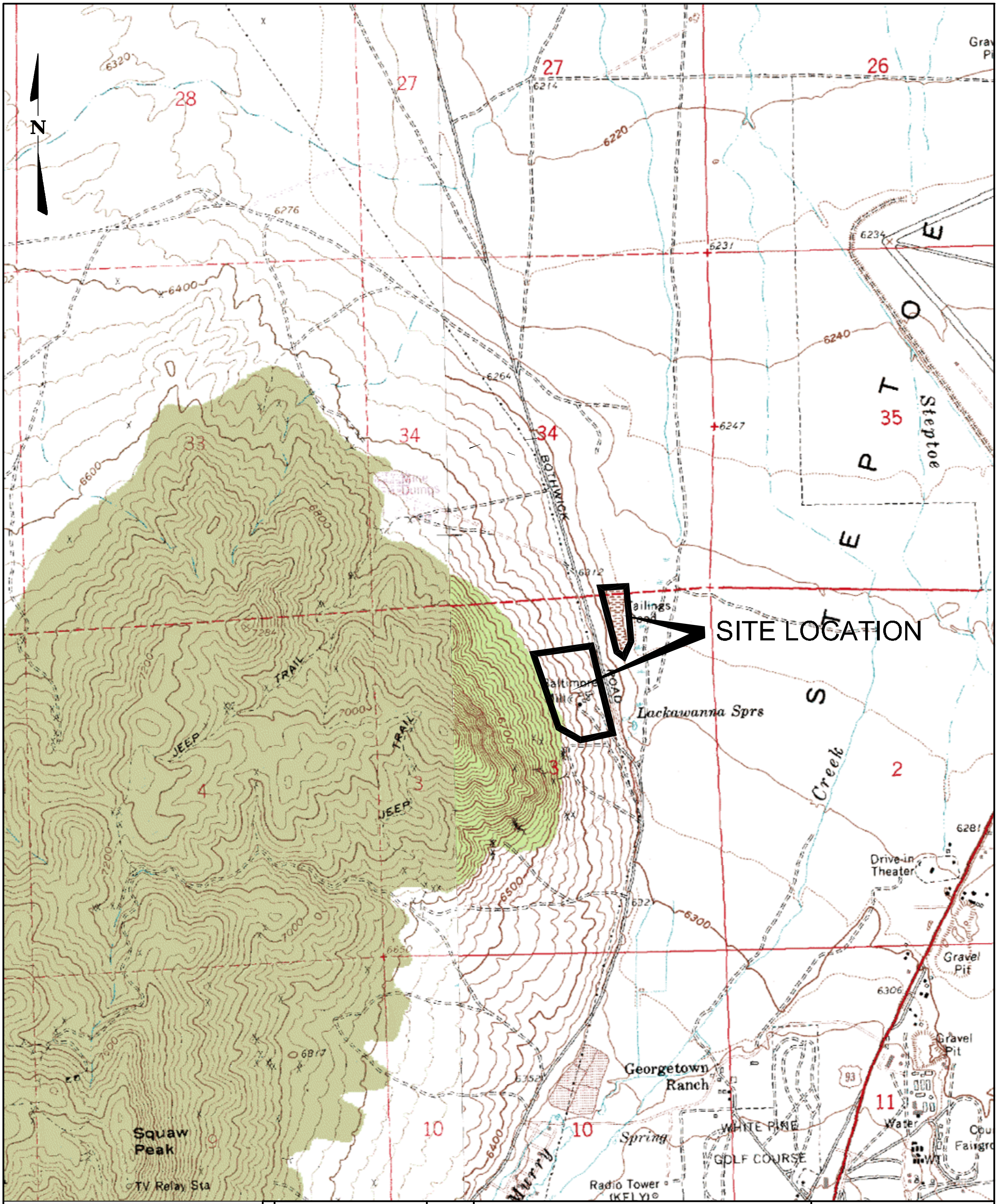
Specify Tolerable Limits on Errors

The number of samples to be collected is not statistically based and will be determined in the field based using professional judgment. MQOs and DQIs established for analytical data are described in the NBP QA Program Plan.

STEP 7

Optimize Sampling Design

The quantity of samples is believed to be adequate to complete an initial assessment of site conditions.



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FEET

REFERENCE		
DESIGNED	BH	
DRAWN	TAD	
CHECKED		
APPROVED		

REVISIONS No.	DESCRIPTION	BY	DATE

FIGURE 1

PROJECT LOCATION
-SHOWING-
PARCEL 010-420-06
OLD LACKAWANNA MILL SITE
WHITE PINE COUNTY, NEVADA

McGinley & Associates

SCALE: AS SHOWN

REVISION

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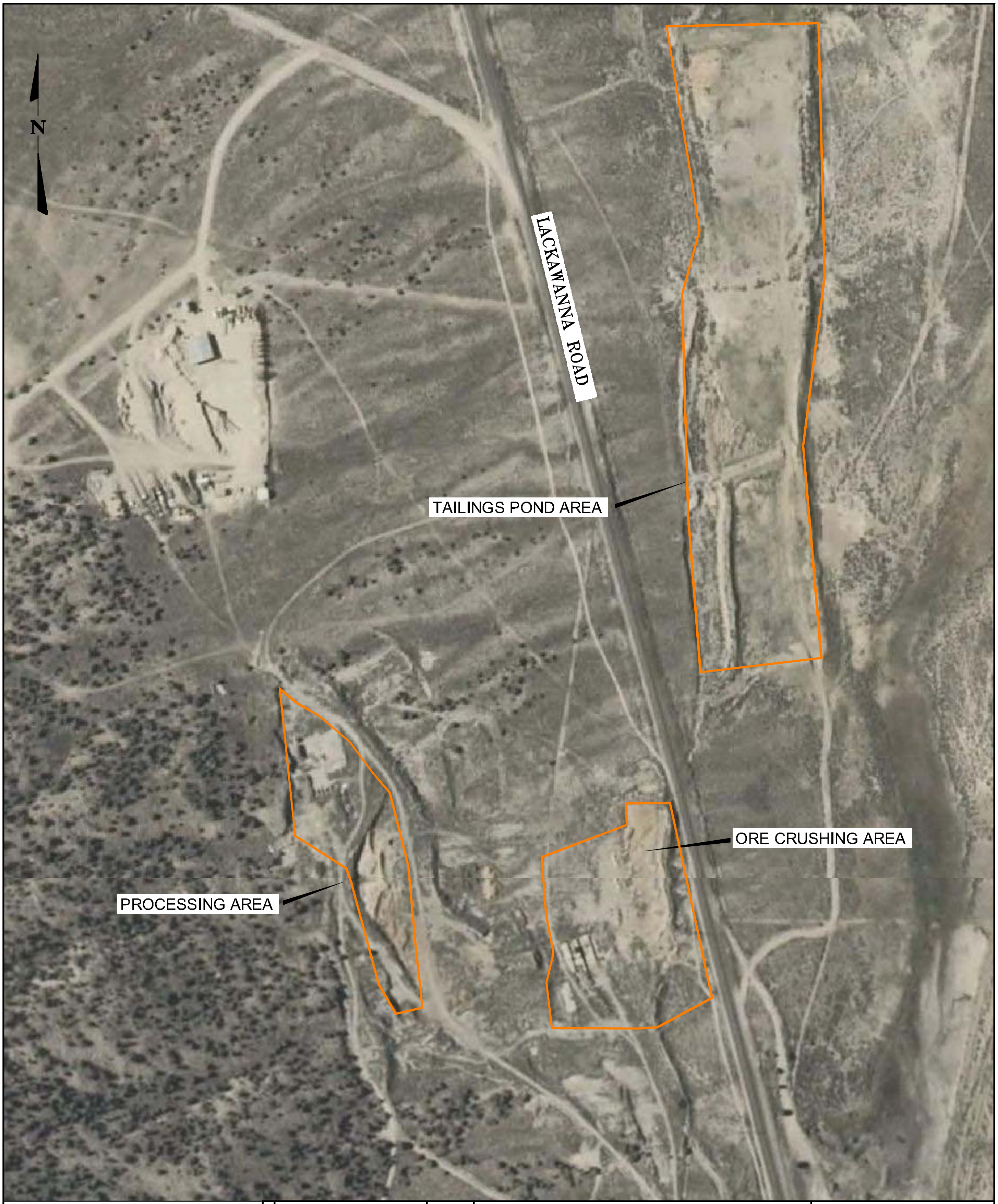

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REVISIONS No.	DESCRIPTION	BY	DATE

FIGURE 2

SITE MAP
-SHOWING-
PARCEL 010-420-06
OLD LACKAWANNA MILL SITE
WHITE PINE COUNTY, NEVADA

McGinley & Associates

SCALE: AS SHOWN
REVISION A
JOB NO. BRN–023

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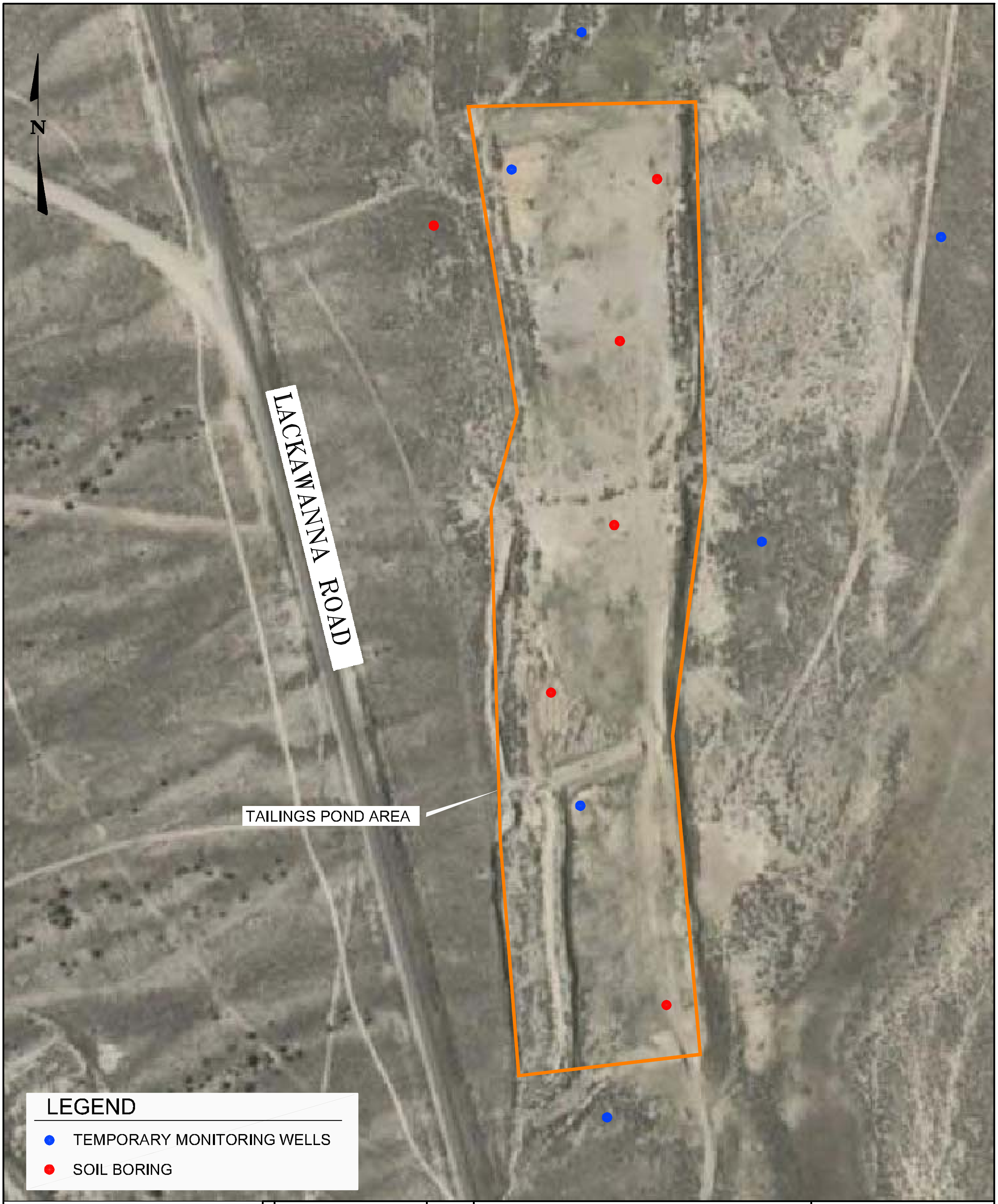

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FIGURE 3

SITE MAP
-SHOWING-
PROPOSED TAILINGS POND
BORING LOCATIONS
OLD LACKAWANNA MILL SITE
WHITE PINE COUNTY, NEVADA

McGinley & Associates

SCALE: AS SHOWN

REVISION

JOB NO. BRN–023

A

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5/17/2012

APPENDIX A

Laboratory Data Quality Objectives and Sample Handling Procedures

CD-ROM
ONLY

APPENDIX B

MGA SOPs

GENERAL FIELD SAMPLING GUIDELINES

SOP#: 2001
DATE: 08/11/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide general field sampling guidelines that will assist REAC personnel in choosing sampling strategies, location, and frequency for proper assessment of site characteristics. This SOP is applicable to all field activities that involve sampling.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

Sampling is the selection of a representative portion of a larger population, universe, or body. Through examination of a sample, the characteristics of the larger body from which the sample was drawn can be inferred. In this manner, sampling can be a valuable tool for determining the presence, type, and extent of contamination by hazardous substances in the environment.

The primary objective of all sampling activities is to characterize a hazardous waste site accurately so that its impact on human health and the environment can be properly evaluated. It is only through sampling and analysis that site hazards can be measured and the job of cleanup and restoration can be accomplished effectively with minimal risk. The sampling itself must be conducted so that every sample collected retains its original physical form and chemical composition. In this way, sample integrity is insured, quality assurance standards are maintained, and the sample can accurately represent the larger body of material under investigation.

The extent to which valid inferences can be drawn from a sample depends on the degree to which the sampling effort conforms to the project's objectives. For example, as few as one sample may produce adequate, technically valid data to address the project's objectives. Meeting the project's objectives requires thorough planning of sampling activities, and implementation of the most appropriate sampling and analytical procedures. These issues will be discussed in this procedure.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected, and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest. Sample preservation, containers, handling, and storage for air and waste samples are discussed in the specific SOPs for air and waste sampling techniques.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The nature of the object or materials being sampled may be a potential problem to the sampler. If a material is homogeneous, it will generally have a uniform composition throughout. In this case, any sample increment can be considered representative of the material. On the other hand, heterogeneous samples present problems to the sampler because of changes in the material over distance, both laterally and vertically.

Samples of hazardous materials may pose a safety threat to both field and laboratory personnel. Proper health and safety precautions should be implemented when handling this type of sample.

Environmental conditions, weather conditions, or non-target chemicals may cause problems and/or interferences when performing sampling activities or when sampling for a specific parameter. Refer to the specific SOPs for sampling techniques.

5.0 EQUIPMENT/APPARATUS

The equipment/apparatus required to collect samples must be determined on a site specific basis. Due to the wide variety of sampling equipment available, refer to the specific SOPs for sampling techniques which include lists of the equipment/apparatus required for sampling.

6.0 REAGENTS

Reagents may be utilized for preservation of samples and for decontamination of sampling equipment. The preservatives required are specified by the analysis to be performed. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

7.0 PROCEDURE

7.1 Types of Samples

In relation to the media to be sampled, two basic types of samples can be considered: the environmental sample and the hazardous sample.

Environmental samples are those collected from streams, ponds, lakes, wells, and are off-site samples that are not expected to be contaminated with hazardous materials. They usually do not require the special handling procedures typically used for concentrated wastes. However, in certain instances, environmental samples can contain elevated concentrations of pollutants and in such cases would have to be handled as hazardous samples.

Hazardous or concentrated samples are those collected from drums, tanks, lagoons, pits, waste piles, fresh spills, or areas previously identified as contaminated, and require special handling procedures because of their potential toxicity or hazard. These samples can be further subdivided based on their degree of hazard; however, care should be taken when handling and shipping any wastes believed to be concentrated regardless of the degree.

The importance of making the distinction between environmental and hazardous samples is two-fold:

(1) Personnel safety requirements: Any sample thought to contain enough hazardous materials to pose a safety threat should be designated as hazardous and handled in a manner which ensures the safety of both field and laboratory personnel.

(2) Transportation requirements: Hazardous samples must be packaged, labeled, and shipped according to the International Air Transport Association (IATA) Dangerous Goods Regulations or Department of Transportation (DOT) regulations and U.S. EPA guidelines.

7.2 Sample Collection Techniques

In general, two basic types of sample collection techniques are recognized, both of which can be used for either environmental or hazardous samples.

Grab Samples

A grab sample is defined as a discrete aliquot representative of a specific location at a given point in time. The sample is collected all at once at one particular point in the sample medium. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples will decrease.

Composite Samples

Composites are nondiscrete samples composed of more than one specific aliquot collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and can in certain instances be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing can mask problems by diluting isolated concentrations of some hazardous compounds below detection limits.

Compositing is often used for environmental samples and may be used for hazardous samples under certain conditions. For example, compositing of hazardous waste is often performed after compatibility tests have been completed to determine an average value over a number of different locations (group of drums). This procedure generates data that can be useful by providing an average concentration within a number of units, can serve to keep analytical costs down, and can provide information useful to transporters and waste disposal operations.

For sampling situations involving hazardous wastes, grab sampling techniques are generally preferred because grab sampling minimizes the amount of time sampling personnel must be in contact with the wastes, reduces risks associated with compositing unknowns, and eliminates chemical changes that might occur due to compositing.

7.3 Types of Sampling Strategies

The number of samples that should be collected and analyzed depends on the objective of the investigation. There are three basic sampling strategies: random, systematic, and judgmental sampling.

Random sampling involves collection of samples in a nonsystematic fashion from the entire site or a specific portion of a site. Systematic sampling involves collection of samples based on a grid or a pattern which has been previously established. When judgmental sampling is performed, samples are collected only from the portion(s) of the site most likely to be contaminated. Often, a combination of these strategies is the best approach depending on the type of the suspected/known contamination, the uniformity and size of the site, the level/type of information desired, etc.

7.4 QA Work Plans (QAWP)

A QAWP is required when it becomes evident that a field investigation is necessary. It should be initiated in conjunction with, or immediately following, notification of the field investigation. This plan should be clear and concise and should detail the following basic components, with regard to sampling activities:

- Objective and purpose of the investigation.
- Basis upon which data will be evaluated.
- Information known about the site including location, type and size of the facility, and length of operations/abandonment.
- Type and volume of contaminated material, contaminants of concern (including concentration), and basis of the information/data.
- Technical approach including media/matrix to be sampled, sampling equipment to be used, sample equipment decontamination (if necessary), sampling design and rationale, and SOPs or description of the procedure to be implemented.
- Project management and reporting, schedule, project organization and responsibilities, manpower and cost projections, and required deliverables.
- QA objectives and protocols including tables summarizing field sampling and QA/QC analysis and objectives.

Note that this list of QAWP components is not all-inclusive and that additional elements may be added or altered depending on the specific requirements of the field investigation. It should also be recognized that although a detailed QAWP is quite important, it may be impractical in some instances. Emergency responses and accidental spills are prime examples of such instances where time might prohibit the development of site-specific QAWPs prior to field activities. In such cases, investigators would have to rely on general guidelines and personal judgment, and the sampling or response plans might simply be a strategy based on preliminary information and finalized on site. In any event, a plan of action should be developed, no matter how concise or informal, to aid investigators in maintaining a logical and consistent order to the implementation of their task.

7.5 Legal Implications

The data derived from sampling activities are often introduced as critical evidence during litigation of a hazardous waste site cleanup. Legal issues in which sampling data are important may include cleanup cost recovery, identification of pollution sources and responsible parties, and technical validation of remedial design methodologies. Because of the potential for involvement in legal actions, strict adherence to technical and administrative SOPs is essential during both the development and implementation of sampling activities.

Technically valid sampling begins with thorough planning and continues through the sample collection and analytical procedures. Administrative requirements involve thorough, accurate documentation of all sampling activities. Documentation requirements include maintenance of a chain of custody, as well as accurate records of field activities and analytical instructions. Failure to observe these procedures fully and consistently may result in data that are questionable, invalid and non-defensible in court, and the consequent loss of enforcement proceedings.

8.0 CALCULATIONS

Refer to the specific SOPs for any calculations which are associated with sampling techniques.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

Refer to the specific SOPs for the type and frequency of QA/QC samples to be analyzed, the acceptance criteria for the QA/QC samples, and any other QA/QC activities which are associated with sampling techniques.

10.0 DATA VALIDATION

Refer to the specific SOPs for data validation activities that are associated with sampling techniques.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and corporate health and safety procedures.

SAMPLING EQUIPMENT DECONTAMINATION

SOP#: 2006
DATE: 08/11/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. An acid rinse provides a low pH media for trace metals removal and is included in the decontamination process if metal samples are to be collected. It is followed by another distilled/deionized water rinse. If sample analysis does not include metals, the acid rinse step can be omitted. Next, a high purity solvent rinse is performed for trace organics removal if organics are a concern at the site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. Acetone is typically chosen because it is an excellent solvent, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern at a given site or if Target Compound List analysis (which includes acetone) is to be performed, another solvent may be substituted. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

The decontamination procedure described above may be summarized as follows:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. 10% nitric acid rinse
6. Distilled/deionized water rinse
7. Solvent rinse (pesticide grade)
8. Air dry
9. Distilled/deionized water rinse

If a particular contaminant fraction is not present at the site, the nine (9) step decontamination procedure specified above may be modified for site specificity. For example, the nitric acid rinse may be eliminated if metals are not of concern at a site. Similarly, the solvent rinse may be eliminated if organics are not of concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest.
More specifically, sample collection and analysis of decontamination waste may be required before beginning proper disposal of decontamination liquids and solids generated at a site. This should be determined prior to initiation of site activities.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

C The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free (specifically for the contaminants of concern).

C The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.

C If acids or solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.

C Damage can be incurred by acid and solvent washing of complex and sophisticated sampling equipment.

5.0 EQUIPMENT/APPARATUS

Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-bristle scrub brushes or long-handled bottle brushes can be used to remove contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children's wading pools can also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

5.1 Decontamination Solutions

C Non-phosphate detergent
C Selected solvents (acetone, hexane, nitric acid, etc.)
C Tap water
C Distilled or deionized water

5.2 Decontamination Tools/Supplies

C Long and short handled brushes
C Bottle brushes
C Drop cloth/plastic sheeting
C Paper towels
C Plastic or galvanized tubs or buckets
C Pressurized sprayers (H_2O)
C Solvent sprayers
C Aluminum foil

5.3 Health and Safety Equipment

Appropriate personal protective equipment (i.e., safety glasses or splash shield, appropriate gloves, aprons or coveralls, respirator, emergency eye wash)

5.4 Waste Disposal

C Trash bags
C Trash containers
C 55-gallon drums
C Metal/plastic buckets/containers for storage and disposal of decontamination solutions

6.0 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions. Table 1 (Appendix A) lists solvent rinses which may be required for elimination of particular chemicals. In general, the following solvents are typically utilized for decontamination purposes:

- 10% nitric acid is typically used for inorganic compounds such as metals. An acid rinse may not be required if inorganics are not a contaminant of concern.
- Acetone (pesticide grade)(1)
- Hexane (pesticide grade)(1)
- Methanol(1)

(1) - Only if sample is to be analyzed for organics.

7.0 PROCEDURES

As part of the health and safety plan, a decontamination plan should be developed and reviewed. The decontamination line should be set up before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- The number, location, and layout of decontamination stations.

- Decontamination equipment needed.

- Appropriate decontamination methods.

- Methods for disposal of contaminated clothing, equipment, and solutions.

- Procedures can be established to minimize the potential for contamination. This may include: (1) work practices that minimize contact with potential contaminants; (2) using remote sampling techniques; (3) covering monitoring and sampling equipment with plastic, aluminum foil, or other protective material; (4) watering down dusty areas; (5) avoiding laying down equipment in areas of obvious contamination; and (6) use of disposable sampling equipment.

7.1 Decontamination Methods

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. Various decontamination methods will remove contaminants by: (1) flushing or other physical action, or (2) chemical complexing to inactivate contaminants by neutralization, chemical reaction, disinfection, or sterilization.

Physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods, as follows:

7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The mechanical abrasive cleaning methods are most commonly used at hazardous waste sites. The following abrasive methods are available:

Mechanical

Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, time of application, and angle at which the abrasive strikes the surface will dictate cleaning efficiency. Disadvantages of this method are the inability to control the amount of material removed and the large amount of waste generated.

Wet Blasting

Wet blast cleaning involves use of a suspended fine abrasive. The abrasive/water mixture is delivered by compressed air to the contaminated area. By using a very fine abrasive, the amount of materials removed can be carefully controlled.

7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with pressure. In general, the equipment surface is not removed using non-abrasive methods.

Low-Pressure Water

This method consists of a container which is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high-pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow rates usually range from 20 to 140 liters per minute.

Ultra-High-Pressure Water

This system produces a water jet that is pressured from 1,000 to 4,000 atmospheres. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 meters/second (m/s) (1,000 atm) to 900 m/s (4,000 atm). Additives can be used to enhance the cleaning action.

Rinsing

Contaminants are removed by rinsing through dilution, physical attraction, and solubilization.

Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps hooked on a fence, placed on a drum, or wrapped in plastic bags are not likely to become heavily contaminated. A damp cloth should be used to wipe off contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set.

Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment. This method of decontamination is typically performed off-site.

7.2 Field Sampling Equipment Decontamination Procedures

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. The spread of contaminants is further reduced by separating each decontamination station by a minimum of three (3) feet. Ideally, the contamination should decrease as the equipment progresses from one station to another farther along in the line.

A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC) which is in the CRZ. Figure 1 (Appendix B) shows a typical contaminant reduction zone layout. The CRC controls access into and out of the exclusion zone and confines decontamination activities to a limited area. The CRC boundaries should be conspicuously marked. The far end is the hotline, the boundary between the exclusion zone and the contamination reduction zone. The size of the decontamination corridor depends on the number of stations in the decontamination process, overall dimensions of the work zones, and amount of space available at the site. Whenever possible, it should be a straight line.

Anyone in the CRC should be wearing the level of protection designated for the decontamination crew. Another corridor may be required for the entry and exit of heavy equipment. Sampling and monitoring equipment and sampling supplies are all maintained outside of the CRC. Personnel don their equipment away from the CRC and enter the exclusion zone through a separate access control point at the hotline. One person (or more) dedicated to decontaminating equipment is recommended.

7.2.1 Decontamination Setup

Starting with the most contaminated station, the decontamination setup should be as follows:

Station 1: Segregate Equipment Drop

Place plastic sheeting on the ground (Figure 2, Appendix B). Size will depend on amount of equipment to be decontaminated. Provide containers lined with plastic if equipment is to be segregated. Segregation may be required if sensitive equipment or mildly contaminated equipment is used at the same time as equipment which is likely to be heavily contaminated.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

As indicated in 7.1.2, a high-pressure wash may be required for compounds which are difficult to remove by washing with brushes. The elevated temperature of the water from the high-pressure washers is excellent at removing greasy/oily compounds. High pressure washers require water and electricity.

A decontamination pad may be required for the high-pressure wash area. An example of a wash pad may consist of an approximately 1 1/2 foot-deep basin lined with plastic sheeting and sloped to a sump at one corner. A layer of sand can be placed over the plastic and the basin is filled with gravel or shell. The sump is also lined with visqueen and a barrel is placed in the hole to prevent collapse. A sump pump is used to remove the water from the sump for transfer into a drum.

Typically heavy machinery is decontaminated at the end of the day unless site sampling requires that the machinery be decontaminated frequently. A separate decontamination pad may be required for heavy equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Prior to setting up Station 3, place plastic sheeting on the ground to cover areas under Station 3 through Station 10.
Fill a wash basin, a large bucket, or child's swimming pool with non-phosphate detergent and tap water. Several bottle and bristle brushes to physically remove contamination should be dedicated to this station . Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 4: Water Basin

Fill a wash basin, a large bucket, or child's swimming pool with tap water. Several bottle and bristle brushes should be dedicated to this station. Approximately 10-50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 5: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to contain the water during the rinsing process. Approximately 10-20 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 6: Nitric Acid Sprayers

Fill a spray bottle with 10% nitric acid. An acid rinse may not be required if inorganics are not a contaminant of concern. The amount of acid will depend on the amount of equipment to be decontaminated. Provide a 5-gallon bucket or basin to collect acid during the rinsing process.

Station 7: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 8: Organic Solvent Sprayers

Fill a spray bottle with an organic solvent. After each solvent rinse, the equipment should be rinsed with distilled/deionized water and air dried. Amount of solvent will depend on the amount of equipment to decontaminate. Provide a 5-gallon bucket or basin to collect the solvent during the rinsing process.

Solvent rinses may not be required unless organics are a contaminant of concern, and may be eliminated from the station sequence.

Station 9: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 10: Clean Equipment Drop

Lay a clean piece of plastic sheeting over the bottom plastic layer. This will allow easy removal of the plastic in the event that it becomes dirty. Provide aluminum foil, plastic, or other protective material to wrap clean equipment.

7.2.2 Decontamination Procedures

Station 1: Segregate Equipment Drop

Deposit equipment used on-site (i.e., tools, sampling devices and containers, monitoring instruments radios, clipboards, etc.) on the plastic drop cloth/sheet or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination. Loose leaf sampling data sheets or maps can be placed in plastic zip lock bags if contamination is evident.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

Use high pressure wash on grossly contaminated equipment. Do not use high- pressure wash on sensitive or non-waterproof equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Scrub equipment with soap and water using bottle and bristle brushes. Only sensitive equipment (i.e., radios, air monitoring and sampling equipment) which is waterproof should be washed. Equipment which is not waterproof should have plastic bags removed and wiped down with a damp cloth. Acids and organic rinses may also ruin sensitive equipment. Consult the manufacturers for recommended decontamination solutions.

Station 4: Equipment Rinse

Wash soap off of equipment with water by immersing the equipment in the water while brushing. Repeat as many times as necessary.

Station 5: Low-Pressure Rinse

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 6: Nitric Acid Sprayers (required only if metals are a contaminant of concern)

Using a spray bottle rinse sampling equipment with nitric acid. Begin spraying (inside and outside) at one end of the equipment allowing the acid to drip to the other end into a 5-gallon bucket. A rinsate blank may be required at this station. Refer to Section 9.

Station 7: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 8: Organic Solvent Sprayers

Rinse sampling equipment with a solvent. Begin spraying (inside and outside) at one end of the equipment allowing the solvent to drip to the other end into a 5-gallon bucket. Allow the solvent to evaporate from the equipment before going to the next station. A QC rinsate sample may be required at this station.

Station 9: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure washer.

Station 10 : Clean Equipment Drop

Lay clean equipment on plastic sheeting. Once air dried, wrap sampling equipment with aluminum foil, plastic, or other protective material.

7.2.3 Post Decontamination Procedures

1. Collect high-pressure pad and heavy equipment decontamination area liquid and waste and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the Department of Transportation (DOT) requirements for appropriate containers based on the contaminant of concern.

2. Collect high-pressure pad and heavy equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

3. Empty soap and water liquid wastes from basins and buckets and store in appropriate

drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

4. Empty acid rinse waste and place in appropriate container or neutralize with a base and place in appropriate drum. pH paper or an equivalent pH test is required for neutralization. Consult DOT requirements for appropriate drum for acid rinse waste.

5. Empty solvent rinse sprayer and solvent waste into an appropriate container. Consult DOT requirements for appropriate drum for solvent rinse waste.

6. Using low-pressure sprayers, rinse basins, and brushes. Place liquid generated from this process into the wash water rinse container.

7. Empty low-pressure sprayer water onto the ground.

8. Place all solid waste materials generated from the decontamination area (i.e., gloves and plastic sheeting, etc.) in an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

9. Write appropriate labels for waste and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum generated from the decontamination process.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITYASSURANCE/ QUALITY CONTROL

A rinsate blank is one specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field.

Rinsate blanks are samples obtained by running analyte free water over decontaminated sampling equipment to test for residual contamination. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identical to samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Where dedicated sampling equipment is not utilized, collect one rinsate blank per day per type of sampling device samples to meet QA2 and QA3 objectives.

If sampling equipment requires the use of plastic tubing it should be disposed of as contaminated and replaced with clean tubing before additional sampling occurs.

10.0 DATA VALIDATION

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the project's data quality objectives.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow OSHA, U.S. EPA, corporate, and other applicable health and safety procedures.

Decontamination can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before use. Decontamination materials may degrade protective clothing or equipment; some solvents can permeate protective clothing. If decontamination materials do pose a health hazard, measures should be taken to protect personnel or substitutions should be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process.

Safety considerations should be addressed when using abrasive and non-abrasive decontamination equipment. Maximum air pressure produced by abrasive equipment could cause physical injury. Displaced material requires control mechanisms.

Material generated from decontamination activities requires proper handling, storage, and disposal. Personal Protective Equipment may be required for these activities.

Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e., acetone, alcohol, and trisodiumphosphate).

In some jurisdictions, phosphate containing detergents (i.e., TSP) are banned.

12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, February, 1988.

A Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February, 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October, 1985.

APPENDIX A

Table

Table 1. Soluble Contaminants and Recommended Solvent Rinse

TABLE 1
Soluble Contaminants and Recommended Solvent Rinse

SOLVENT[1]	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Tap water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Nitric acid Acetic acid Boric acid	Basic (caustic) compounds (e.g., amines and hydrazines)
Dilute Bases	Sodium bicarbonate (e.g., soap detergent)	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents [2]	Alcohols Ethers Ketones Aromatics Straight chain alkalines (e.g., hexane) Common petroleum products (e.g., fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent[2]	Hexane	PCBs

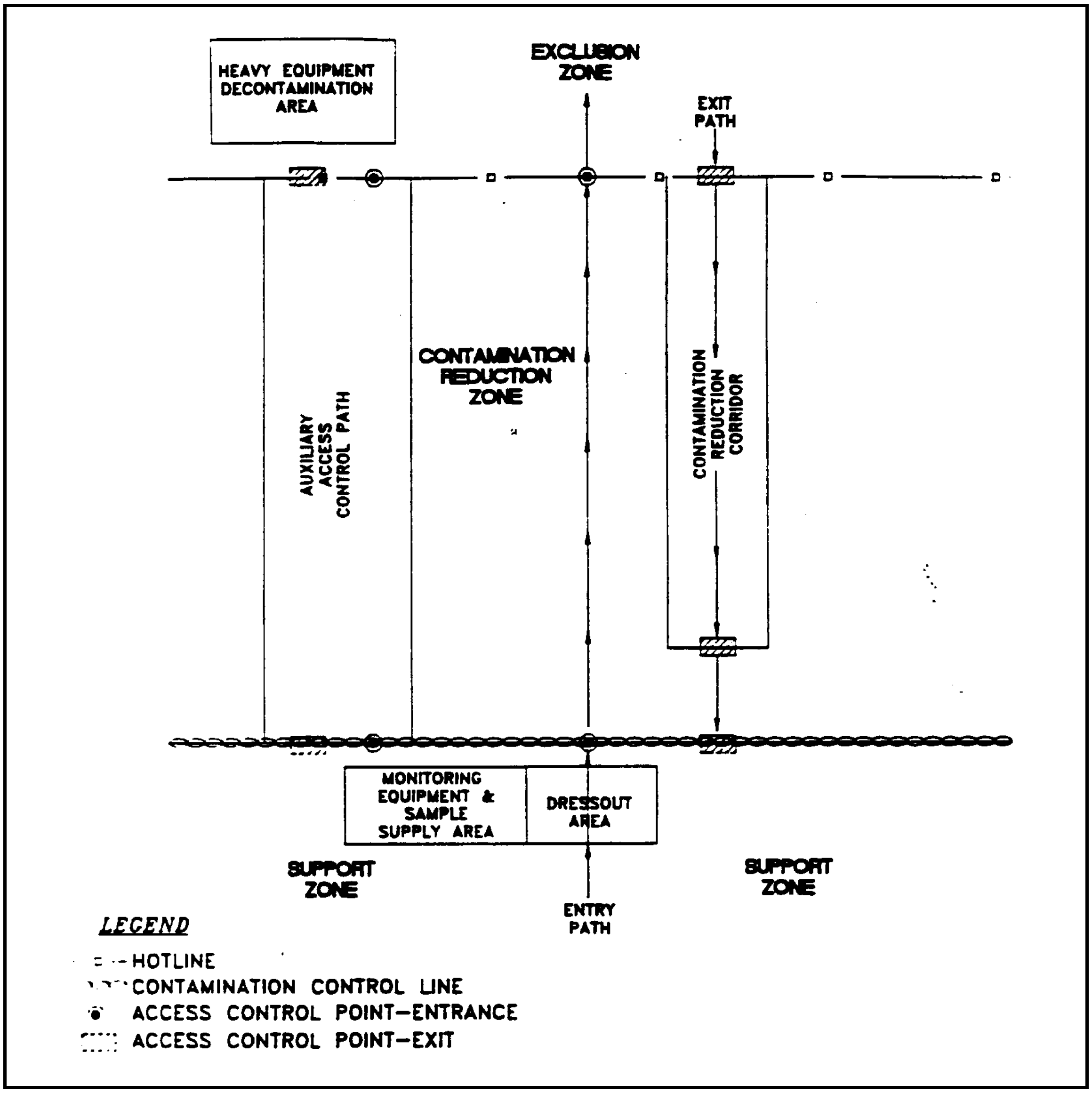
[1] - Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

[2] - WARNING: Some organic solvents can permeate and/or degrade the protective clothing

APPENDIX B

Figures

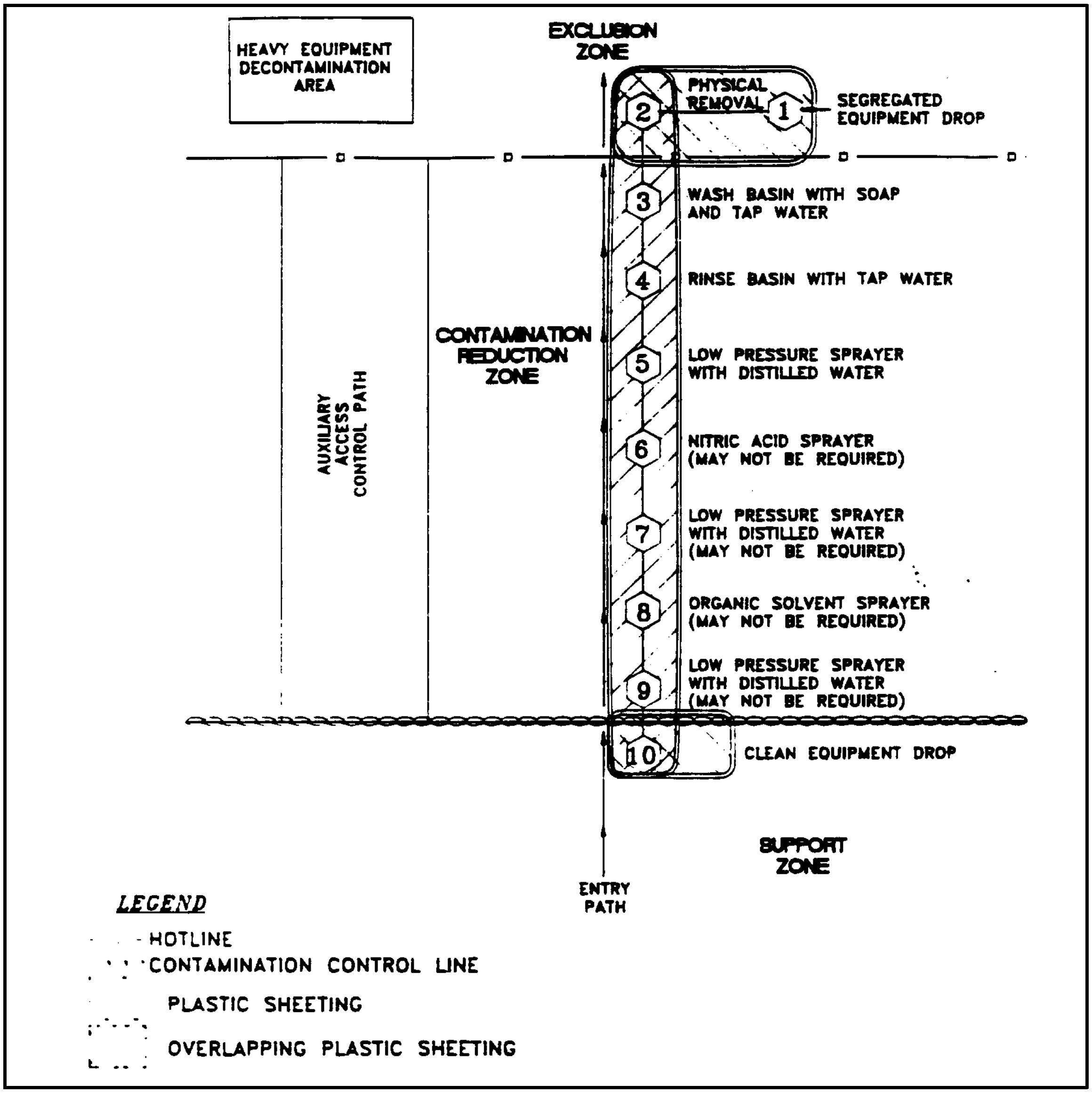
Figure 1. Contamination Reduction Zone Layout



APPENDIX B (Cont'd.)

Figures

Figure 2. Decontamination Layout



MODEL 5400
GEOPROBE™ OPERATION

SOP#: 2050
DATE: 03/27/96
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to describe the collection of representative soil, soil-gas, and groundwater samples using a Model 5400 Geoprobe^{TM} sampling device. Any deviations from these procedures should be documented in the site/field logbook and stated in project deliverables.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

The Geoprobe^{TM} sampling device is used to collect soil, soil-gas and groundwater samples at specific depths below ground surface (BGS). The Geoprobe^{TM} is hydraulically powered and is mounted in a customized four-wheel drive vehicle. The base of the sampling device is positioned on the ground over the sampling location and the vehicle is hydraulically raised on the base. As the weight of the vehicle is transferred to the probe, the probe is pushed into the ground. A built-in hammer mechanism allows the probe to be driven through dense materials. Maximum depth penetration under favorable circumstances is about 50 feet. Components of the Model 5400 Geoprobe^{TM} are shown in Figures 1 through 6 (Appendix A).

Soil samples are collected with a specially-designed sample tube. The sample tube is pushed and/or vibrated to a specified depth (approximately one foot above the intended sample interval). The interior plug of the sample tube is removed by inserting small-diameter threaded rods. The sample tube is then driven an additional foot to collect the samples. The probe sections and sample tube are then withdrawn and the sample is extruded from the tube into sample jars.

Soil gas can be collected in two ways. One method involves withdrawing a sample directly from the probe rods, after evacuating a sufficient volume of air from the probe rods. The other method involves collecting a sample through tubing attached by an adaptor to the bottom probe section. Correctly used, the latter method provides more reliable results.

Slotted lengths of probe can be used to collect groundwater samples if the probe rods can be driven to the water table. Groundwater samples are collected using either a peristaltic pump or a small bailer.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

Refer to specific ERT SOPs for procedures appropriate to the matrix, parameters and sampling objector.

Applicable ERT SOPs include:

ERT #2012, Soil Sampling

ERT #2007, Groundwater Well Sampling

ERT #2042, Soil Gas Sampling

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

A preliminary site survey should identify areas to be avoided with the truck. All underground utilities should be located and avoided during sampling. Begin sampling activities with an adequate fuel supply.

Decontamination of sampling tubes, probe rods, adaptors, non-expendable points and other equipment that contacts the soil is necessary to prevent cross-contamination of samples. During sampling, the bottom portion and outside of the sampling tubes can be contaminated with soil from other depth intervals.

Care must be taken to prevent soil which does not represent the sampled interval form being incorporated into the sample. Excess soil should be carefully wiped from the outside surface of the sampling tube and the bottom 3 inches of the sample should be discarded before extruding the sample into a sample jar.

The amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent upon the parameter(s) of interest. Guidelines for the containment, preservation, handling and storage of soil-gas samples are described in ERT SOP #2042, Soil-Gas Sampling.

Obtaining sufficient volume of soil for multiple analyses from one sample location may present a problem. The Geoprobe™ soil sampling system recovers a limited volume of soil and it is not possible to reenter the same hole and collect additional soil. When multiple analyses are to be performed on soil samples collected with the Geoprobe™, it is important that the relative importance of the analyses be identified. Identifying the order of importance will ensure that the limited sample volume will be used for the most crucial analyses.

5.0 EQUIPMENT/APPARATUS

Sampling with the Geoprobe™ involves use of the equipment listed below. Some of the equipment is used for all sample types, others are specific to soil (S), soil gas (SG), or groundwater (GW) as noted.

C Geoprobe™ sampling device
C Threaded probe rods (36", 24", and 12" lengths)
C Drive Caps
C Pull Caps
C Rod Extractor
C Expendable Point Holders
C Expendable Drive Points
C Solid Drive Points
C Extension Rods
C Extension Rod Couplers
C Extension Rod Handle
C Hammer Anvil
C Hammer Latch
C Hammer Latch Tool
C Drill Steels
C Carbide-Tipped Drill Bit
C Mill-Slotted Well Point (GW)
C Threaded Drive Point (GW)
C Well Mini-Bailer (GW)
C Tubing Bottom Check Valve (GW)
C 3/8" O.D. Low Density Polyethylene Tubing (GW, SG)
C Gas Sampling Adaptor and Cap (SG)
C Teflon Tape
C Neoprene "O" - Rings (SG)
C Vacuum System (mounted in vehicle) (SG)
C Piston Tip (S)
C Piston Rod (S)
C Piston Stop (S)
C Sample Tube (11.5" in length) (S)
C Vinyl Ends Caps (S)
C Sample Extruder (S)
C Extruder Pistons (Wooden Dowels) (S)
C Wire Brush
C Brush Adapters
C Cleaning Brush (Bottle)

6.0 REAGENTS

Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

7.0 PROCEDURES

Portions of the following sections have been condensed from the Model 5400 Geoprobe™ Operations Manual(1). Refer to this manual for more detailed information concerning equipment specifications, general maintenance, tools, throttle control, clutch pump, GSK-58 Hammer, and trouble-shooting. A copy of this manual will be maintained with the Geoprobe™ and on file in the Quality Assurance (QA) office.

7.1 Preparation

1. Determine extent of the sampling effort, sample matrices to be collected, and types and amounts of equipment and supplies required to complete the sampling effort.

2. Obtain and organize necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Perform a general site survey prior to site

entry in accordance with the site-specific Health and Safety Plan.

5. Use stakes or flagging to identify and mark all sampling locations. All sample locations should be cleared for utilities prior to sampling.

7.2 Setup of Geoprobe™

1. Back carrier vehicle to probing location.

2. Shift the vehicle to park and shut off ignition.

3. Set parking brake and place chocks under rear tires.

4. Attach exhaust hoses so exhaust blows downwind of the sampling location (this is particularly important during soil gas sampling).

5. Start engine using the remote ignition at the Geoprobe™ operator position.

6. Activate hydraulic system by turning on the Electrical Control Switch located on the Geoprobe™ electrical control panel (Figure 1, Appendix A). When positioning the probe, always use the SLOW speed. The SLOW speed switch is located on the hydraulic control panel (Figure 2, Appendix A).

   Important: Check for clearance on vehicle roof before folding Geoprobe™ out of the carrier vehicle.

7. Laterally extend the Geoprobe™ from the vehicle as far as possible by pulling the EXTEND control lever toward the back of the vehicle while the Geoprobe™ is horizontal.

8. Using the FOOT control, lower the Derrick Slide so it is below cylinder (A) before folding the Geoprobe™ out of the carrier vehicle (Figure 3, Appendix A). This will ensure clearance at the roof of the vehicle.

9. Use the FOLD, FOOT, and EXTEND controls to place Geoprobe™ to the exact probing location. Never begin probing in the fully extended position.

10. Using the FOLD control, adjust the long axis of the probe cylinder so that it is perpendicular (visually) to the ground surface.

11. Using the FOOT control, put the weight of the vehicle on the probe unit. Do not raise the rear of the vehicle more than six inches.

    Important: Keep rear vehicle wheels on the ground surface when transferring the weight of the vehicle to the probe unit. Otherwise, vehicle may shift when probing begins.

12. When the probe axis is vertical and the weight of the vehicle is on the probe unit, probing is ready to begin.

7.3 Drilling Through Surface Pavement or Concrete

1. Position carrier vehicle to drilling location.

2. Fold unit out of carrier vehicle.

3. Deactivate hydraulics.

4. Insert carbide-tipped drill bit into hammer.

5. Activate HAMMER ROTATION control by turning knob counter-clockwise (Figure 4, Appendix A). This allows the drill bit to rotate when the HAMMER control is pressed.

6. Press down on HAMMER control to activate counterclockwise rotation.

7. Both the HAMMER control and the PROBE control must be used when drilling through the surface (Figure 4, Appendix A). Fully depress the HAMMER control, and incrementally lower the bit gradually into the pavement by periodically depressing the PROBE control.

8. When the surface has been penetrated, turn the HAMMER Control Valve knob

clockwise to deactivate hammer rotation and remove the drill bit from the HAMMER.

Important: Be sure to deactivate the rotary action before driving probe rods.

7.4 Probing

1. Position the carrier vehicle to the desired sampling location and set the vehicle parking brake.

2. Deploy Geoprobe^{TM} Sampling Device.

3. Make sure the hydraulic system is turned off.

4. Lift up latch and insert hammer anvil into hammer - push latch back in (Figure 5, Appendix A).

5. Thread the drive cap onto the male end of the probe rod.

6. Thread an expendable point holder onto the other end of the first probe rod.

7. Slip an expendable drive point into point holder.

8. Position the leading probe rod with expendable drive point in the center of the derrick foot and directly below the hammer anvil.

   Important: Positioning the first probe rod is critical in order to drive the probe rod vertically. Therefore, both the probe rod and the probe cylinder shaft must be in the vertical position (Figure 6, Appendix A).

9. To begin probing, activate the hydraulics and push the PROBE Control downward. When advancing the first probe rod, always use the SLOW speed. Many times the probe rods can be advanced using only the weight of the carrier vehicle. When this is the case, only the PROBE control is used.

   Important: When advancing rods, always keep the probe rods parallel to the probe cylinder shaft (Figure 6, Appendix A). This is done by making minor adjustments with the FOLD control. Failure to keep probe rods parallel to probe cylinder shaft may result in broken rods and increased difficulty in achieving desired sampling depth.

7.5 Probing - Percussion Hammer

The percussion hammer must be used in situations where the weight of the vehicle is not sufficient to advance the probe rods.

1. Make sure the Hammer Rotation Valve is closed.

2. Using the PROBE control to advance the rod, press down the HAMMER control to allow percussion to drive the rods (Figure 2, Appendix A).

   Important: Always keep static weight on the probe rod or the rod will vibrate and chatter while you are hammering, causing rod threads to fracture and break.

3. Keep the hammer tight to the drive cap so the rod will not vibrate.

4. Periodically stop hammering and check if the probe rods can be advanced by pushing only.

5. Any time the downward progress of the probe rods is refused, the derrick foot may lift off of the ground surface. When this happens, reduce pressure on the PROBE control. Do not allow the foot to rise more than six inches off the ground or the vehicle's wheels may lift off the ground surface, causing the vehicle to shift (Figure 6, Appendix A).

6. As the derrick foot is raised off the ground surface, the probe cylinder may not be in a perpendicular position. If this happens, use the FOLD control to correct the probe cylinder position.

7.6 Probing - Adding Rods

1. Standard probe rods are three feet in length. If the desired depth is more than three feet,

another rod must be threaded onto the rod that has been driven into the ground. In order to ensure a vacuum-tight seal (soil-gas sampling), two wraps of teflon tape around the thread is recommended.

2. Using the PROBE control, raise the probe cylinder as high as possible.

   Important: Always deactivate hydraulics when adding rods.

3. Deactivate hydraulics.

4. Unthread the drive cap from the probe rod that is in the ground.

5. Wrap teflon tape around the threads.

6. Thread the drive cap onto the male end of the next probe rod to be used.

7. After threading the drive cap onto the rod to be added, thread the rod onto the probe rod that has been driven into the ground. Make sure threads have been teflon taped. Continue probing.

8. Continue these steps until the desired sampling depth has been reached.

7.7 Probing/Pulling Rods

1. Once the probe rods have been driven to depth, they can also be pulled using the Geoprobe^{TM} Machine.

2. Turn off the hydraulics.

3. Lift up latch and take the hammer anvil out of the hammer.

4. Replace the drive cap from the last probe rod driven with a pull cap.

5. Lift up the hammer latch.

6. Activate the hydraulics.

7. Hold down on the PROBE control, and move the probe cylinder down until the latch can be closed over the pull cap.

   Important: If the latch will not close over the pull cap, adjust the derrick assembly by using the extend control. This will allow you to center the pull cap directly below the hammer latch.

8. Retract the probe rods by pulling up on the PROBE control.

   Important: Do not raise the probe cylinder all the way when pulling probe rods or it will be impossible to detach a rod that has been pulled out. However, it is necessary to raise the probe cylinder far enough to allow the next probe section to be pulled.

9. After retracting the first probe rod, lower the probe cylinder only slightly to ease the pressure off of the hammer latch.

10. Attach a clamping device to the base of the rods where it meets the ground to prevent rods from falling back into the hole.

11. Raise the hammer latch.

12. Hold the PROBE control up and raise the probe cylinder as high as possible.

13. Unthread the pull cap from the retracted rod.

14. Unthread the retracted rod.

15. Thread the pull cap onto the next rod that is to be pulled.

16. Continue these steps until all the rods are retracted from the hole.

17. Decontaminate all portions of the equipment that have been in contact with the soil, soil gas and groundwater.

7.8 Soil-Gas Sampling Without Interior Tubing

1. Follow procedures outlined in Sections 7.1 through 7.6.

2. Remove hammer anvil from hammer.

3. Thread on pull cap to end of probe rod.

4. Retract rod approximately six inches. Retraction of the rod disengages expendable drive point and allows for soil vapor to enter rod.

5. Unthread pull cap and replace it with a gas sampling cap. Cap is furnished with barbed hose connector.

   Important: Shut engine off before taking sample (exhaust fumes can cause faulty sample data).

6. Turn vacuum pump on and allow vacuum to build in tank.

7. Open line control valve. For each rod used, purge 300 liters of volume. Example: Three rods used = 900 liters = .900 on gauge.

8. After achieving sufficient purge volume, close valve and allow sample line pressure gauge to return to zero. This returns sample train to atmospheric pressure.

9. The vapor sample can now be taken.

   1. Pinch hose near gas sampling cap to prevent any outside vapors from entering the rods.

   2. Insert syringe needle into center of barbed hose connector and withdraw vapor sample.

10. To maintain suction at the sampling location, periodically drain the vacuum tank.

11. To remove rods, follow procedures outlined in Section 7.7.

7.9 Soil-Gas Sampling With Post-Run Tubing (PRT)

1. Follow procedures outlined in Sections 7.1 through 7.6.

2. Retract rod approximately six inches. Retraction of rod disengages expendable drive point and allows for soil vapor to enter rod.

3. Remove pull cap from the end of the probe rod.

4. Position the Geoprobe™ to allow room to work.

5. Secure PRT Tubing Adapter with "O" - Ring to selected tubing.

6. Insert the adapter end of the tubing down the inside diameter of the probe rods.

7. Feed the tubing down the hole until it hits bottom on the expendable point holder. Cut the tubing approximately two feet from the top probe rod.

8. Grasp excess tubing and apply some downward pressure while turning it in a counter-clockwise motion to engage the adapter threads with the expendable point holder.

9. Pull up lightly on the tubing to test engagement of threads.

10. Connect the outer end of the tubing to silicon tubing and vacuum hose (or other sampling apparatus).

11. Follow the appropriate sampling procedure (ERT SOP #2042, Soil Gas Sampling) to collect a soil-gas sample.

12. After collecting a sample, disconnect the tubing from the vacuum hose or sampling system.

13. Pull up firmly on the tubing until it releases from the adapter at the bottom of the hole.

14. Extract the probe rods from the ground and recover the expendable point holder with the attached adapter.

15. Inspect the "O"-ring at the base of the adapter to verify that proper sealing was achieved during sampling. The "O"-ring should be compressed.

    Note: If the "O"-ring is not compressed, vapors from within the probe sections may have been collected rather than vapors from the intended sample interval.

7.10 Soil Sampling

1. Follow procedures outlined in Sections 7.1 through 7.6.
2. Assemble soil-sampling tube.
    1. Thread piston rod into piston tip.
    2. Insert piston tip into sample tube, seating piston tip into cutting edge of sample tube.
    3. Thread drive head into threaded end of sample tube.
    4. Thread piston stop pin into drive head. Stop pin should be tightened with wrench so that it exerts pressure against the piston rod.
3. Attach assembled sampler onto leading probe rod.
4. Drive the sampler with the attached probe rods to the top of the interval to be sampled.
5. Move probe unit back from the top of the probe rods to allow work room.
6. Remove drive cap and lower extension rods into inside diameter of probe rods using couplers to join rods together.
7. Attach extension rod handle to top extension rod.
8. Rotate extension rod handle clockwise until the leading extension rod is threaded into the piston stop in downhole.
9. Continue to rotate extension rod handle clockwise until reverse-threaded stop-pin has disengaged from the drive head.
10. Remove extension rods and attached stop-pin from the probe rods.
11. Replace drive cap onto top probe rod.
12. Mark the top probe rod with a marker or tape at the appropriate distance above the ground surface (dependent on sample tube length).
13. Drive probe rods and sampler the designated distance. Be careful not to overdrive the sampler which could compact the soil sample in the tube, making it difficult to extrude.

    Important: Documentation of sample location should include both surface and subsurface identifiers. Example: Correct Method - Sample Location S-6, 12.0' - 13.0'. Incorrect Method - Sample Location S-6, 12.0'.

14. Retract probe rods from the hole and recover the sample tube. Inspect the sample tube to confirm that a sample was recovered.
15. Disassemble sampler. Remove all parts.
16. Position extruder rack on the foot of the Geoprobe™ derrick.
17. Insert sample tube into extruder rack with the cutting end up.
18. Insert hammer anvil into hammer.
19. Position the extruder piston (wood dowel) and push sample out of the tube using the PROBE control on the Geoprobe™. Collect the sample as it is extruded in an appropriate sample container.

    Caution: use care when performing this task. Apply downward pressure gradually. Use of excessive force could result in injury to operator or damage to tools. Make sure proper diameter extruder piston is used.

20. To remove rods follow procedures outlined in Section 7.7.

7.11 Groundwater Sampling

1. Follow Sections 7.1 thorough 7.6 with the following exception: the Mill-Slotted Well Rod with attached threaded drive point should be the first section probed into the ground. Multiple sections of mill-slotted well rods can be used to provide a greater vertical section into which groundwater can flow.

2. Probe to a depth at which groundwater is expected.

3. Remove Drive Cap and insert an electric water-level indicator to determine if water has entered the slotted sections of probe rod. Refer to ERT SOP #2043, Water Level Measurement, to determine water level.

4. If water is not detected in the probe rods, replace the drive cap and continue probing. Stop after each additional probe length and determine if groundwater has entered the slotted rods.
5. After the probe rods have been driven into the saturated zone, sufficient time should be allowed for the water level in the probe rods to stabilize.

   Note: It will be difficult if not impossible to collect a groundwater sample in aquifer material small enough to pass through the slots (<0.02 inch diameter).

6. Groundwater samples may be collected with the 20-mL well Mini-Bailer or a pumping device. If samples are being collected for volatile organic analysis (VOA), the 20-mL Well Mini-Bailer should be used. If samples are being collected for a variety of analyses, VOA samples should be collected first using the bailer. Remaining samples can be collected by pumping water to the surface. Withdrawing water with the pump is more efficient than collecting water with the 20-mL well Mini-Bailer.

   Important: Documentation of sample location should include both surface and subsurface identifiers. Example: Sample Location GW-6, 17'-21' bgs, water level in probe rods is 17 feet bgs, and the leading section of probe rod is 21 feet bgs. The water sample is from this zone, not from 17 feet bgs or 21 feet bgs.

7. Remove rods following procedures outlined in Section 7.7.

8.0 CALCULATIONS

Calculating Vapor Purge Volume for Soil-Gas Sampling without Interior Tubing

Volume of Air to be Purged (Liters) = 300 x Number of Rods in the Ground

Volume in Liters/1000 = Reading on Vacuum Pump Instrument Gauge

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

The following general QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and the REAC site specific Health and Safety Plan. The following is a list of health and safety precautions which specifically apply to Geoprobe^{TM} operation.

1. Always put vehicle in "park", set emergency the brake, and place chocks under the tires, before engaging remote ignition.

2. If vehicle is parked on a loose or soft surface, do not fully raise rear of vehicle with probe foot, as vehicle may fall or move.

3. Always extend the probe unit out from the vehicle and deploy the foot to clear vehicle roof line before folding the probe unit out.

4. Operators should wear OSHA approved steel-toed shoes and keep feet clear of probe foot.

5. Operator should wear ANSI approved hard hats.

6. Only one person should operate the probe machine and the assemble or disassemble probe rods and accessories.

7. Never place hands on top of a rod while it is under the machine.

8. Turn off the hydraulic system while changing rods, inserting the hammer anvil, or attaching accessories.

9. Operator must stand on the control side of the probe machine, clear of the probe foot and mast, while operating controls.

10. Wear safety glasses at all times during the operation of this machine.

11. Never continue to exert downward pressure on the probe rods when the probe foot has risen six inches off the ground.

12. Never exert enough downward pressure on a probe rod so as to lift the rear tires of the vehicle off the ground.

13. Always remove the hammer anvil or other tool from the machine before folding the machine to the horizontal position.

14. The vehicle catalytic converter is hot and may present a fire hazard when operating over dry grass or combustibles.

15. Geoprobe^{TM} operators must wear ear protection. OSHA approved ear protection for sound levels exceeding 85 dba is recommended.

16. Locations of buried or underground utilities and services must be known before starting to drill or probe.

17. Shut down the hydraulic system and stop the vehicle engine before attempting to clean or service the equipment.

18. Exercise extreme caution when using extruder pistons (wooden dowels) to extrude soil from sample tubes. Soil in the sample tube may be compacted to the point that the extruder piston will break or shatter before it will push the sample out.

19. A dry chemical fire extinguisher (Type ABC) should be kept with the vehicle at <u>all</u> times.

12.0 REFERENCES

1. Model 5400 Geoprobe^{TM} Operations Manual. Geoprobe^{TM} Systems, Salina, Kansas. July 27, 1990.

2. Geoprobe^{TM} Systems - 1995-96 Tools and Equipment Catalog.

APPENDIX A

Figures

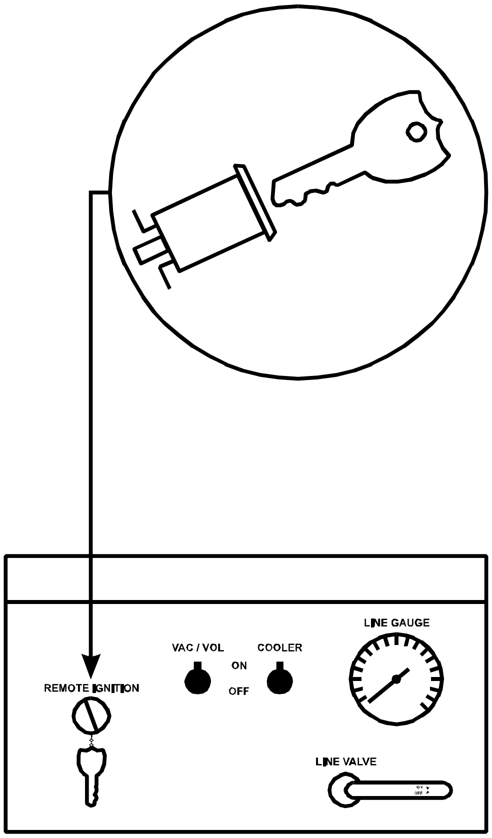
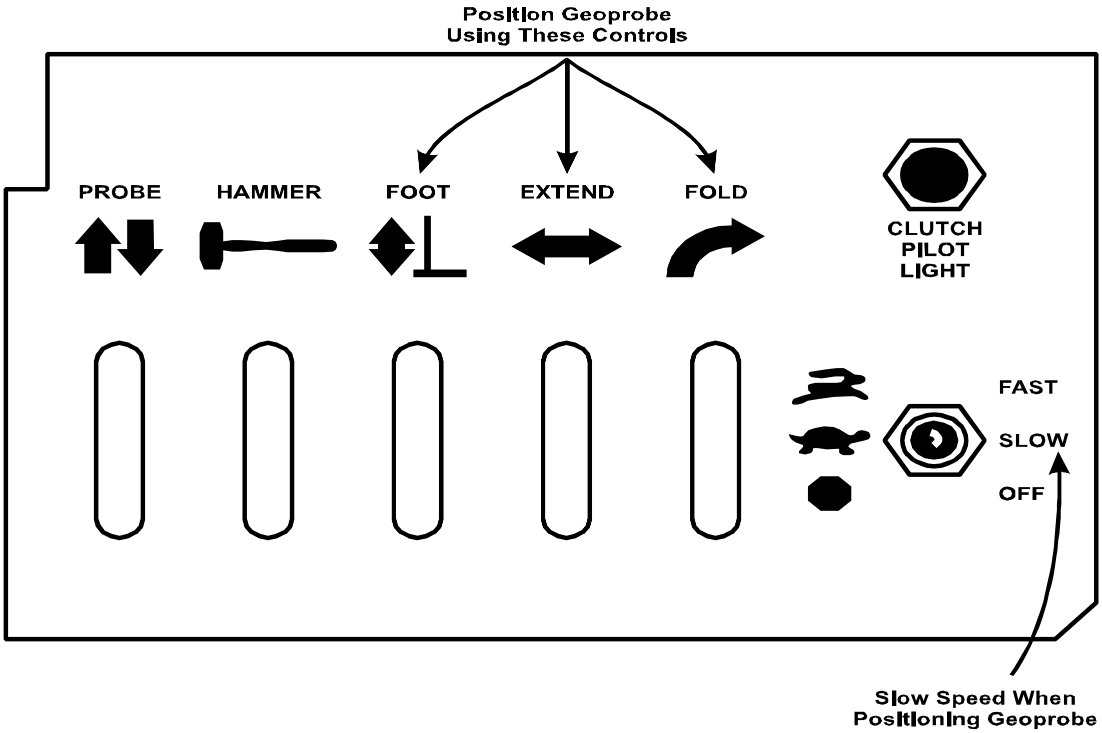


FIGURE 1. Electrical Control Panel

APPENDIX A (Cont'd)

Figures

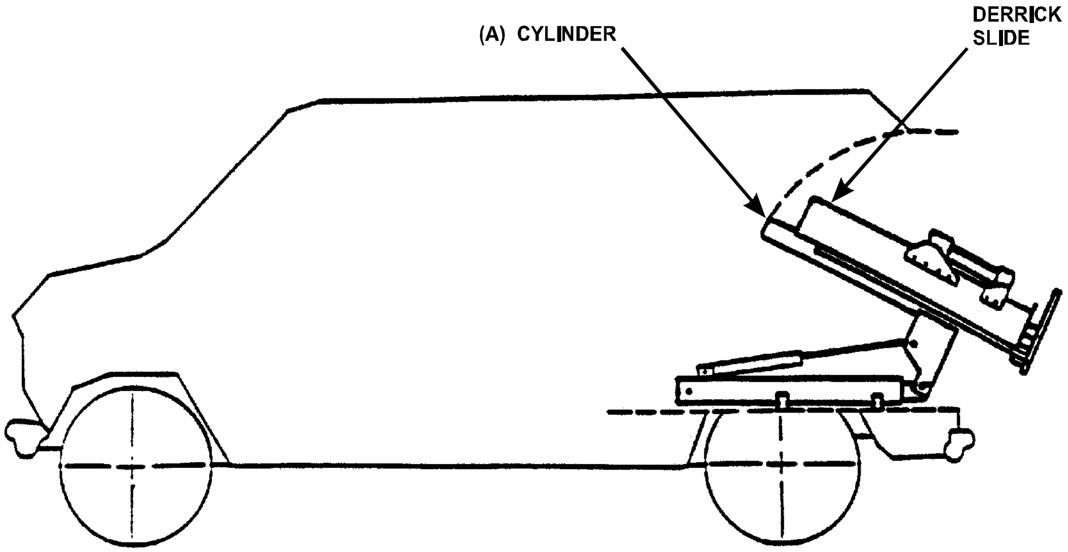
FIGURE 2. Hydraulic Control Panel



APPENDIX A (Cont'd)

Figures

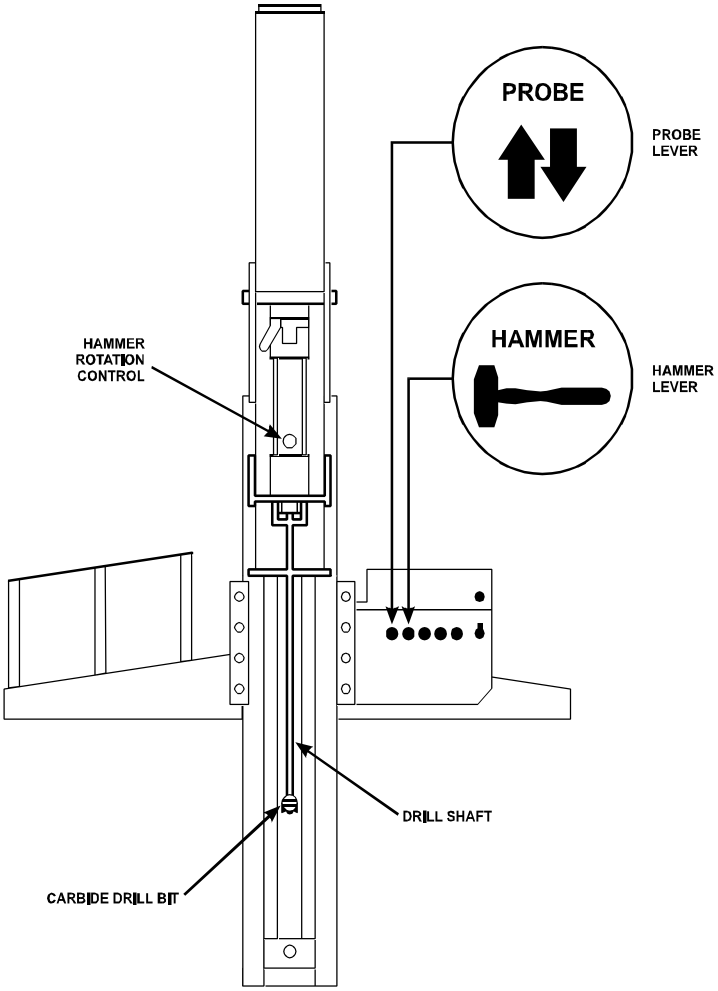
FIGURE 3. Deployment of Geoprobe™ from Sampling Vehicle



APPENDIX A (Cont'd)

Figures

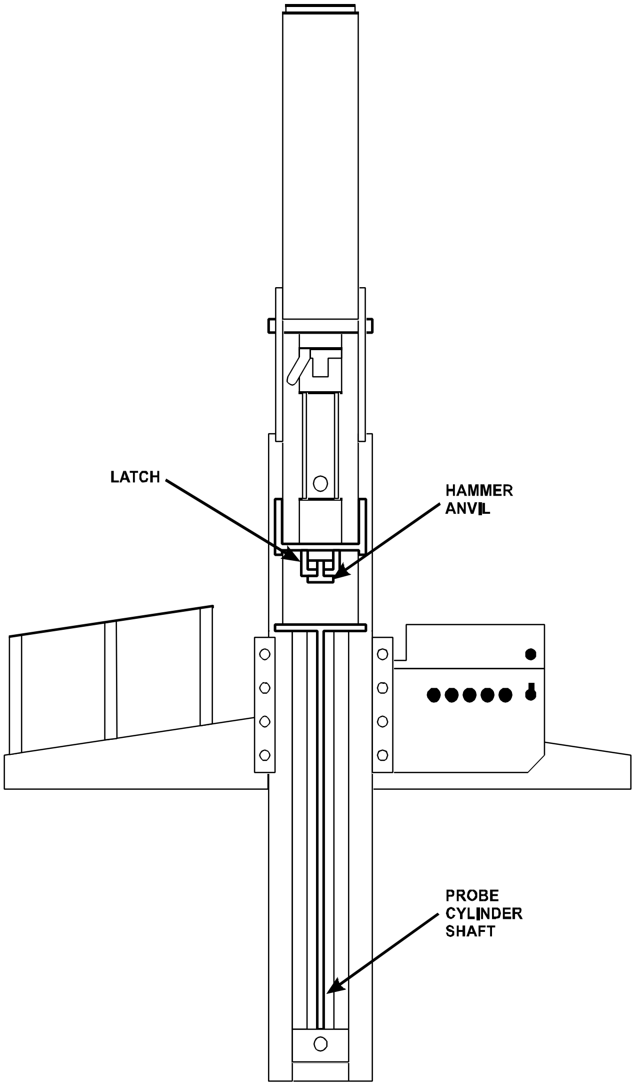
FIGURE 4. Geoprobe^{TM} Setup for Drilling Through Concrete and Pavement



APPENDIX A (Cont'd)

Figures

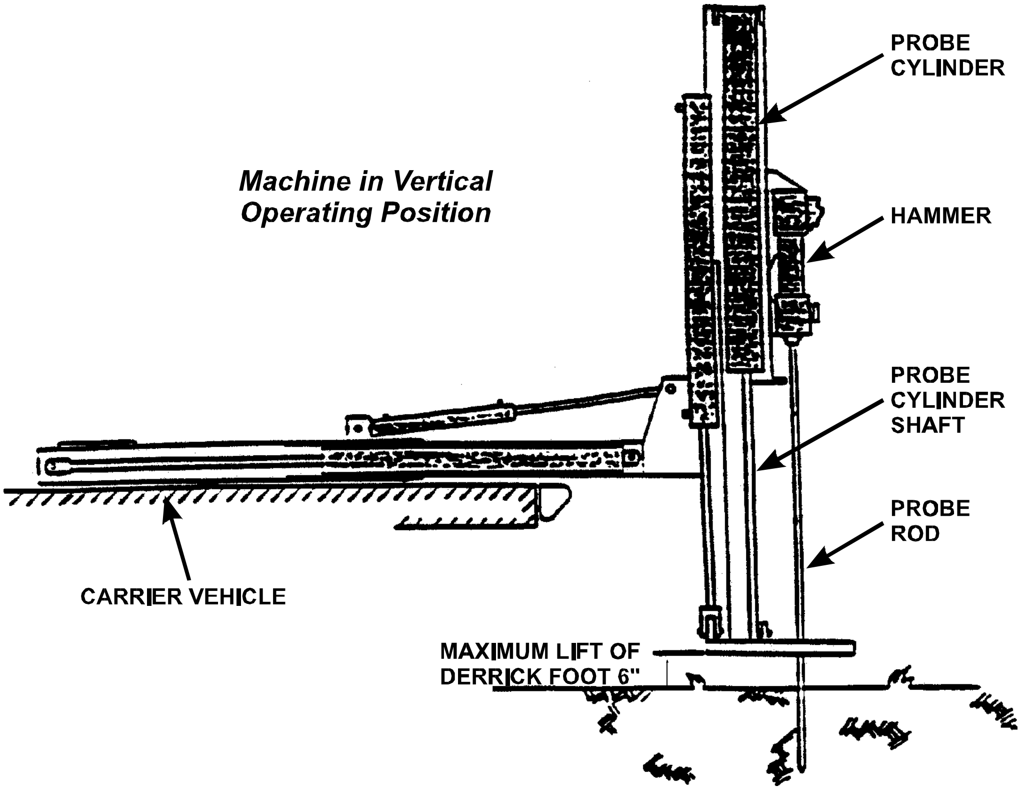
FIGURE 5. Inserting Hammer Anvil



APPENDIX A (Cont'd)

Figures

FIGURE 6. Probe Cylinder Shaft and Probe Rod - Parallel and Vertical



U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOIL SAMPLING

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SUPERCEDES: SOP #2012; Revision 0.0; 11/16/94; U.S. EPA Contract 68-C4-0022.

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of representative soil samples. Sampling depths are assumed to be those that can be reached without the use of a drill rig, direct-push, or other mechanized equipment (except for a back-hoe). Analysis of soil samples may determine whether concentrations of specific pollutants exceed established action levels, or if the concentrations of pollutants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriate site report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (disturbed vs. undisturbed), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and scoop. Sampling at greater depths may be performed using a hand auger, continuous flight auger, a trier, a split-spoon, or, if required, a backhoe.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is not generally recommended. Samples should, however, be cooled and protected from sunlight to minimize any potential reaction. The amount of sample to be collected and proper sample container type are discussed in ERT/REAC SOP #2003 Rev. 0.0 08/11/94, *Sample Storage, Preservation and Handling*.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary potential problems associated with soil sampling - cross contamination of samples and improper sample collection. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results.

5.0 EQUIPMENT

Soil sampling equipment includes the following:

- Maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Survey equipment or global positioning system (GPS) to locate sampling points
- Tape measure
- Survey stakes or flags
- Camera and film
- Stainless steel, plastic, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Logbook
- Labels
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Cooler(s)
- Ice
- Vermiculite
- Decontamination supplies/equipment
- Canvas or plastic sheet
- Spade or shovel
- Spatula
- Scoop
- Plastic or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoons
- Vehimeyer soil sampler outfit
    - Tubes
    - Points
    - Drive head
    - Drop hammer
    - Puller jack and grip
- Backhoe

6.0 REAGENTS

Reagents are not used for the preservation of soil samples. Decontamination solutions are specified in ERT/REAC SOP #2006 Rev. 0.0 08/11/94, *Sampling Equipment Decontamination*, and the site specific work plan.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies required.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare schedules and coordinate with staff, client, and regulatory agencies, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Use stakes, flagging, or buoys to identify and mark all sampling locations. Specific site factors, including extent and nature of contaminant, should be considered when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared by the property owner or the On-Scene-Coordinator (OSC) prior to soil sampling; and utility clearance should always be confirmed before beginning work.

7.2 Sample Collection

7.2.1 Surface Soil Samples

Collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. Surface material is removed to the required depth and a stainless steel or plastic scoop is then used to collect the sample.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. Tools plated with chrome or other materials should not be used. Plating is particularly common with garden implements such as potting trowels.

The following procedure is used to collect surface soil samples:

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.

2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.

3. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

This system consists of an auger, or a thin-wall tube sampler, a series of extensions, and a "T" handle (Figure 1, Appendix A). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin wall tube sampler. The system is then lowered down the borehole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected from the thin wall tube sampler.

Several types of augers are available; these include: bucket type, continuous flight (screw), and post-hole augers. Bucket type augers are better for direct sample recovery because they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights. The continuous flight augers are satisfactory when a composite of the complete soil column is desired. Post-hole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil and cannot be used below a depth of approximately three feet.

The following procedure is used for collecting soil samples with the auger:

1. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.

2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first three to six inches of surface soil for an area approximately six inches in radius around the drilling location.

3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.

4. After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger, collect the sample after the auger is removed from the hole and proceed to Step 10.

5. Remove auger tip from the extension rods and replace with a pre-cleaned thin wall tube sampler. Install the proper cutting tip.

6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.

7. Remove the tube sampler, and unscrew the drill rods.

8. Remove the cutting tip and the core from the device.

9. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container. Sample homogenization is not required.

10. If volatile organic analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly.

    When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.

12. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

7.2.3 Sampling with a Trier

The system consists of a trier, and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

The following procedure is used to collect soil samples with a sampling trier:

1. Insert the trier (Figure 2, Appendix A) into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes the spillage of sample.

2. Rotate the trier once or twice to cut a core of material.

3. Slowly withdraw the trier, making sure that the slot is facing upward.

4. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split spoon sampling is performed to gain geologic information, all work should be performed in accordance with ASTM D1586-98, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils".

The following procedures are used for collecting soil samples with a split spoon:

1. Assemble the sampler by aligning both sides of barrel and then screwing the drive shoe on the bottom and the head piece on top.

2. Place the sampler in a perpendicular position on the sample material.

3. Using a well ring, drive the tube. Do not drive past the bottom of the head piece or compression of the sample will result.

4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth.

5. Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2 and 3 1/2 inch diameters. A larger barrel may be necessary to obtain the required sample volume.

6. Without disturbing the core, transfer it to appropriate labeled sample container(s) and seal tightly.

7.2.5 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil, when detailed examination of soil characteristics are required. This is probably the most expensive sampling method because of the relatively high cost of backhoe operation.

The following procedures are used for collecting soil samples from test pits or trenches:

1. Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of overhead and buried utilities.

2. Review the site specific Health & Safety plan and ensure that all safety precautions including appropriate monitoring equipment are installed as required.

3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by OSHA regulations.

4. A shovel is used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.

5. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.

6. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7. Abandon the pit or excavation according to applicable state regulations. Generally, shallow excavations can simply be backfilled with the removed soil material.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, the following QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration

activities must occur prior to sampling/operation, and they must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OHSA and corporate health and safety procedures, in addition to the procedures specified in the site specific Health & Safety Plan..

12.0 REFERENCES

Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Technique and Strategies. EPA-600/4-83-020.

Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043.

U.S. Environmental Protection Agency. 1984 Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, E.R., B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. Samplers and Sampling Procedures for Hazardous Waste Streams. EPA-600/2-80-018.

ASTM D 1586-98, ASTM Committee on Standards, Philadelphia, PA.

APPENDIX A
Figures
SOP #2012
February 2000

FIGURE 1. Sampling Augers

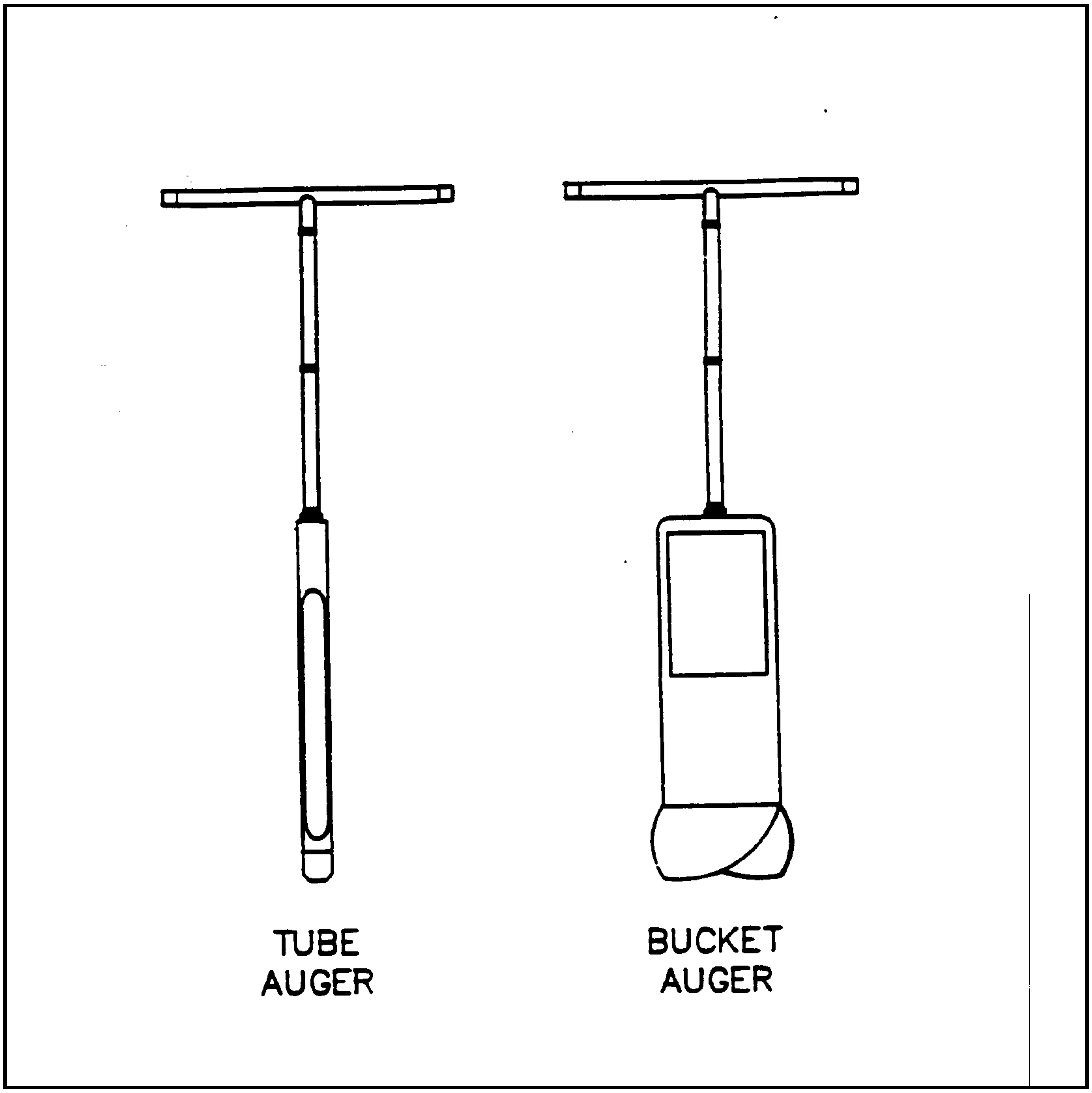
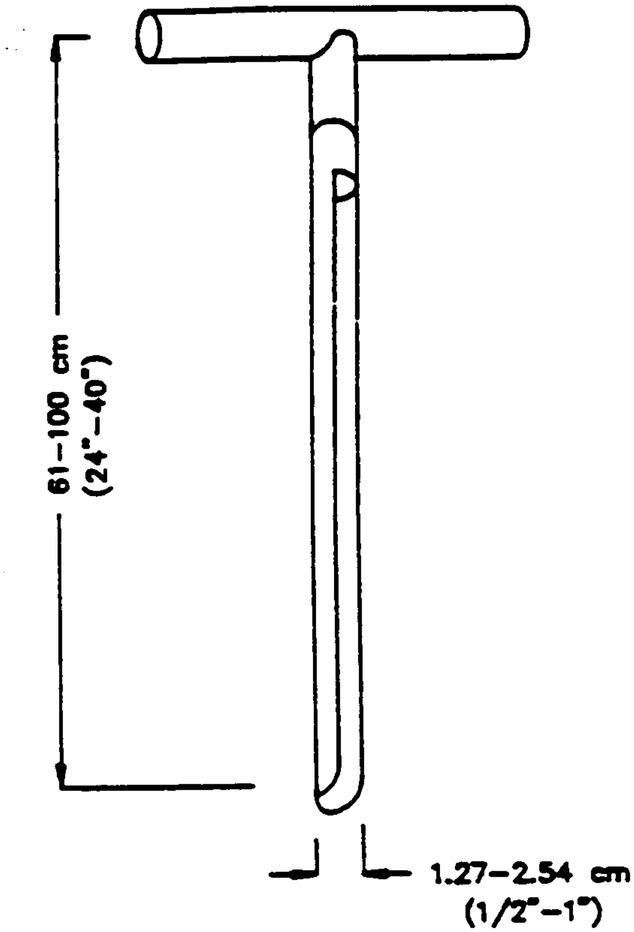


FIGURE 2. Sampling Trier



GROUNDWATER WELL SAMPLING

SOP#: 2007
DATE: 01/26/95
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The objective of this standard operating procedure (SOP) is to provide general reference information on sampling of ground water wells. This guideline is primarily concerned with the collection of water samples from the saturated zone of the subsurface. Every effort must be made to ensure that the sample is representative of the particular zone of water being sampled. These procedures are designed to be used in conjunction with analyses for the most common types of ground water contaminants (e.g., volatile and semi-volatile organic compounds, pesticides, metals, biological parameters).

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

In order to obtain a representative groundwater sample for chemical analysis it is important to remove stagnant water in the well casing and the water immediately adjacent to the well before collection of the sample. This may be achieved with one of a number of instruments. The most common of these are the bailer, submersible pump, non-contact gas bladder pump, inertia pump and suction pump. At a minimum, three well volumes should be purged, if possible. Equipment must be decontaminated prior to use and between wells. Once purging is completed and the correct laboratory-cleaned sample containers have been prepared, sampling may proceed. Sampling may be conducted with any of the above instruments, and need not be the same as the device used for purging. Care should be taken when choosing the sampling device as some will affect the integrity of the sample. Sampling should occur in a progression from the least to most contaminated well, if this information is known.

The growing concern over the past several years over low levels of volatile organic compounds in water supplies has led to the development of highly sophisticated analytical methods that can provide detection limits at part per trillion levels. While the laboratory methods are extremely sensitive, well controlled and quality assured, they cannot compensate for a poorly collected sample. The collection of a sample should be as sensitive, highly developed and quality assured as the analytical procedures.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The type of analysis for which a sample is being collected determines the type of bottle, preservative, holding time, and filtering requirements. Samples should be collected directly from the sampling device into appropriate laboratory cleaned containers. Check that a Teflon liner is present in the cap, if required. Attach a sample identification label. Complete a field data sheet, a chain of custody form, and record all pertinent data in the site logbook.

Samples shall be appropriately preserved, labelled, logged, and placed in a cooler to be maintained at 4EC. Samples must be shipped well before the holding time is up and ideally should be shipped within 24 hours of sample collection. It is imperative that samples be shipped or delivered daily to the analytical laboratory in order to maximize the time available for the laboratory to perform the analyses. The bottles should be shipped with adequate packing and cooling to ensure that they arrive intact.

Sample retrieval systems suitable for the valid collection of volatile organic samples are: positive displacement bladder pumps, gear driven submersible pumps, syringe samplers and bailers (Barcelona, 1984; Nielsen, 1985). Field conditions and other constraints will limit the choice of appropriate systems. The focus of concern must remain to provide a valid sample for analysis, one which has been subjected to the least amount of turbulence possible.

Treatment of the sample with sodium thiosulfate preservative is required only if there is residual chlorine in the water that could cause free radical chlorination and change the identity of the original contaminants. It should not be used if there is no chlorine in the water.

Holding time for volatiles analysis is seven days. It is imperative that the sample be shipped or delivered daily to the analytical laboratory. The bottles must be shipped on their sides to aid in maintaining the airtight seal during shipment, with adequate packing and cooling to ensure that they arrive intact.

For collection of volatile organic samples, refer to the work plan to ensure that 40 mL glass sample vials with Teflon lined septa are ordered and in sufficient numbers. Check sampling supplies; field kit for chlorine, preservatives, Parafilm, foam sleeves and coolers. Due to the extreme trace levels at which volatile organics are detectable, cross contamination and introduction of contaminants must be avoided. Trip blanks are incorporated into the shipment package to provide a check against cross contamination.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

4.1 General

The primary goal in performing ground water sampling is to obtain a representative sample of the ground water body. Analysis can be compromised by field personnel in two primary ways: (1) taking an unrepresentative sample, or (2) by incorrect handling of the sample. There are numerous ways of introducing foreign contaminants into a sample, and these must be avoided by following strict sampling procedures and utilizing trained field personnel.

4.2 Purging

In a nonpumping well, there will be little or no vertical mixing of the water, and stratification will occur. The well water in the screened section will mix with the ground water due to normal flow patterns, but the well water above the screened section will remain isolated, become stagnant, and may lack the contaminants representative of the ground water. Persons sampling should realize that stagnant water may contain foreign material inadvertently or deliberately introduced from the surface, resulting in an unrepresentative sample. To safeguard against collecting nonrepresentative stagnant water, the following guidelines and techniques should be adhered to during sampling:

1. As a general rule, all monitor wells should be pumped or bailed prior to sampling. Purge water should be containerized on site or handled as specified in the site specific project plan. Evacuation of a minimum of one volume of water in the well casing, and preferably three to five volumes, is recommended for a representative sample. In a high-yielding ground water formation and where there is no stagnant water in the well above the screened section, evacuation prior to sample withdrawal is not as critical. However, in all cases where the monitoring data is to be used for enforcement actions, evacuation is recommended.

2. When purging with a pump (not a bailer), the pump should be set at the screened interval, or if the well is an open-rock well, it should be set at the same depth the sample will be collected. When sampling a screened well, the sample should also be collected from the same depth the pump was set at.

3. The well should be sampled as soon as possible after purging.

4. Analytical parameters typically dictate whether the sample should be collected through the purging device, or through a separate sampling instrument.

5. For wells that can be pumped or bailed to dryness with the equipment being used, the well should be evacuated and allowed to

recover prior to collecting a sample. If the recovery rate is fairly rapid and time allows, evacuation of more than one volume of water is preferred. If recovery is slow, sample the well upon recovery after one evacuation.

6. A non-representative sample can also result from excessive pre-pumping of the monitoring well. Stratification of the leachate concentration in the ground water formation may occur, or heavier-than-water compounds may sink to the lower portions of the aquifer. Excessive pumping can dilute or increase the contaminant concentrations from what is representative of the sampling point of interest.

4.3 Materials

Materials of construction for samplers and evacuation equipment (bladders, pump, bailers, tubing, etc.) should be limited to stainless steel, Teflon^{R}, and glass in areas where concentrations are expected to be at or near the detection limit. The tendency of organics to leach into and out of many materials make the selection of materials critical for trace analyses. The use of plastics, such as PVC or polyethylene, should be avoided when analyzing for organics. However, PVC may be used for evacuation equipment as it will not come in contact with the sample, and in highly contaminated wells, disposable equipment (i.e., polypropylene bailers) may be appropriate to avoid cross-contamination.

Materials of construction (bladders/ pumps, bailers, tubing, etc.) suitable for collecting and handling Volatile Organic Samples should be limited to stainless steel, Teflon and glass in areas which detection limit range concentrations are expected. The tendency of organics to leach into and out of many materials, make the selection of materials critical for these trace analyses. The use of plastics, e.g., PVC etc., should be avoided. There are numerous ways of introducing foreign contaminants into a sample, and these must be avoided by following strict sampling procedures and utlization of trained personnel.

4.4 Advantages/Disadvantages of Certain Equipment

4.4.1 Bailers

Advantages

- Only practical limitations on size and materials
- No power source needed
- Portable
- Inexpensive, so it can be dedicated and hung in a well, thereby reducing the chances of cross contamination
- Minimal outgassing of volatile organics while sample is in bailer
- Readily available
- Removes stagnant water first
- Rapid, simple method for removing small volumes of purge water

Disadvantages

- Time-consuming to flush a large well of stagnant water
- Transfer of sample may cause aeration
- Stoppers at the bottom of the bailer usually leak thus the bailer must be brought to the surface rapidly
- If the bailer is allowed to hit the bottom of the well boring, gravel can displace the ball valve not allowing the bailer to hold water

4.4.2 Submersible Pumps

Advantages

- Portable and can be transported to several wells
- Depending upon the size of the pump and the pumping depths, relatively high pumping rates are possible
- Generally very reliable and does not require priming

Disadvantages

- Potential for effects on analysis of trace organics
- Heavy and cumbersome to deal with, particularly in deeper wells
- Expensive
- Power source needed
- Sediment in water may cause problems with the pumps
- Impractical in low yielding or shallow wells

4.4.3 Non-Contact Gas Bladder Pumps

Advantages

- Maintains integrity of sample
- Easy to use
- Can sample from discrete locations within the monitor well

Disadvantages

- Difficulty in cleaning, though dedicated tubing and bladder may be used
- Only useful to about 100 feet
- Supply of gas for operation, gas bottles and/or compressors are often difficult to obtain and are cumbersome
- Relatively low pumping rates
- Requires air compressor or pressurized gas source and control box

4.4.4 Suction Pumps

Advantages

- Portable, inexpensive, and readily available

Disadvantages

- Restricted to areas with water levels within 20 to 25 feet of the ground surface
- Vacuum can cause loss of dissolved gasses and volatile organics
- Pump must be primed and vacuum is often difficult to maintain during initial stages of pumping

4.4.5 Inertia Pumps

Advantages

- Portable, inexpensive, and readily available
- Offers a rapid method for purging relatively shallow wells

Disadvantages

- Restricted to areas with water levels within 70 feet of the ground surface
- May be time consuming to purge wells with these manual pumps
- Labor intensive
- WaTerra pumps are only effective in 2-inch diameter wells

5.0 EQUIPMENT APPARATUS

5.1 Equipment Checklist

5.1.1 General

- Water level indicator
  - electric sounder
  - steel tape
  - transducer
  - reflection sounder
  - airline
- Depth sounder
- Appropriate keys for well cap locks
- Steel brush
- HNU or OVA (whichever is most appropriate)
- Logbook
- Calculator
- Field data sheets and samples labels

- Chain of custody records and seals
- Sample containers
- Engineer's rule
- Sharp knife (locking blade)
- Tool box (to include at least: screwdrivers, pliers, hacksaw, hammer, flashlight, adjustable wrench)
- Leather work gloves
- Appropriate Health & Safety gear
- 5-gallon pail
- Plastic sheeting
- Shipping containers
- Packing materials
- Bolt cutters
- Ziploc plastic bags
- Containers for evacuation liquids
- Decontamination solutions
- Tap water
- Non phosphate soap
- Several brushes
- Pails or tubs
- Aluminum foil
- Garden sprayer
- Preservatives
- Distilled or deionized water
- Fire extinguisher (if using a generator for your power source)

5.1.2 Bailers

- Clean, decontaminated bailers of appropriate size and construction material
- Nylon line, enough to dedicate to each well
- Teflon coated bailer wire
- Sharp knife
- Aluminum foil (to wrap clean bailers)
- Five gallon bucket

5.1.3 Submersible Pump

- Pump(s)
- Generator (110, 120, or 240 volt) or 12 volt battery if inaccessible to field vehicle - amp meter is useful
- 1" black PVC coil tubing - enough to dedicate to each well
- Hose clamps
- Safety cable
- Tool box supplement
    - pipe wrenches
    - wire strippers
    - electrical tape
    - heat shrink
    - hose connectors
    - Teflon tape
- Winch, pulley or hoist
- Gasoline for generator/gas can
- Flow meter with gate valve
- 1" nipples and various plumbing (i.e., pipe connectors)
- Control box (if necessary)

5.1.4 Non-Gas Contact Bladder Pump

- Non-gas contact bladder pump
- Compressor or nitrogen gas tank
- Batteries and charger
- Teflon tubing - enough to dedicate to each well
- Swagelock fitting
- Toolbox supplements - same as submersible pump
- Control box (if necessary)

5.1.5 Suction Pump

- Pump
- 1" black PVC coil tubing - enough to dedicate to each well
- Gasoline - if required
- Toolbox
- Plumbing fittings
- Flow meter with gate valve

5.1.6 Inertia Pump

- Pump assembly (WaTerra pump, piston pump)
- Five gallon bucket

6.0 REAGENTS

Reagents may be utilized for preservation of samples and for decontamination of sampling equipment. The preservatives required are specified by the analysis to be performed. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

7.0 PROCEDURE

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed (i.e, diameter and depth of wells to be sampled).
2. Obtain necessary sampling and monitoring equipment, appropriate to type of contaminant being investigated. For collection of volatile organic samples, refer to the work plan to ensure that 40 mL glass sample vials with Teflon lined septa are ordered and in sufficient numbers. Check sampling supplies; field kit for chlorine, preservatives, Parafilm, foam sleeves and coolers. Due to extreme trace levels at which volatile organics are detectable, cross contamination and introduction of contaminants must be avoided. Trip blanks are incorporated into the shipment package to provide a check against cross contamination.
3. Decontaminate or preclean equipment, and ensure that it is in working order.
4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Identify and mark all sampling locations.

7.2 Field Preparation

1. Start at the least contaminated well, if known.
2. Lay plastic sheeting around the well to minimize likelihood of contamination of equipment from soil adjacent to the well.
3. Remove locking well cap, note location, time of day, and date in field notebook or appropriate log form.
4. Remove well casing cap.
5. Screen headspace of well with an appropriate monitoring instrument to determine the presence of volatile organic compounds and record in site logbook.
6. Lower water level measuring device or equivalent (i.e., permanently installed transducers or airline) into well until water surface is encountered.
7. Measure distance from water surface to reference measuring point on well casing or protective barrier post and record in site logbook. Alternatively, if no reference point, note that water level measurement is from top of steel casing, top of PVC riser pipe, from ground surface, or some other position on the well head.

   If floating organics are of concern, this can be determined by measuring the water level with an oil/water interface probe which measures floating organics.
8. Measure total depth of well (at least twice to confirm measurement) and record in site logbook or on field data sheet.
9. Calculate the volume of water in the well and the volume to be purged using the calculations in Section 8.0.
10. Select the appropriate purging and sampling equipment.
11. If residual chlorine is suspected, use the Hach Field Test Kit for chlorine to determine if there is residual chlorine in the water to be sampled. If there is, treat the sample vial with a crystal of sodium thiosulfate prior to sample collection.

7.3 Purging

The amount of flushing a well receives prior to sample collection depends on the intent of the monitoring program as well as the hydrogeologic conditions. Programs where overall quality determination of water resources are involved may require long pumping periods to obtain a sample that is representative of a large volume of that aquifer. The pumped volume can be determined prior to sampling so that the sample is a collected after a known volume of the water is evacuated from the aquifer, or the well can be pumped until the stabilization of parameters such as temperature, electrical conductance, pH, or turbidity has occurred.

However, monitoring for defining a contaminant plume requires a representative sample of a small volume of the aquifer. These circumstances require that the well be pumped enough to remove the stagnant water but not enough to induce flow from other areas. Generally, three well volumes are considered effective, or calculations can be made to determine, on the basis of the aquifer parameters and well dimensions, the appropriate volume to remove prior to sampling.

During purging, water level measurements may be taken regularly at 15-30 second intervals. This data may be used to compute aquifer transmissivity and other hydraulic characteristics. The following well evacuation devices are most commonly used. Other evacuation devices are available, but have been omitted in this discussion due to their limited use.

7.3.1 Bailers

Bailers are the simplest purging device used and have many advantages. They generally consist of a rigid length of tube, usually with a ball check-valve at the bottom. A line is used to lower the bailer into the well and retrieve a volume of water. The three most common types of bailer are PVC, Teflon, and stainless steel.

This manual method of purging is best suited to shallow or narrow diameter wells. For deep, larger diameter wells which require evacuation of large volumes of water, other mechanical devices may be more appropriate.

7.3.1.1 Operation

Equipment needed will include a clean decontaminated bailer, Teflon or nylon line, a sharp knife, and plastic sheeting.

1. Determine the volume of water to be purged as described in 8.0, calculations.

2. Lay plastic sheeting around the well to prevent contamination of the bailer line with foreign materials.

3. Attach the line to the bailer and slowly lower until the bailer is completely submerged, being careful not to drop the bailer to the water, causing turbulence and the possible loss of volatile organic contaminants.

4. Pull bailer out ensuring that the line either falls onto a clean area of plastic sheeting or never touches the ground.

5. Empty the bailer into a pail until full to determine the number of bails necessary to achieve the required purge volume.

6. Thereafter, pour the water into a container and dispose of purge waters as specified in the site specific sampling plan.

7.3.2 Submersible Pumps

The use of submersible pumps for sample collection is permissible provided they are constructed of suitably noncontaminating materials. The chief drawback, however, is the difficulty avoiding cross-contamination between wells. Although some units can be disassembled easily to allow surfaces contacted by contaminants to be cleaned, field decontamination may be difficult and require solvents that can affect sample analysis. The use of submersible pumps in multiple well-sampling programs, therefore, should be carefully considered against other sampling mechanisms (bailers, bladder pumps). In most cases, a sample can be collected by bailer after purging with a submersible pump, however, submersible pumps may be the only practical sampling device for extremely deep wells (greater than 300 feet of water). Under those conditions, dedicated pump systems should be installed to eliminate the potential for cross-contamination of well samples.

Submersible pumps generally use one of two types of power supplies, either electric or compressed gas or air. Electric powered pumps can run off a 12 volt DC rechargeable battery, or a 110 or 220 volt AC power supply. Those units powered by compressed air normally use a small electric or gas-powered air compressor. They may also utilize compressed gas (i.e., nitrogen) from bottles. Different size pumps are available for different depth or diameter monitoring wells.

7.3.2.1 Operation

1. Determine the volume of water to be purged as described in 8.0 Calculations.

2. Lay plastic sheeting around the well to prevent contamination of pumps, hoses or lines with foreign materials.

3. Assemble pump, hoses and safety cable, and lower the pump into the well. Make sure the pump is deep enough so all the water is not evacuated. (Running the pump without water may cause damage.)

4. Attach flow meter to the outlet hose to measure the volume of water purged.

5. Use a ground fault circuit interrupter (GFCI) or ground the generator to avoid possible electric shock.

6. Attach power supply, and purge the well until the specified volume of water has been evacuated (or until field parameters, such as temperature, pH, conductivity, etc, have stabilized). Do not allow the pump to run dry. If the pumping rate exceeds the well recharge rate, lower the pump further into the well, and continue pumping.

7. Collect and dispose of purge waters as specified in the site specific sampling plan.

7.3.3 Non-Contact Gas Bladder Pumps

For this procedure, an all stainless-steel and Teflon Middleburg-squeeze bladder pump (e.g., IEA, TIMCO, Well Wizard, Geoguard, and others) is used to provide the least amount of material interference to the sample (Barcelona, 1985). Water comes into contact with the inside of the bladder (Teflon) and the sample tubing, also Teflon, that may be dedicated to each well. Some wells may have permanently installed bladder pumps, (i.e., Well Wizard, Geoguard), that will be used to sample for all parameters.

7.3.3.1 Operation

1. Assemble Teflon tubing, pump and charged control box.

2. Procedure for purging with a bladder pump is the same as for a submersible pump (Section 7.3.2.1).

3. Be sure to adjust flow rate to prevent violent jolting of the hose as sample is drawn in.

7.3.4 Suction Pumps

There are many different types of suction pumps. They include: centrifugal, peristaltic and diaphragm. Diaphragm pumps can be used for well evacuation at a fast pumping rate and sampling at a low pumping rate. The peristaltic pump is a low volume pump that uses rollers to squeeze the flexible tubing thereby creating suction. This tubing can be dedicated to a well to prevent cross contamination. Peristaltic pumps, however, require a power source.

7.3.4.1 Operation

1. Assembly of the pump, tubing, and power source if necessary.

2. Procedure for purging with a suction pump is exactly the same as for a submersible pump (Section 7.3.2.1).

7.3.5 Inertia Pumps

Inertia pumps such as the WaTerra pump and piston pump, are manually operated. They are most appropriate to use when wells are too deep to bail by hand, or too shallow or narrow (or inaccessible) to warrant an automatic (submersible, etc.) pump. These pumps are made of plastic and may be either decontaminated or discarded.

7.3.5.1 Operation

1. Determine the volume of water to be purged as described in 8.0, Calculations.

2. Lay plastic sheeting around the well to prevent contamination of pumps or hoses with foreign materials.

3. Assemble pump and lower to the appropriate depth in the well.

4. Begin pumping manually, discharging water into a 5 gallon bucket (or other graduated vessel). Purge until specified volume of water has been evacuated (or until field parameters such as temperature, pH,

conductivity, etc. have stabilized).

5. Collect and dispose of purge waters as specified in the site specific project plan.

7.4 Sampling

Sample withdrawal methods require the use of pumps, compressed air, bailers, and samplers. Ideally, purging and sample withdrawal equipment should be completely inert, economical to manufacture, easily cleaned, sterilized, reusable, able to operate at remote sites in the absence of power resources, and capable of delivering variable rates for sample collection.

There are several factors to take into consideration when choosing a sampling device. Care should be taken when reviewing the advantages or disadvantages of any one device. It may be appropriate to use a different device to sample than that which was used to purge. The most common example of this is the use of a submersible pump to purge and a bailer to sample.

7.4.1 Bailers

The positive-displacement volatile sampling bailer is perhaps the most appropriate for collection of water samples for volatile analysis. Other bailer types (messenger, bottom fill, etc.) are less desirable, but may be mandated by cost and site conditions.

7.4.1.1 Operation

1. Surround the monitor well with clean plastic sheeting. If using the GPI bailer, insert a vial into the claim and assemble the unit.

2. Attach a line to a clean decontaminated bailer.
3. Lower the bailer slowly and gently into the well, taking care not to shake the casing sides or to splash the bailer into the water. Stop lowering at a point adjacent to the screen.

4. Allow bailer to fill and then slowly and gently retrieve the bailer from the well avoiding contact with the casing, so as not to knock flakes of rust or other foreign materials into the bailer. If using the GPI bailer for collecting volatile organic samples, once at the surface, remove the bailer from the cable. Carefully open the GPI bailer unit and remove the vial. Begin slowly pouring from the bailer, and collect the duplicate samples from the midstream sample.

5. Remove the cap from the sample container and place it on the plastic sheet or in a location where it won't become contaminated. See Section 7.7 for special considerations on VOA samples.

6. Begin slowly pouring from the bailer.

7. Filter and preserve samples as required by sampling plan.

8. Cap the sample container tightly and place prelabeled sample container in a carrier.

9. Replace the well cap.

10. Log all samples in the site logbook and on field data sheets and label all samples.

11. Package samples and complete necessary paperwork.

12. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

7.4.2 Submersible Pumps

Although it is recommended that samples not be collected with a submersible pump due to the reasons stated in Section 4.4.2, there are some situations where they may be used.

7.4.2.1 Operation

1. Allow the monitor well to recharge after purging, keeping the pump just above screened section.

2. Attach gate valve to hose (if not already fitted), and reduce flow of water to a manageable sampling rate.

3. Assemble the appropriate bottles.

4. If no gate valve is available, run the water

down the side of a clean jar and fill the sample bottles from the jar.

5. Cap the sample container tightly and place prelabeled sample container in a carrier.

6. Replace the well cap.

7. Log all samples in the site logbook and on the field data sheets and label all samples.

8. Package samples and complete necessary paperwork.

9. Transport sample to decontamination zone for preparation for transport to the analytical laboratory.

10. Upon completion, remove pump and assembly and fully decontaminate prior to setting into the next sample well. Dedicate the tubing to the hole.

7.4.3 Non-Contact Gas Bladder Pumps

The use of a non-contact gas positive displacement bladder pump is often mandated by the use of dedicated pumps installed in wells. These pumps are also suitable for shallow (less than 100 feet) wells. They are somewhat difficult to clean, but may be used with dedicated sample tubing to avoid cleaning. These pumps require a power supply and a compressed gas supply (or compressor). They may be operated at variable flow and pressure rates making them ideal for both purging and sampling.

Barcelona (1984) and Nielsen (1985) report that the non-contact gas positive displacement pumps cause the least amount of alteration in sample integrity as compared to other sample retrieval methods.

7.4.3.1 Operation

1. Allow well to recharge after purging.

2. Assemble the appropriate bottles.

3. Turn pump on, increase the cycle time and reduce the pressure to the minimum that will allow the sample to come to the surface.

4. Cap the sample container tightly and place prelabeled sample container in a carrier.

5. Replace the well cap.

6. Log all samples in the site logbook and on field data sheets and label all samples.

7. Package samples and complete necessary paperwork.

8. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

9. On completion, remove the tubing from the well and either replace the Teflon tubing and bladder with new dedicated tubing and bladder or rigorously decontaminate the existing materials.

10. Nonfiltered samples shall be collected directly from the outlet tubing into the sample bottle.

11. For filtered samples, connect the pump outlet tubing directly to the filter unit. The pump pressure should remain decreased so that the pressure build up on the filter does not blow out the pump bladder or displace the filter. For the Geotech barrel filter, no actual connections are necessary so this is not a concern.

7.4.4 Suction Pumps

In view of the limitations of these type pumps, they are not recommended for sampling purposes.

7.4.5 Inertia Pumps

Inertia pumps may be used to collect samples. It is more common, however, to purge with these pumps and sample with a bailer (Section 7.4.1).

7.4.5.1 Operation

1. Following well evacuation, allow the well to recharge.

2. Assemble the appropriate bottles.

3. Since these pumps are manually operated,

the flow rate may be regulated by the sampler. The sample may be discharged from the pump outlet directly into the appropriate sample container.

4. Cap the sample container tightly and place prelabeled sample container in a carrier.

5. Replace the well cap.

6. Log all samples in the site logbook and on field data sheets and label all samples.

7. Package samples and complete necessary paperwork.

8. Transport sample to decontamination zone for preparation for transport to the analytical laboratory.

9. Upon completion, remove pump and decontaminate or discard, as appropriate.

7.4.6. Sample Retrieval - Syringe

A limited number of commercial syringe type samplers are available, (IEA, TIMCO, etc.) some are homemade devices. These devices are claimed to provide good quality samples for volatile analysis, but are severly limited in sample volume and are specific to sampling for volatiles. Essentially, they operated with an evacuated chamber that is lowered down the well, and allowed to fill with the pressure of the water. The entire mechanism is then brought to the surface with the sample. The sample may then be transferred to a sample vial, or the entire unit may be sent as the sample container.

1. Evacuate the syringe if necessary, and lower the sampling device to just below the well screen.

2. Remove the constriction from the device and allow the sample to fill the syringe, apply slight suction as necessary.

3. Bring unit to the surface. If necessary, transfer the sample to vials, as outlined in steps 2 through 7 above.

7.5 Filtering

For samples requiring filtering, such as total metals analysis, the filter must be decontaminated prior to and between uses. Filters work by two methods. A barrel filter such as the "Geotech" filter works with a bicycle pump, used to build up positive pressure in the chamber containing the sample which is then forced through the filter paper (minimum size 0.45 µm) into a jar placed underneath. The barrel itself is filled manually from the bailer or directly via the hose of the sampling pump. The pressure must be maintained up to 30 lbs/in^2 by periodic pumping.

A vacuum type filter involves two chambers; the upper chamber contains the sample and a filter (minimum size 0.45 µm) divides the chambers. Using a hand pump or a Gilian type pump, air is withdrawn from the lower chamber, creating a vacuum and thus causing the sample to move through the filter into the lower chamber where it is drained into a sample jar. Repeated pumping may be required to drain all the sample into the lower chamber. If preservation of the sample is necessary, this should be done after filtering.

7.6 Post Operation

After all samples are collected and preserved, the sampling equipment should be decontaminated prior to sampling another well to prevent cross-contamination of equipment and monitor wells between locations.

1. Decontaminate all equipment.

2. Replace sampling equipment in storage containers.

3. Prepare and transport ground water samples to the laboratory. Check sample documentation and make sure samples are properly packed for shipment.

7.7 Special Considerations for VOA Sampling

The proper collection of a sample for volatile organics requires minimal disturbance of the sample to limit volatilization and therefore a loss of volatiles from the sample.

Sample retrieval systems suitable for the valid collection of volatile organic samples are: positive displacement bladder pumps, gear driven submersible pumps, syringe samplers and bailers (Barcelona, 1984; Nielsen, 1985). Field conditions and other constraints will limit the choice of appropriate systems. The focus of concern must be to provide a valid sample for analysis, one which has been subjected to the least amount of turbulence possible.

The following procedures should be followed:

1. Open the vial, set cap in a clean place, and collect the sample during the middle of the cycle. When collecting duplicates, collect both samples at the same time.

2. Fill the vial to just overflowing. Do not rinse the vial, nor excessively overflow it. There should be a convex meniscus on the top of the vial.

3. Check that the cap has not been contaminated (splashed) and carefully cap the vial. Place the cap directly over the top and screw down firmly. Do not overtighten and break the cap.

4. Invert the vial and tap gently. Observe vial for at least ten (10) seconds. If an air bubble appears, discard the sample and begin again. It is imperative that no entrapped air is in the sample vial.

5. Immediately place the vial in the protective foam sleeve and place into the cooler, oriented so that it is lying on its side, not straight up.

6. The holding time for VOAs is seven days. Samples should be shipped or delivered to the laboratory daily so as not to exceed the holding time. Ensure that the samples remain at 4°C, but do not allow them to freeze.

8.0 CALCULATIONS

If it is necessary to calculate the volume of the well, utilize the following equation:

$$\textit{Well volume} = nr^2h\ (cf) \qquad [\textit{Equation } 1]$$

where:

n = pi
r = radius of monitoring well (feet)
h = height of the water column (feet) [This may be determined by subtracting the depth to water from the total depth of the well as measured from the same reference point.]
cf = conversion factor (gal/ft^3) = 7.48 gal/ft^3 [In this equation, 7.48 gal/ft^3 is the necessary conversion factor.]

Monitor well diameters are typically 2", 3", 4", or 6". Knowing the diameter of the monitor well, there are a number of standard conversion factors which can be used to simplify the equation above.

The volume, in gallons per linear foot, for various standard monitor well diameters can be calculated as follows:

$$v(gal/ft) = nr^2\ (cf) \qquad [\textit{Equation } 2]$$

where:

n = pi
r = radius of monitoring well (feet)
cf = conversion factor (7.48 gal/ft^3)

For a 2" diameter well, the volume per linear foot can be calculated as follows:

$$\begin{aligned} vol/linear\ ft &= nr^2\ (cf) \qquad [\textit{Equation } 2] \\ &= 3.14\ (1/12\ ft)^2\ \ 7.48\ gal/ft^3 \\ &= 0.1632\ gal/ft \end{aligned}$$

Remember that if you have a 2" diameter well, you must convert this to the radius in feet to be able to use the equation.

The conversion factors for the common size monitor wells are as follows:

Well diameter	2"	3"	4"	6"
Volume (gal/ft.)	0.1632	0.3672	0.6528	1.4688

If you utilize the conversion factors above, Equation

1 should be modified as follows:

$$\textbf{\textit{Well volume}} = (\textbf{\textit{h}})(\textbf{\textit{cf}}) \qquad [\textit{Equation}\ 3]$$

where:

h = height of water column (feet)
cf = the conversion factor calculated from Equation 2

The well volume is typically tripled to determine the volume to be purged.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, the following general QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

3. The collection of rinsate blanks is recommended to evaluate potential for cross contamination from the purging and/or sampling equipment.

4. Trip blanks are required if analytical parameters include VOAs.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA or REAC health and safety guidelines. More specifically, depending upon the site specific contaminants, various protective programs must be implemented prior to sampling the first well. The site health and safety plan should be reviewed with specific emphasis placed on the protection program planned for the well sampling tasks. Standard safe operating practices should be followed such as minimizing contact with potential contaminants in both the vapor phase and liquid matrix through the use of respirators and disposable clothing.

When working around volatile organic contaminants:

1. Avoid breathing constituents venting from the well.

2. Pre-survey the well head-space with an FID/PID prior to sampling.

3. If monitoring results indicate organic constituents, sampling activities may be conducted in Level C protection. At a minimum, skin protection will be afforded by disposable protective clothing.

Physical hazards associated with well sampling:

1. Lifting injuries associated with pump and bailers retrieval; moving equipment.

2. Use of pocket knives for cutting discharge hose.

3. Heat/cold stress as a result of exposure to extreme temperatures and protective clothing.

4. Slip, trip, fall conditions as a result of pump discharge.

5. Restricted mobility due to the wearing of protective clothing.

6. Electrical shock associated with use of submersible pumps is possible. Use a GFCI or a copper grounding stake to avoid this problem.

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APPENDIX C

Chain-of-Custody Forms

McGinley and Associates
6280 S Valley Blvd Ste604
Las Vegas, NV 89118
MCGINLVNV

Billing Information:
McGinley and Associates
6280 S Valley Blvd., Suite 604
Las Vegas, NV 89118

Report to: Brett Bottenberg

Email to: bbottenberg@mcgin.com

Chain of Custody
Page 1 of 1

ESC
L·A·B S·C·I·E·N·C·E·S
12065 Lebanon Road
Mt. Juliet, TN 37122

Phone: (800) 767-5859
Phone: (615) 758-5858
Fax: (615) 758-5859

Project Description:

City/Sate Collected

Phone: 702-260-4961
FAX:

Client Project #:

ESC Key: MCGINLVNV

Collected by:

Site/Facility ID#:

P.O.#:

Collected by (signature):

Immediately Packed on Ice N ____ Y ___

Rush? (Lab MUST Be Notified)
- ☐ Same Day. 200%
- ☐ Next Day.. . . . . . . 100%
- ☐ Two Day 50%
- ☐ Three Day 25%

Date Results Needed:

Email? ☐ __No__ ☐ Yes
FAX? ☐ __No__Yes

CoCode MCGINLVNV (lab use only)
Template/Prelogin
Shipped Via:

Sample ID	Comp/Grab	Matrix*	Depth	Date	Time	No. of Cntrs	Analysis/Container/Preservative								Remarks/Contaminant	Sample # (lab only)

*Matrix: **SS** - Soil/Solid **GW** - Groundwater **WW** - WasteWater **DW** - Drinking Water **OT** - Other__________

pH ______________ Temp ____________

Remarks:

Flow ______________ Other ____________

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Samples returned via: ☐ UPS ☐ FedEx ☐ Courier ☐ _______		Condition: (lab use only)
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Temp:	Bottles Received:	CoC Seals Intact: ____ Y ____ N _____ NA
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date:	Time:	pH Checked: NCF:

APPENDIX D

Sample Labels

McGinley and Assoc.-Las Vegas,NV MCGINLVNV
Prepared by Environmental Science Corp
Project:
Project #:
Sample Location/ID:
Analysis Reqd:
Date: ______________ Time: ______________

McGinley and Assoc.-Las Vegas,NV MCGINLVNV
Prepared by Environmental Science Corp
Project:
Project #:
Sample Location/ID:
Analysis Reqd:
Date: ______________ Time: ______________

McGinley and Assoc.-Las Vegas,NV MCGINLVNV
Prepared by Environmental Science Corp
Project:
Project #:
Sample Location/ID:
Analysis Reqd:
Date: ______________ Time: ______________

APPENDIX E

Site Health and Safety Plan

McGinley & Associates

Reno Office
815 Maestro Drive
Reno, Nevada 89511
Ph: 775.829.2245

Las Vegas Office
6280 South Valley View Boulevard
Suite 604
Las Vegas, Nevada 89118
Ph: 702.260.4961

www.mcgin.com

| Site Remediation

| Soil & Groundwater Investigations

| Closure Optimization

| Brownfields Redevelopment

| Permitting & Compliance

| Phase I Assessments

| Storm Water & Spill Plans

| Underground Tank Services

| Toxic Release Inventory

| Geographic Information Systems

| Groundwater Modeling

| Litigation Support & Expert Witness

HEALTH AND SAFETY PLAN

Lackawanna Mill Site
Phase II Site Assessment
APN: 010-420-06 (Portion of)
Ely
Nevada
NDEP Contract #14-008
Task M14-04

Prepared for:

State of Nevada
Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Corrective Actions
901 S. Stewart Street, Suite 4001
Carson City, Nevada 89701-5249

On behalf of:

City of Ely

May 28, 2014

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FIGURES

Figure 1 Site Location Map

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1. INTRODUCTION

McGinley & Associates Inc. (MGA) is pleased to submit this Health and Safety Plan (HASP) detailing personal safety precautions being performed on behalf of the Nevada Division of Environmental Protection (NDEP). This HASP addresses activities associated with collection of soil and groundwater samples. The sampling activities will be conducted at the old Lackawanna Mill site which is located approximately two miles north of Ely, Nevada on Lackawanna Road and proximal to the Lackawanna Springs.

Planned site activities will include:

- Site reconnaissance;
- Collection of surface soil samples for laboratory analysis;
- Advancement of 13 Geoprobe boring and collection of a continuous core for logging and sampling purposes;
- Collection of soil samples at the surface of each boring and every two to three feet of boring depth;
- Collection of a soil sample approximately two feet beyond the extent of the tailings;
- Conversion of six borings into temporary monitoring wells;
- Collection of groundwater samples from each temporary monitoring well.

1.1 Scope and Applicability of the Site Health and Safety Plan

The purpose of this HASP is to define the requirements and designate protocols to be followed for the site sampling activities. Applicability extends to all MGA employees, contractors and subcontractors. Each person will also be expected to provide his or her own protective equipment.

All on-site personnel shall be informed of the site emergency response procedures and any potential fire, explosion, health, or safety hazards of the operation. This HASP summarizes hazards and defines protective measures planned for the site. This plan must be reviewed and signed by all site personnel prior to commencing with field activities. An agreement of compliance is provided in Appendix A.

During development of this plan consideration was given to current safety standards as defined by EPA/OSHA/NIOSH, health effects and standards for known contaminants, and procedures designed to account for the potential for exposure to unknown substances. Specifically, the following reference sources have been consulted:

- OSHA 29 CFR parts 1910.120, 1910.134, 1926.350 and 1926.650;
- U.S. EPA, OERR ERT Standard Operating Safety Guides
- NIOSH/OSHA/USCG/EPA Occupational Health and Safety Guidelines
- (ACGIH) Threshold Limit Values

1.2 On-Site Personnel

All personnel entering the designated work areas at the Site are responsible for the following:

- Taking all reasonable precautions to prevent injury to themselves and to their fellow employees, and being alert to potentially harmful situations;

- Obeying all applicable laws and regulations relating to health and safety;
- Ensuring that activities do not impact the neighboring community;
- Performing only those tasks that they have been trained to complete and can do safely;
- Notifying their supervisor of any special medical conditions (i.e., allergies, contact lenses, diabetes) that may affect their ability to perform certain tasks;
- Notifying their supervisor of any prescription and/or non-prescription medication that they may be taking that might cause drowsiness, anxiety, or other unfavorable side-affects;
- Learning and complying with Site security requirements;
- Complying with the Site's prohibition on drug and alcohol use, smoking, horseplay, and restricted eating/drinking areas;
- Practicing good housekeeping by keeping the work areas neat, clean and orderly;
- Immediately reporting all injuries, incidents and near-misses to the HSO;
- Properly using PPE specified by this HASP.
- Properly maintaining their designated PPE per manufacturers' recommendations.
- Complying with the HASP and all health and safety recommendations and precautions.

In the event that a person does not adhere to the provisions of the HASP, he/she will be requested to leave the work area. All non-conformance incidents will be recorded in the site log.

2. KEY PERSONNEL

The Site Health and Safety Officer (HSO) is fully responsible for ensuring the provisions of this HASP are adequate and implemented in the field. Changing field conditions may require decisions to be made concerning adequate protection programs. Therefore, it is vital that personnel assigned as HSO be experienced and meet the additional training requirements specified by OSHA in 29 CFR 1910.120. The following personnel are critical to the planned activities at the Site. The organizational structure will be reviewed and updated periodically by the site supervisor.

Title/Responsibility	**Name**	**Phone**
City of Ely		
Site Contact	Ross Rivera	(775) 289-6633
McGinley and Associates, Inc.		
Project Manager – Project management, regulatory liaison, coordinate field activities, site safety, data review, report preparation.	Brett Bottenberg	(702) 232-5247
Project Geologist – Log soils, field activity oversight	Justin Fike	(775) 378-8901
Staff Engineer – Collect soil samples.	Jeri Prante	(281) 793-7204
Contractors/Vendors		
Cascade Drilling	Jeff Townsend	(208) 345-0878
ESC Lab Sciences – sample analysis	Jarred Willis	(615) 773-9678

2.1 Site Specific Health and Safety Personnel

The HSO is also responsible for conducting site inspections on a regular basis in order to ensure the effectiveness of this plan. The HSO at the site is Justin Fike, Project Geologist for MGA. The designated alternate is Jeri Prante, Staff Engineer for MGA.

2.2 Organizational Responsibility

City of Ely:	Party initiating investigation of soil impacts from previous mill site activities.
MGA:	Primary agent for the City of Ely providing field services and project oversight of soil and groundwater sampling.
Subcontractors:	Various companies and organizations providing services or skilled trades.

3. TASK/OPERATION SAFETY AND HEALTH RISK ANALYSIS

3.1 Historical Overview of Site

Currently, the site is an abandoned and dilapidated mill site. In 1962, Silver King Mines negotiated the construction of a mill site on the property due to its proximity to a high volume water source known as Lackawanna Springs. At the time, Silver King Mines needed the mill for processing large volumes of mine tailings and ore that were discovered nearby. By 1965, the mill was operational. Remnants of a ball crusher, kiln, and other equipment remain on site. Damaged capacitors, abandoned 55-gallon drums, and multi-colored soil and debris piles are scattered throughout the property. The City of Ely has not utilized the property in the past and does not currently utilize the property.

The purpose of this project is to assess the soils and groundwater for historical contamination from former mill activities. The City of Ely is also concerned that potential contamination of soils within the site may be a health hazard to unauthorized visitors to the site.

3.2 Chemical Hazards

The following sections provide descriptions of the principal health hazards of the potential contaminants affecting this investigation and include:

- Poly-chlorinated biphenyls (PCBs);
- Metals (Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Molybdenum, Nickel, Selenium, Silver, Thallium, Vanadium, and Zinc);
- Volatile Organic Compounds (VOCs);
- Semi-VOCs (SVOCs);
- Cyanide; and/or
- Dioxins/Furans.

3.2.1 Poly-chlorinated biphenyls (PCBs)

PCBs are commonly found in dielectric fluids utilized by transformers and capacitors manufactured prior to 1980. They are considered non-flammable viscous liquids that have a mild, hydrocarbon odor. They are considered to be carcinogenic.

Some possible health effects from exposure to PCBs include irritation to the eyes and skin; chloracne; and liver damage. The most likely exposure to PCBs during field activities will occur through dermal contact. As field activities normally involve subsurface disturbance for generally short periods of time, these pathways should be considered. Planning, development, and implementation of specific sampling protocol should be conducted to mitigate these potential concerns. If PCBs contact the skin, immediately wash the contaminated skin with soap and water. If PCBs penetrate the clothing, immediately remove the clothing and wash the skin with soap and water. Get medical attention promptly.

3.2.2 Inorganic Metals

These metals include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc. Care will be undertaken to prevent contaminant contact by wearing gloves and avoiding dust. Heavy metals are known to cause neurologic effects (lead, mercury), kidney damage (cadmium), and respiratory damage (arsenic, cadmium). Oral and respiratory exposures should be minimized.

3.2.3 Organic Compounds

Volatile Organic Compounds (VOCs) and Semi Volatile Organic Compounds (SVOCs) are commonly found in oils, fuels, paints, solvents, and other chemicals that may have been utilized historically on and adjacent to the study area. Exposure to the vapors of these compounds above their respective OSHA permissible exposure limits (PELs) may produce irritation of the mucous membranes of the upper respiratory tract, nose, and mouth. Symptoms of such exposure include drowsiness, headache, fatigue, and “drunken-like” behaviors. Chronic and prolonged overexposure to the vapors of benzene may cause damage to the blood-forming organs and is known to cause leukemia in humans. In addition, these compounds may also present hazards through dermal absorption. As field activities normally involve subsurface disturbance for generally short periods of time, these pathways should be considered. Planning, development, and implementation of specific sampling protocol should be conducted to mitigate these potential concerns.

3.2.4 Cyanide

Cyanide is commonly used for processing mine tailings for precious metals. Although it may be naturally attenuated by multiple routes, including volatilization, chemical oxidation, biological oxidation, hydrolysis, and others, cyanide may still exist below the soils surface within the tailing pond impoundments. Exposure to the soil and groundwater via dermal contact or inhalation may occur during drilling and sampling activities. Symptoms may include weakness, difficulty in breathing, headache, confusion, dizziness, vertigo, nausea, vomiting, coma, pulmonary edema, and cardiac arrest. Planning, development, and implementation of specific sampling protocol should be conducted to mitigate these potential concerns.

3.2.5 Dioxins/Furans

Dioxins and/or furans are released during combustion processes and are not generally intended to be created. They are considered to likely be carcinogenic by the EPA. Exposure to dioxins and/or furans during field activities may be through inhalation or dermal contact. Some possible health effects from exposure to dioxins and/or furans include chloracne as well as changes in the hormone system and a suppressed immune system.

As field activities normally involve subsurface disturbance for generally short periods of time, these pathways should be considered. Planning, development, and implementation of specific sampling protocol should be conducted to mitigate these potential concerns.

3.3 Biological Hazards

The former mill site is likely to contain spiders, snakes, and other types of natural hazards. Boots and protective clothing should be inspected for spiders prior to putting them on. Snakes should be avoided to prevent snakebites. Site personnel should avoid high grass and underbrush and avoid disturbing objects that snakes may hide in or beneath. If a spider or snake bit occurs, the Field Safety Officer shall be notified immediately and the victim should be transported to the William Bee Ririe Hospital in Ely.

3.4 General Hazards

General hazards that may be encountered during sampling activities and preventative measures are described in the following sections and include:

- Slips, trips, and falls
- Elevated noise levels
- Electrical hazards
- Hazards associated with lifting and carrying
- Heat/cold stress

3.4.1 Slips, Trips, and Falls

Falls are a leading cause of occupational fatalities. These fatalities are considered preventable with the use of fall protection systems. The following is a list of common fall hazards:

- Elevated work at > 6 feet above lower level with unprotected sides or edges
- Wall openings > 4 feet above lower level
- Floor/Roof openings (hatches)
- Floor/Roof holes (deterioration), i.e. failing roof
- Ramps, walkways, bridges
- Excavations

Protection from fall hazards can be achieved in one of three ways: 1) fixed position systems, 2) personal fall protection, and 3) safety monitoring systems. A combination of these three protection systems is often used to ensure the safety of site workers. Fixed position systems consist of guardrails, safety nets, and floor covers. Personal fall protection will consist of a full-body harness with a 6-foot shock-absorbing lanyard. Good housekeeping, proper PPE, and daily safety meetings can minimize injuries from falls.

3.4.2 Elevated Noise Levels

During on-site activities requiring the use of power equipment, hearing protection may be required to be worn for certain tasks or in designated areas where noise levels reach > 85 dBA. Training on proper use of hearing protection will be conducted prior to initiation of specified onsite work.

3.4.3 Hazards Associated with Sharp Tools

Sampling activities may require the use of sharp tools when digging within soils with pick-axes and shovels. Cuts and punctures may occur if care is not heeded. Use extreme care when using sharp instruments. Hold sharp tools away from the body when walking.

3.4.4 Hazards Associated with Lifting and Carrying

The human body is subject to severe damage in the form of back injury and/or hernia if caution is not observed in the handling process. General rules for minimizing injuries from manual lifting are:

- Get good footing.
- Place feet shoulder width apart.
- BEND AT KNEES to grasp object.
- Keep back straight.
- Get a good grip on object.
- Lift gradually by straightening the legs.
- GET HELP if object is too heavy for you to lift (usually 50-60 lbs lifting limit).

3.5 Task Hazard Analysis

3.5.1 Collection of Surface Soil Samples

If sampling activities disturb the soil in such a way that causes dust to become airborne, then the risk of respiratory exposure goes up. In addition, dermal contact may occur if care is not taken to avoid contact with skin. Care should be taken to avoid the previously stated actions.

3.5.2 Geoprobe Drilling

During Geoprobe drilling activities, site personnel can have suspended loads dropped on them, be caught behind a load or a stationary object, be struck by counterweights, or be run over by the track-mounted equipment. All subcontractor personnel working with Geoprobe equipment shall take care to avoid the previously stated actions.

Each day before work commences, the operator or crew shall inspect the Geoprobe equipment to ensure the equipment is in proper working order prior to starting boring advancement. Further, the site personnel shall conduct a site safety meeting prior to start of boring advancement.

3.5.3 Collection of Soil and Groundwater Samples

While collecting soil and groundwater samples, sample collection personnel may be exposed to contaminants from the media being sampled or the chemicals being used in the preservation of samples. Therefore, prior to sampling activities, the following controls shall be utilized:

- Ensure area is secure prior to sampling;
- Handle all sampling media as if it is contaminated with hazardous compounds;
- Wear appropriate PPE as described in Section 5 of this HASP; and
- Review the SDS for all chemicals to be used or possibly encountered.

4. PERSONNEL TRAINING REQUIREMENTS

Consistent with OSHA's 29 CFR 1910.120, regulation covering Hazardous Waste Operations and Emergency Response and, OSHA's 29 CFR 1926 Construction Industry Standards, workers are required to be trained in accordance with those standards. At a minimum, all personnel are required to be trained to recognize the hazards on-site and the provisions of this HASP.

4.1 Pre-assignment and Annual Refresher Training

Prior to arrival on site, each employer will be responsible for certifying that his/her employees meet the requirements of training, consistent with OSHA 29 CFR 1910.120 paragraph (e)(3) or (e)(9). The employer should be able to provide a document certifying that each general site worker has received 40 hours of instruction off the site, and 24 hours of training for any workers who are on site only occasionally for a specific task. If an individual employee has work experience and/or training that is equivalent to that provided in the initial training, an employer may waive the 40-hour training so long as that equivalent experience is documented or certified. All personnel must also receive 8 hours of refresher training annually.

4.2 Training and Briefing Topics

The following items may be discussed by a qualified individual at the site pre-entry briefing(s) and at periodic tailgate safety meetings.

Physical Hazards
Emergency Response Plan
Training Requirements
Respiratory Protection
Site Control
Chemical Hazards
Air Monitoring
Animal Bites and Stings
Medical Surveillance
Personal Protective Equipment

Heavy Machinery

5. PERSONAL PROTECTIVE EQUIPMENT TO BE USED

This section describes the general requirements of the EPA designated Levels of Protection (A-D), and the specific levels of protection required for each task at the site.

5.1 Levels of Protection

Personnel wear protective equipment when response activities involve known or suspected atmospheric contamination vapors, gases, or particulate that may be generated by site activities, or when direct contact with skin-affecting substances may occur. The specific levels of protection and necessary components for each have been divided into four categories according to the degrees of protection afforded:

Level A:	Should be worn when the highest level of respiratory, skin, and eye protection is needed.
Level B:	Should be worn when the highest level of respiratory protection is needed, but a lesser level of skin protection. Level B is the primary level of choice when encountering unknown environments.
Level C:	Should be worn when the criteria for using air-purifying respirators are met, and a lesser level of skin protection is needed.
Level D:	Should be worn only as a work uniform and not in any area with respiratory or skin hazards. It provides minimal protection against chemical hazards.

Modifications of these levels are permitted, and routinely employed during site work activities to maximize efficiency. For example, Level C respiratory protection and Level D skin protection may be required for a given task. Likewise the type of chemical protective ensemble (i.e., material, format) will depend upon contaminants and degrees of contact. The Level of Protection selected is based upon the following:

- Type and measured concentration of the chemical substance in the ambient atmosphere and its toxicity.
- Potential for exposure to substances in air, liquids, or other direct contact with material due to work being done.
- Knowledge of chemicals on-site along with properties such as toxicity, route of exposure, contaminant matrix, and adequate warning properties.

In situations where the type of chemical, concentration, and possibilities of contact are not known, the appropriate Level of Protection must be selected based on professional experience and judgment until the hazards can be better identified. For all unknown situations on this site, Level D is the highest level anticipated.

5.2 Recommended Levels of Protection – Task Specific

The following specific personal protective ensembles are recommended for the site:

(Level D)

- Outer Gloves - Nitrile
- Outer Garment/Coveralls - Tyvek
- Hardhat
- Safety Glasses
- Steel-toed Boots

5.3 Reassessment of Protection Program

The level of Protection provided by PPE selection shall be upgraded or downgraded based upon a change in site conditions or findings of investigations. When a significant change occurs, the hazards should be reassessed and the HASP updated. Some indicators of the need for reassessment are:

- Commencement of a new work phase, such as the start of unexpected sampling or work that begins on a different portion of the site;
- Change in job tasks during a work phase;
- Contaminants other than those previously identified are encountered;
- Change in ambient levels of contaminants;
- Change in work scope which affects the degree of contact with contaminants.

5.4 SOP for Personal Protective Equipment

Proper inspection of PPE features several sequences of inspection depending upon specific articles of PPE and its frequency of use. The different levels of inspection are as follows:

- Inspection and operational testing of equipment received from the factory or distributor;
- Inspection of equipment as it is issued to workers;
- Inspection after use or training and prior to maintenance;
- Periodic inspection of stored equipment; and
- Periodic inspection when a question arises concerning the appropriateness of the selected equipment, or when problems with similar equipment arise.

The primary inspection of PPE in use for activities at the site will occur prior to immediate use and will be conducted by the user. This ensures that the specific device or article has been checked-out by the user and that the user is familiar with its use.

6. MEDICAL SURVEILLANCE REQUIREMENTS

Medical monitoring programs are designed to track the physical condition of employees on a regular basis as well as survey pre-employment or baseline conditions prior to potential exposures. The medical surveillance program is a part of each employers Health and Safety program. Exposure to toxic materials is not anticipated at the Site.

6.1 Exposure/Injury/Medical Support

As a follow-up to an injury or possible exposure above established exposure limits, all employees are entitled to and encouraged to seek medical attention and physical testing. Depending upon the type of exposure, it is critical to perform follow-up testing within 24-28 hours. It will be up to the employer's medical consultant to advise the type of test required to accurately monitor for exposure effects.

7. EXPOSURE MONITORING/AIR MONITORING

Exposure monitoring will not take place at the Site.

8. SITE CONTROL MEASURES

The following section defines measures and procedures for maintaining site control. Site control is an essential component in the implementation of the site health and safety program.

8.1 Site Communications Plan

Successful communications between field teams and contact with personnel in the support zone is essential. The following communications systems will be available during activities at the site.

- Hand Signals
- Verbal
- Honk Vehicle Horn - Evacuate immediately

Signal	Definition
Hands on top of head	Need assistance
Thumbs up	OK/I am all right/I understand
Thumbs down	No/negative
Arms waving upright	Send backup support
Grip partners wrist	Exit area immediately

8.2 Safe Work Practices

The following is a list of standing orders for the duration of the project.

- No smoking, eating, or drinking in areas where there is a potential of cross contamination or risk of fire or explosion.
- No horse play.
- Implement the communications system.
- Line of sight must be in position.
- Wear the appropriate level of protection as defined in the Safety Plan.

- No unauthorized entry into hazardous work areas by unauthorized personnel

9. DECONTAMINATION PLAN

Consistent with the levels of protection required, the decontamination process provides a step by step representation of the personnel decontamination steps for level D and C. These procedures should be modified to suit site conditions and protective ensembles in use. Decontamination involves the orderly controlled removal of contaminants. All site personnel should minimize contact with contaminants in order to minimize the need for extensive decontamination.

9.1 Personnel Decontamination

All workers exposed to COCs will be required to enact an orderly removal of contaminated PPE. This can be accomplished through repeated change of disposable garments and or PPE wash at the end of the shift. Workers shall be instructed to the importance of decontamination to prevent cross contamination.

9.2 Sampling Equipment Decontamination

Sampling equipment and heavy equipment may be decontaminated in accordance with procedures as defined in the work plan or as follows:

- Sampling equipment will be rinsed using water and Alconox solution (or an acceptable substitute).
- Sampling equipment will be decontaminated between taking samples to prevent cross contamination.

Disposable sampling equipment shall be utilized wherever practical to minimize employee exposure and possible cross contamination between sampling events.

10. EMERGENCY RESPONSE/CONTINGENCY PLAN

This section describes contingencies and emergency planning procedures to be implemented at the Site. This plan is compatible with local, state, and federal disaster and emergency management plans as appropriate.

10.1 Pre-Emergency Planning

A field pre-construction / field activities meeting will be conducted at the project site prior to implementation of field services. The meeting will include personnel from MGA and selected contractors, if applicable. Each of the activities and procedures presented will be reviewed during this meeting.

In addition, tailgate site safety discussions will be held daily. All employees will be trained in and reminded of provisions of the emergency response plan, communication systems, and evacuation routes. The plan will be reviewed and revised if necessary, on a regular basis by the HSO. This will ensure that the plan is adequate and consistent with prevailing site conditions.

10.2 Emergency Recognition/Prevention

Section 3 provides a listing of chemical hazards onsite. Additional hazards as a direct result of site activities are listed in Section 3.2 as are prevention and control techniques/mechanisms. Personnel will be familiar with techniques of hazard recognition from pre-assignment training and site specific briefings. The HSO is responsible for ensuring that prevention devices or equipment is available to personnel.

10.3 Evacuation Routes/Procedures

Since all individuals sampling will be within shouting distance, no special alarm system is anticipated as necessary. Contact appropriate emergency authorities. No other situation calling for site evacuation is reasonably anticipated.

10.4 Emergency Contact/Notification System

The following list provides names and telephone numbers for emergency contact personnel. In the event of a medical emergency, personnel will take direction from the HSO and notify the appropriate emergency organization. In the event of a fire or spill, the site supervisor will notify the appropriate local, state, and federal agencies.

Organization	**Telephone**
Ambulance:	911
Police:	911
Fire:	911
William Bee Ririe Hospital	775-289-3001
NDEP	775-687-4670
Regional EPA:	415-744-1500
EPA Emergency Response Team:	908-321-6660
National Response Center:	800-424-8802
Center for Disease Control:	404-488-4100
Chemtrec:	800-424-9555

10.5 Nearest Medical Assistance

The nearest medical facility is the William Bee Ririe Hospital. The facility is located at 1500 Avenue H, Ely, Nevada. A map of the route to this facility which can provide emergency care for individuals who may experience an injury or exposure on site is included in Appendix C of this HASP. The route to the facility should be verified by the HSO prior to sampling activities, and should be familiar to all site personnel.

10.6 Emergency Medical Treatment Procedures

Any person who becomes ill or injured in the work area must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed (i.e., complete disrobing of the victim and redressing in clean coveralls or wrapping in a blanket.) First aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must immediately be reported to the project manager.

10.7 Fire or Explosion

In the event of a fire or explosion, the local fire department should be summoned immediately. Upon their arrival, the project manager or designated alternate will advise the fire commander of the location, nature, and identification of the hazardous materials on site. If it is safe to do so, site personnel may:

- Use fire-fighting equipment available on site to control or extinguish the fire; and
- Remove or isolate flammable or other hazardous materials which may sustain a fire.

10.8 Emergency Equipment/Facilities

All emergency equipment will be located in the command post and/or support zone and shall include:

- First aid kit;
- Fire extinguisher;
- Mobile telephone;
- Eye wash station.

11. HAZARD COMMUNICATION

In order to comply with 29 CFR 1910.1200, Hazard Communication, the following written Hazard Communication Program has been established. All employees will be briefed on this program and have a written copy for review.

11.1 Container Labeling

All containers received on site will be inspected to ensure the following:

- All containers will be clearly labeled as to the contents;
- The appropriate hazard warnings will be noted; and
- The name and address of the manufacturer will be listed.

All secondary containers will be labeled with either an extra copy of the original manufacturer’s label or with generic labels which have a block for identify and blocks for the hazard warning.

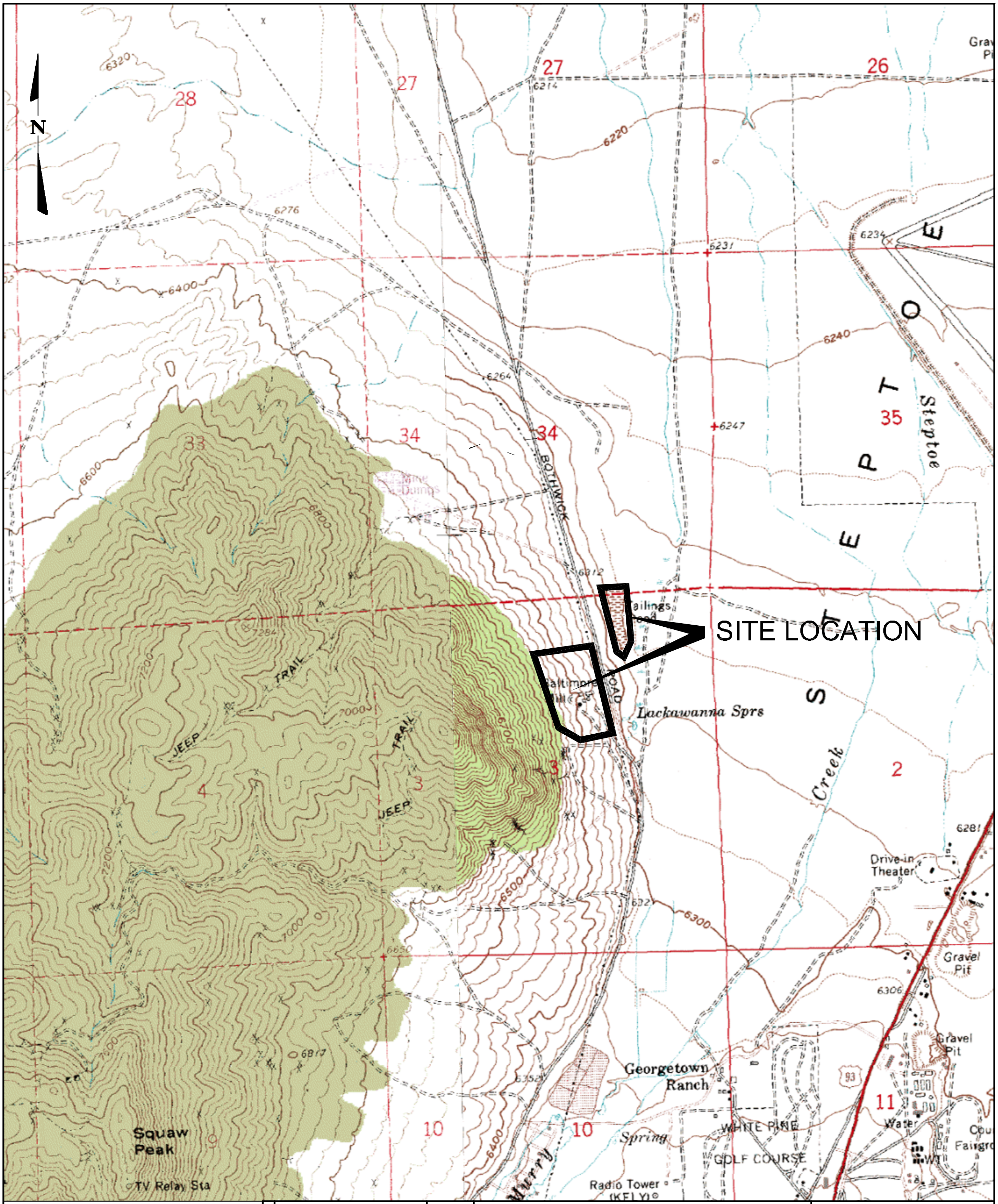
11.2 Safety Data Sheets (SDSs)

Copies of SDSs for all hazardous chemicals known on site will be maintained in the work area. SDSs will be available to all employees for review during each work shift.

11.3 Employee Training and Information

Prior to starting work, each employee will attend a health and safety orientation and will receive information and training on the following:

- An overview of the requirements contained in the Hazard Communication Standard, 29 CFR 1910.1200;
- Chemicals present in their workplace operations;
- Location and availability of a written hazard program;
- Physical and health effects of the hazardous chemicals;
- Methods and observation techniques used to determine the presence or release of hazardous chemicals;
- How to lessen or prevent exposure to these hazardous chemicals through usage of control/work practices and personal protective equipment;
- Emergency procedures to follow if they are exposed to these chemicals;
- How to read labels and review MSDSs to obtain appropriate hazard information;
- Specialized hot work and tank processing techniques.



0 100 200

FEET

REFERENCE	
DESIGNED	BH
DRAWN	TAD
CHECKED	
APPROVED	

REVISIONS No.	DESCRIPTION	BY	DATE

FIGURE 1

PROJECT LOCATION
-SHOWING-
PARCEL 010-420-06
OLD LACKAWANNA MILL SITE
WHITE PINE COUNTY, NEVADA

McGinley & Associates

SCALE: AS SHOWN

REVISION A

JOB NO. BRN–023

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5/17/2012

APPENDIX A

Agreement of Compliance

HASP

Statement of Compliance

I have read and understand the HASP for the site soils investigation at the Old Lackawanna Mill Site (Egan Mill) in Ely, Nevada.

I agree to comply with the contents of the HASP and understand that not doing so may be reason for discharge from the site.

Signature: ______________________________ Date: ____________________

Signature: ______________________________ Date: ____________________

Signature: ______________________________ Date: ____________________

Signature: ______________________________ Date: ____________________

Signature: ______________________________ Date: ____________________

Signature: ______________________________ Date: ____________________

APPENDIX B

SDS Sheets

SAFETY DATA SHEET

1. Identification

Product identifier: SODIUM CYANIDE

Other means of identification
Product No.: 7616, 3662

Recommended use and restriction on use

Recommended use: Not available.
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company Name:	Avantor Performance Materials, Inc.
Address:	3477 Corporate Parkway, Suite 200 Center Valley, PA 18034
Telephone:	
	Customer Service: 855-282-6867
Fax:	
Contact Person:	Environmental Health & Safety
e-mail:	info@avantormaterials.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard classification

Health hazards

Acute toxicity (Oral)	Category 2

Environmental hazards

Acute hazards to the aquatic environment	Category 1

Label elements

Hazard symbol:

Signal word: Danger

Hazard statement: Fatal if swallowed.
Very toxic to aquatic life.

Precautionary statement

Prevention: Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Avoid release to the environment.

Response:	IF SWALLOWED: Immediately call a POISON CENTER/doctor. Rinse mouth. Specific treatment (see this label). Collect spillage.
Storage:	Store locked up.
Disposal:	Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification:	None.

3. Composition/information on ingredients

Substances

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
SODIUM CYANIDE		143-33-9	90 - 100%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information:	Get medical attention immediately. Show this safety data sheet to the doctor in attendance.
Ingestion:	Call a physician or poison control center immediately. Never give liquid to an unconscious person. Give activated charcoal and keep patient quiet, in a dark place if possible. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Rinse mouth. Ensure unobstructed airway.
Inhalation:	Call a physician or poison control center immediately. Move to fresh air. Ensure unobstructed airway. Administer antidote kit and oxygen per pre-planned instructions if symptoms occur. Do not give mouth-to-mouth resuscitation.
Skin contact:	Call a physician or poison control center immediately. Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.
Eye contact:	Call a physician or poison control center immediately. Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses.

Most important symptoms/effects, acute and delayed

Symptoms:	Fatal if swallowed.

Indication of immediate medical attention and special treatment needed

Treatment:	Treat symptomatically.

5. Fire-fighting measures

General fire hazards:	No data available.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media:	Dry chemical. Dry sand.
Unsuitable extinguishing media:	Water, CO2 or Foam
Specific hazards arising from the chemical:	Combustion by-products include oxides of nitrogen, hydrogen cyanide, and other irritants and toxic gases.

Special protective equipment and precautions for firefighters

Special fire fighting procedures:	Move containers from fire area if you can do so without risk.
Special protective equipment for fire-fighters:	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures:	See Section 8 of the MSDS for Personal Protective Equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Keep unauthorized personnel away. Ventilate closed spaces before entering them.
Methods and material for containment and cleaning up:	Remove material, as much as possible, using mechanical equipment. Collect powder using special dust vacuum cleaner with particle filter or carefully sweep into closed container. Clean surface thoroughly to remove residual contamination.
Notification Procedures:	Dike for later disposal. Prevent entry into waterways, sewer, basements or confined areas. Stop the flow of material, if this is without risk. Inform authorities if large amounts are involved.
Environmental precautions:	Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so. Avoid release to the environment.

7. Handling and storage

Precautions for safe handling:	Do not get in eyes, on skin, on clothing. Wash hands thoroughly after handling. Do not taste or swallow. Wash thoroughly after handling. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. See Section 8 of the MSDS for Personal Protective Equipment. Avoid dust formation. Use only with adequate ventilation. Wash at the end of each work shift and before eating, smoking and using the toilet. Immediately change contaminated clothes. Contaminated work clothing should not be allowed out of the workplace. Ensure no residue on outside of container before returning to storage. Use only in controlled area. Carefully open container. Toxic or caustic vapors may escape.
Conditions for safe storage, including any incompatibilities:	Keep container tightly closed. Store in cool, dry place. Store in a well-ventilated place. Store in original container. Store locked up.

8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Chemical identity	Type	Exposure Limit values		Source
SODIUM CYANIDE - as CN	Ceiling		5 mg/m3	US. ACGIH Threshold Limit Values (02 2012)
	Ceil_Time	4.7 ppm	5 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL		5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	TWA		5 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	TWA PEL		5 mg/m3	US. California Code of Regulations, Title 8, Section 5155. Airborne Contaminants (08 2010)

Appropriate engineering controls No data available.

Individual protection measures, such as personal protective equipment

General information: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area.

Eye/face protection: Wear safety glasses with side shields (or goggles) and a face shield. Wear a full-face respirator, if needed.

Skin protection

Hand protection: Chemical resistant gloves

Other: Wear suitable protective clothing. Gloves made from: Natural rubber. Nitrile rubber.

Respiratory protection: In case of inadequate ventilation and work of brief duration, use suitable respiratory equipment.

Hygiene measures: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not eat, drink or smoke when using the product. Wash contaminated clothing before reuse. Observe good industrial hygiene practices. Do not get this material in contact with skin. Wash hands before breaks and immediately after handling the product. Wash hands after handling.

9. Physical and chemical properties

Appearance

Physical state:	Solid
Form:	Granules
Color:	White
Odor:	Faint almond odor
Odor threshold:	No data available.
pH:	No data available.
Melting point/freezing point:	564 °C
Initial boiling point and boiling range:	1,496 °C
Flash Point:	Not applicable

Evaporation rate: No data available.

Flammability (solid, gas): No data available.

Upper/lower limit on flammability or explosive limits

- **Flammability limit - upper (%):** No data available.
- **Flammability limit - lower (%):** No data available.
- **Explosive limit - upper (%):** No data available.
- **Explosive limit - lower (%):** No data available.

Vapor pressure: 0.13332 kPa (817 °C)

Vapor density: No data available.

Relative density: 1.60 (20 °C)

Solubility(ies)

- **Solubility in water:** 480 g/l (10 °C)
- **Solubility (other):** No data available.

Partition coefficient (n-octanol/water): No data available.

Auto-ignition temperature: No data available.

Decomposition temperature: No data available.

Viscosity: No data available.

Other information

Molecular weight: 49.01 g/mol (CNNa)

10. Stability and reactivity

Reactivity: No dangerous reaction known under conditions of normal use.

Chemical stability: No data available.

Possibility of hazardous reactions: Hazardous polymerization does not occur. Contact with water liberates toxic gas.

Conditions to avoid: Heat. Moisture. Sunlight. Contact with incompatible materials.

Incompatible materials: Acids. Acid salts. Strong oxidizing agents. Fluorine. Alcohols. Aluminum. Copper. Magnesium. Zinc. Isocyanates.

Hazardous decomposition products: Cyanides. Nitrogen Oxides

11. Toxicological information

Information on likely routes of exposure

- **Ingestion:** Fatal if swallowed.
- **Inhalation:** No data available.
- **Skin contact:** Fatal in contact with skin. Causes mild skin irritation.
- **Eye contact:** No data available.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral

Product: LD 50 (Rat): 6.44 mg/kg

Dermal

Product: No data available.

Inhalation

Product:	No data available.

Repeated dose toxicity

Product:	No data available.

Skin corrosion/irritation

Product:	No data available.

Serious eye damage/eye irritation

Product:	No data available.

Respiratory or skin sensitization

Product:	Not a skin sensitizer.

Carcinogenicity

Product:	This substance has no evidence of carcinogenic properties.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity

In vitro

Product:	No mutagenic components identified

In vivo

Product:	No mutagenic components identified

Reproductive toxicity

Product:	Suspected of damaging fertility or the unborn child.

Specific target organ toxicity - single exposure

Product:	None known.

Specific target organ toxicity - repeated exposure

Product:	None known.

Aspiration hazard

Product:	No data available.

Other effects:	None known.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish

Product:	No data available.
Specified substance(s):	
SODIUM CYANIDE	LC 50 (Rainbow trout,donaldson trout (Oncorhynchus mykiss), 96 h): 0.0391 - 0.0548 mg/l Mortality LC 50 (Bluegill (Lepomis macrochirus), 96 h): 0.066 - 0.0852 mg/l Mortality

Aquatic invertebrates

Product:	No data available.
Specified substance(s):	
SODIUM CYANIDE	LC 50 (Water flea (Daphnia magna), 96 h): 0.09 mg/l Mortality

Chronic hazards to the aquatic environment:

Fish

Product:	No data available.

Aquatic invertebrates

Product:	No data available.

Toxicity to Aquatic Plants

Product:	No data available.

Persistence and degradability

Biodegradation

Product:	There are no data on the degradability of this product.

BOD/COD ratio

Product:	No data available.

Bioaccumulative potential

Bioconcentration factor (BCF)

Product:	No data available on bioaccumulation.

Partition coefficient n-octanol / water (log Kow)

Product:	No data available.

Mobility in soil:	The product is water soluble and may spread in water systems.
Other adverse effects:	Very toxic to aquatic life with long lasting effects.

13. Disposal considerations

Disposal instructions:	Discharge, treatment, or disposal may be subject to national, state, or local laws. Do not allow to enter drains, sewers or watercourses.
Contaminated packaging:	Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number:	UN 1689
UN proper shipping name:	Sodium cyanide, solid
Transport hazard class(es)	
Class(es):	6.1
Label(s):	6.1
Packing group:	I
Marine Pollutant:	Yes

IMDG

UN number: UN 1689
UN proper shipping name: SODIUM CYANIDE, SOLID
Transport hazard class(es)
Class(es): 6.1
Label(s): 6.1
EmS No.: F-A, S-A

Packing group: I
Marine Pollutant: Yes

IATA

UN number: UN 1689
Proper Shipping Name: Sodium cyanide, solid
Transport hazard class(es):
Class(es): 6.1
Label(s): 6.1

Marine Pollutant: No
Packing group: I

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

SODIUM CYANIDE Reportable quantity: 10 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

☒ Acute (Immediate) ☒ Chronic (Delayed) ☐ Fire ☐ Reactive ☐ Pressure Generating

SARA 302 Extremely hazardous substance

Chemical identity	RQ	Threshold Planning Quantity
SODIUM CYANIDE	10 lbs.	100 lbs.

SARA 304 Emergency release notification

Chemical identity	RQ
SODIUM CYANIDE	10 lbs.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity
SODIUM CYANIDE	100lbs

SARA 313 (TRI reporting)

Chemical identity	Reporting threshold for other users	Reporting threshold for manufacturing and processing
SODIUM CYANIDE	10000 lbs	25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)

SODIUM CYANIDE Reportable quantity: 10 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):

None present or none present in regulated quantities.

US state regulations

US. California Proposition 65

SODIUM CYANIDE	Male reproductive toxin. WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

US. New Jersey Worker and Community Right-to-Know Act

SODIUM CYANIDE	Listed

US. Massachusetts RTK - Substance List

SODIUM CYANIDE	Listed

US. Pennsylvania RTK - Hazardous Substances

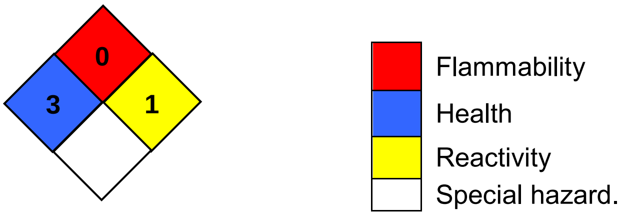
SODIUM CYANIDE	Listed

US. Rhode Island RTK

SODIUM CYANIDE	Listed

16.Other information, including date of preparation or last revision

NFPA Hazard ID



Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe

Issue date:	05-05-2014
Revision date:	No data available.
Version #:	1.0
Further information:	No data available.

Disclaimer:

THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET (MSDS/SDS) WAS PREPARED BY TECHNICAL PERSONNEL BASED ON DATA THAT THEY BELIEVE IN THEIR GOOD FAITH JUDGMENT IS ACCURATE. HOWEVER, THE INFORMATION PROVIDED HEREIN IS PROVIDED “AS IS,” AND AVANTOR PERFORMANCE MATERIALS MAKES AND GIVES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER, AND EXPRESSLY DISCLAIMS ALL WARRANTIES REGARDING SUCH INFORMATION AND THE PRODUCT TO WHICH IT RELATES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING WITHOUT LIMITATION, WARRANTIES OF ACCURACY, COMPLETENESS, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY, STABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE. THIS MSDS/SDS IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT, AND IS NOT INTENDED TO BE COMPREHENSIVE AS TO THE MANNER AND CONDITIONS OF USE, HANDLING, STORAGE, OR DISPOSAL OF THE PRODUCT. INDIVIDUALS RECEIVING THIS MSDS/SDS MUST ALWAYS EXERCISE THEIR OWN INDEPENDENT JUDGMENT IN DETERMINING THE APPROPRIATENESS OF SUCH ISSUES. ACCORDINGLY, AVANTOR PERFORMANCE MATERIALS ASSUMES NO LIABILITY WHATSOEVER FOR THE USE OF OR RELIANCE UPON THIS INFORMATION. NO SUGGESTIONS FOR USE ARE INTENDED AS, AND NOTHING HEREIN SHALL BE CONSTRUED AS, A RECOMMENDATION TO INFRINGE ANY EXISTING PATENTS OR TO VIOLATE ANY FEDERAL, STATE, LOCAL, OR FOREIGN LAWS. AVANTOR PERFORMANCE MATERIALS REMINDS YOU THAT IT IS YOUR LEGAL DUTY TO MAKE ALL INFORMATION IN THIS MSDS/SDS AVAILABLE TO YOUR EMPLOYEES.

Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909
US GHS

Synonyms: Ultra Low Sulfur Diesel; Low Sulfur Diesel; No. 2 Diesel; Motor Vehicle Diesel Fuel; Non-Road Diesel Fuel; Locomotive/Marine Diesel Fuel

* * * Section 1 - Product and Company Identification * * *

Manufacturer Information

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS
Emergency # 800-424-9300 CHEMTREC
www.hess.com (Environment, Health, Safety Internet Website)

* * * Section 2 - Hazards Identification * * *

GHS Classification:

Flammable Liquids - Category 3
Skin Corrosion/Irritation – Category 2
Germ Cell Mutagenicity – Category 2
Carcinogenicity - Category 2
Specific Target Organ Toxicity (Single Exposure) - Category 3 (respiratory irritation, narcosis)
Aspiration Hazard – Category 1
Hazardous to the Aquatic Environment, Acute Hazard – Category 3

GHS LABEL ELEMENTS

Symbol(s)

Signal Word

DANGER

Hazard Statements

Flammable liquid and vapor.
Causes skin irritation.
Suspected of causing genetic defects.
Suspected of causing cancer.
May cause respiratory irritation.
May cause drowsiness or dizziness.
May be fatal if swallowed and enters airways.
Harmful to aquatic life.

Precautionary Statements

Prevention

Keep away from heat/sparks/open flames/hot surfaces. No smoking
Keep container tightly closed.
Ground/bond container and receiving equipment.

Use explosion-proof electrical/ventilating/lighting/equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Wear protective gloves/protective clothing/eye protection/face protection.
Wash hands and forearms thoroughly after handling.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Avoid breathing fume/mist/vapours/spray.

Response
In case of fire: Use water spray, fog or foam to extinguish.
IF ON SKIN (or hair): Wash with plenty of soap and water. Remove/Take off immediately all contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical advice/attention.
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell.
If swallowed: Immediately call a poison center or doctor. Do NOT induce vomiting.
IF exposed or concerned: Get medical advice/attention.

Storage
Store in a well-ventilated place. Keep cool.
Keep container tightly closed.
Store locked up.

Disposal
Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 3 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
68476-34-6	Fuels, diesel, no. 2	100
91-20-3	Naphthalene	<0.1

A complex mixture of hydrocarbons with carbon numbers in the range C9 and higher.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

First Aid: Skin

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or with waterless hand cleanser. Obtain medical attention if irritation or redness develops. Thermal burns require immediate medical attention depending on the severity and the area of the body burned.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

See Section 9 for Flammability Properties.

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, and other gaseous agents.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Unsuitable Extinguishing Media

None

Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

* * * Section 6 - Accidental Release Measures * * *

Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Caution, flammable vapors may accumulate in closed containers.

Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Prevention of Secondary Hazards

None

* * * Section 7 - Handling and Storage * * *

Handling Procedures

Handle as a combustible liquid. Keep away from heat, sparks, excessive temperatures and open flame! No smoking or open flame in storage, use or handling areas. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

Storage Procedures

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks."

Incompatibilities

Keep away from strong oxidizers.

* * * Section 8 - Exposure Controls / Personal Protection * * *

Component Exposure Limits

Fuels, diesel, no. 2 (68476-34-6)

ACGIH:	100 mg/m3 TWA (inhalable fraction and vapor, as total hydrocarbons, listed under Diesel fuel) Skin - potential significant contribution to overall exposure by the cutaneous route (listed under Diesel fuel)

Naphthalene (91-20-3)

ACGIH:	10 ppm TWA 15 ppm STEL Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA:	10 ppm TWA; 50 mg/m3 TWA
NIOSH:	10 ppm TWA; 50 mg/m3 TWA 15 ppm STEL; 75 mg/m3 STEL

Engineering Measures

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

Personal Protective Equipment: Respiratory

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Personal Protective Equipment: Hands

Gloves constructed of nitrile, neoprene, or PVC are recommended.

Personal Protective Equipment: Eyes

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

Personal Protective Equipment: Skin and Body

Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

* * * Section 9 - Physical & Chemical Properties * * *

Appearance:	Clear, straw-yellow.	**Odor:**	Mild, petroleum distillate odor
Physical State:	Liquid	**pH:**	ND
Vapor Pressure:	0.009 psia @ 70 °F (21 °C)	**Vapor Density:**	>1.0
Boiling Point:	320 to 690 °F (160 to 366 °C)	**Melting Point:**	ND
Solubility (H2O):	Negligible	**Specific Gravity:**	0.83-0.876 @ 60°F (16°C)
Evaporation Rate:	Slow; varies with conditions	**VOC:**	ND
Percent Volatile:	100%	**Octanol/H2O Coeff.:**	ND
Flash Point:	>125 °F (>52 °C) minimum	**Flash Point Method:**	PMCC
Upper Flammability Limit (UFL):	7.5	**Lower Flammability Limit (LFL):**	0.6
Burning Rate:	ND	**Auto Ignition:**	494°F (257°C)

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Conditions to Avoid

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

Incompatible Products

Keep away from strong oxidizers.

Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

* * * Section 11 - Toxicological Information * * *

Acute Toxicity

A: General Product Information

Harmful if swallowed.

B: Component Analysis - LD50/LC50

Naphthalene (91-20-3)

Inhalation LC50 Rat >340 mg/m3 1 h; Oral LD50 Rat 490 mg/kg; Dermal LD50 Rat >2500 mg/kg; Dermal LD50 Rabbit >20 g/kg

Potential Health Effects: Skin Corrosion Property/Stimulativeness

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

Potential Health Effects: Eye Critical Damage/ Stimulativeness

Contact with eyes may cause mild irritation.

Potential Health Effects: Ingestion

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

Potential Health Effects: Inhalation

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity

This material has been positive in a mutagenicity study.

Carcinogenicity

A: General Product Information

Suspected of causing cancer.

Studies have shown that similar products produce skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation.

B: Component Carcinogenicity

Fuels, diesel, no. 2 (68476-34-6)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans (listed under Diesel fuel)

Naphthalene (91-20-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen
NTP: Reasonably Anticipated To Be A Human Carcinogen (Possible Select Carcinogen)
IARC: Monograph 82 [2002] (Group 2B (possibly carcinogenic to humans))

Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

Specified Target Organ General Toxicity: Single Exposure

This product is not reported to have any specific target organ general toxicity single exposure effects.

Specified Target Organ General Toxicity: Repeated Exposure

This product is not reported to have any specific target organ general toxicity repeat exposure effects.

Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Fuels, diesel, no. 2 (68476-34-6)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	35 mg/L [flow-through]	

Naphthalene (91-20-3)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	5.74-6.44 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	1.6 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	0.91-2.82 mg/L [static]	
96 Hr LC50 Pimephales promelas	1.99 mg/L [static]	

96 Hr LC50 Lepomis macrochirus	31.0265 mg/L [static]
72 Hr EC50 Skeletonema costatum	0.4 mg/L
48 Hr LC50 Daphnia magna	2.16 mg/L
48 Hr EC50 Daphnia magna	1.96 mg/L [Flow through]
48 Hr EC50 Daphnia magna	1.09 - 3.4 mg/L [Static]

Persistence/Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

* * * Section 13 - Disposal Considerations * * *

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 14 - Transportation Information * * *

DOT Information

Shipping Name: Diesel Fuel

NA #: 1993 **Hazard Class:** 3 **Packing Group:** III

Placard:

* * * Section 15 - Regulatory Information * * *

Regulatory Information

Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Naphthalene (91-20-3)

CERCLA: 100 lb final RQ; 45.4 kg final RQ

SARA Section 311/312 – Hazard Classes

Acute Health	Chronic Health	Fire	Sudden Release of Pressure	Reactive
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product may contain listed chemicals below the de minimis levels which therefore are not subject to the supplier notification requirements of Section 313 of the Emergency Planning and Community Right- To-Know Act (EPCRA) of 1986 and of 40 CFR 372. If you may be required to report releases of chemicals listed in 40 CFR 372.28, you may contact Hess Corporate Safety if you require additional information regarding this product.

State Regulations

Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Fuels, diesel, no. 2	68476-34-6	No	No	No	Yes	No	No
Naphthalene	91-20-3	Yes	Yes	Yes	Yes	Yes	No

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

Component Analysis - WHMIS IDL

No components are listed in the WHMIS IDL.

Additional Regulatory Information

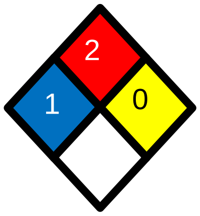
Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Fuels, diesel, no. 2	68476-34-6	Yes	DSL	EINECS
Naphthalene	91-20-3	Yes	DSL	EINECS

* * * Section 16 - Other Information * * *

NFPA® Hazard Rating

Health	1
Fire	2
Reactivity	0



HMIS® Hazard Rating

Health	1*	Slight
Fire	2	Moderate
Physical	0	Minimal
		*Chronic

Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail; ADR/RID = European Agreement of Dangerous Goods by Road/Rail; AS = Standards Australia; DFG = Deutsche Forschungsgemeinschaft; DOT = Department of Transportation; DSL = Domestic Substances List; EEC = European Economic Community; EINECS = European Inventory of Existing Commercial Chemical Substances; ELINCS = European List of Notified Chemical Substances; EU = European Union; HMIS = Hazardous Materials Identification System; IARC = International Agency for Research on Cancer; IMO = International Maritime Organization; IATA = International Air Transport Association; MAK = Maximum Concentration Value in the Workplace; NDSL = Non-Domestic Substances List; NFPA = National Fire Protection Association; NOHSC = National Occupational Health & Safety Commission; NTP = National Toxicology Program; STEL = Short-term Exposure Limit; TDG = Transportation of Dangerous Goods; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time Weighted Average

Literature References

None

Other Information

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

End of Sheet

Monsanto
Material Safety Data

POLYCHLORINATED BIPHENYLS (PCBs)

Emergency Phone No.
(Call Collect)
314-694-1000

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: POLYCHLORINATED BIPHENYLS (PCBs)
Aroclor® Series 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, 1268
Therminol® FR Series

MSDS Number: M00018515 Date: 12/95

Chemical Family:	Chlorinated Hydrocarbons
Chemical Name:	Polychlorinated biphenyls
Synonyms:	PCBs, Chlorodiphenyls, Chlorinated biphenyls

Trade Names/Common Names:

PYRANOL® and INERTEEN® are trade names for commonly used dielectric fluids that may have contained varying amounts of PCBs as well as other components including chlorinated benzenes.

ASKAREL is the generic name for a broad class of fire resistant synthetic chlorinated hydrocarbons and mixtures used as dielectric fluids that commonly contained about 30 - 70% PCBs. Some ASKAREL fluids contained 99% or greater PCBs and some contained no PCBs.

PYDRAUL® is the trade name for hydraulic fluids that, prior to 1972, may have contained varying amounts of PCBs and other components including phosphate esters.

The product names/trade names are representative of several commonly used Monsanto products (or products formulated with Monsanto products). Other trademarked PCB products were marketed by Monsanto and other manufacturers. PCBs were also manufactured and sold by several European and Japanese companies. Contact the manufacturer of the trademarked product, if not in this listing, to determine if the formulation contained PCBs.

In 1972, Monsanto restricted sales of PCBs to applications involving only closed electrical systems, (transformers and capacitors). In 1977, all manufacturing and sales were voluntarily terminated. In 1979, EPA restricted the manufacture, processing, use, and distribution of PCBs to specifically exempted and authorized activities.

MONSANTO COMPANY, 800 N. LINDBERGH BLVD., ST. LOUIS, MO 63167

FOR CHEMICAL EMERGENCY, SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT
Call CHEMTREC - Day or Night - 1-800-424-9300 Toll free in the continental U.S., Hawaii, Puerto Rico, Canada, Alaska, or Virgin Islands. For calls originating elsewhere: 202-483-7616 (collect calls accepted)

For additional nonemergency information, call: 314-694-3344.

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemically, commercial PCBs are defined as a series of technical mixtures, consisting of many isomers and compounds that vary from mobile, oily liquids to white crystalline solids and hard noncrystalline resins. Technical products vary in composition, in the degree of chlorination, and possibly according to batch.

The mixtures generally used contain an average of 3 atoms of chlorine per molecule (42% chlorine) to 5 atoms of chlorine per module (54% chlorine). They were used as components of dielectric fluids in transformers and capacitors. Prior to 1972, PCB applications included heat transfer media, hydraulic, and other industrial fluids, plasticizers, carbonless copy paper, paints, inks, and adhesives.

Component	CAS No.
chlorinated biphenyl	1336-36-3
Aroclor 1016	12674-11-2
Aroclor 1221	11104-28-2
Aroclor 1232	11141-16-5
Aroclor 1242	53469-21-9
Aroclor 1248	12672-29-6
Aroclor 1254	11097-69-1
Aroclor 1260	11096-82-5
Aroclor 1262	37324-23-5
Aroclor 1268	11100-14-4

There are also CAS Numbers for individual PCB congeners and for mixtures of Aroclor® products.

PCBs are identified as hazardous chemicals under criteria of the OSHA Hazard Communication Standard (29 CFR Part 1910.1200). PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1987)-Group 2A and in the National Toxicology Program (NTP) Annual Report on Carcinogens (Seventh).

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Appearance and Odor: PCB mixtures range in form and color from clear to amber liquids to white crystalline solids. They have a mild, distinctive odor and are not volatile at room temperature. Refer to Section 9 for details.

WARNING!
CAUSES EYE IRRITATION
MAY CAUSE SKIN IRRITATION

PROCESSING AT ELEVATED TEMPERATURES MAY RELEASE VAPORS OR FUMES WHICH MAY CAUSE RESPIRATORY TRACT IRRITATION

POTENTIAL HEALTH EFFECTS

Likely Routes of Exposure: Skin contact and inhalation of heated vapors

Eye Contact: Causes moderate irritation based on worker experience.

Skin Contact: Prolonged or repeated contact may result in redness, dry skin and defatting based on human experience. A potential exists for developing chloracne. PCBs can be absorbed through intact skin.

Inhalation: Due to the low volatility of PCBs, exposure to this material in ambient conditions is not expected to produce adverse health effects. However, at elevated processing temperatures, PCBs may produce a vapor that may cause respiratory tract irritation if inhaled based on human experience.

Ingestion: No more than slightly toxic based on acute animal toxicity studies. Coughing, choking and shortness of breath may occur if liquid material is accidentally drawn into the lungs during swallowing or vomiting.

Other: Numerous epidemiological studies of humans, both occupationally exposed and nonworker environmentally exposed populations, have not demonstrated any causal relationship between PCB exposure and chronic human illnesses such as cancer or neurological or cardiovascular effects. PCBs at high dosage can cause skin symptoms; however, these subside upon removal of the exposure source.

Refer to Section 11 for toxicological information.

4. FIRST AID MEASURES

IF IN EYES, immediately flush with plenty of water for at least 15 minutes. If easy to do, remove any contact lenses. Get medical attention. Remove material from skin and clothing.

IF ON SKIN, immediately flush the area with plenty of water. Wash skin gently with soap as soon as it is available. Get medical attention if irritation persists.

IF INHALED, remove person to fresh air. If breathing is difficult, get medical attention.

IF SWALLOWED, do NOT induce vomiting. Rinse mouth with water. Get medical attention. Contact a Poison Control Center. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

NOTE TO PHYSICIANS: Hot PCBs may cause thermal burn. If electrical equipment arcs between conductors, PCBs or other chlorinated hydrocarbon dielectric fluids may decompose to produce hydrochloric acid (HCl), a respiratory irritant. If large amounts are swallowed, gastric lavage may be considered.

5. FIRE FIGHTING MEASURES

Flash Point: 284 degrees F (140 degrees C) or higher depending on the chlorination level of the Aroclor product

Fire Point: 349 degrees F (176 degrees C) or higher depending on the chlorination level of the Aroclor product

NOTE: Refer to Section 9 for individual flash points and fire points.

Extinguishing Media: Extinguish fire using agent suitable for surrounding fire. Use dry chemical, foam, carbon dioxide or water spray. Water may be ineffective. Use water spray to keep fire-exposed containers or transformer cool.

PCBs are fire-resistant compounds. They may decompose to form CO, CO2, HCl, phenolics, aldehydes, and other toxic combustion products under severe conditions such as exposure to flame or hot surfaces.

Dielectric fluids having PCBs and chlorinated benzenes as components have been reported to produce polychlorinated dibenzo-p-dioxins (PCDDs) and furans (PCDFs) during fire situations involving electrical equipment. At temperatures in the range of 600-650 degrees C in the presence of excess oxygen, PCBs may form polychlorinated dibenzofurans (PCDFs). Laboratory studies under similar conditions have demonstrated that PCBs do not produce polychlorinated dibenzo-p-dioxins (PCDDs).

Federal regulations require all PCB transformers to be registered with fire response personnel.

If a PCB transformer is involved in a fire-related incident, the owner of the transformer may be required to report the incident. Consult and follow appropriate federal, state and local regulations.

Fire Fighting Equipment: Fire fighters and others exposed to products of combustion should wear self-contained breathing apparatus. Equipment should be thoroughly decontaminated after use.

6. ACCIDENTAL RELEASE MEASURES

Cleanup and disposal of liquid PCBs and other PCB items are strictly regulated by the federal government. The regulations are found at 40 CFR Part 761. Consult these regulations as well as applicable state and local regulations prior to any cleanup or disposal of PCBs, PCB items, or PCB contaminated items.

If PCBs leak or are spilled, the following steps should be taken immediately:

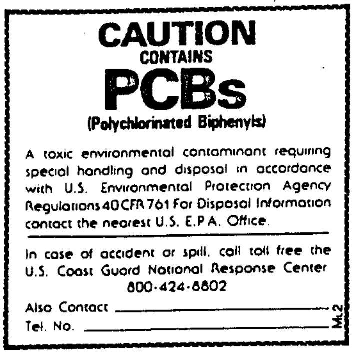
> All nonessential personnel should leave the leak or spill area.
>
> The area should be adequately ventilated to prevent the accumulation of vapors.
>
> The spill/leak should be contained. Loss to sewer systems, navigable waterways, and streams should be prevented. Spills/leaks should be removed promptly by means of absorptive material, such as sawdust, vermiculite, dry sand, clay, dirt or other similar materials, or trapped and removed by pumping or other suitable means (traps, drip-pans, trays, etc.).
>
> Personnel entering the spill or leak area should be furnished with appropriate personal protective equipment and clothing as needed. Refer to Section 8 for personal protection equipment and clothing.
>
> Personnel trained in emergency procedures and protected against attendant hazards should shut off sources of PCBs, clean up spills, control and repair leaks, and fight fires in PCB areas.

Refer to Section 13 for disposal information and Sections 14 and 15 for information regarding reportable quantity, and Section 7 for marking information.

7. HANDLING AND STORAGE

Care should be taken to prevent entry into the environment through spills, leakage, use vaporization, or disposal of liquid or containers. Avoid prolonged breathing of vapors or mists. Avoid contact with eyes or prolonged contact with skin. If skin contact occurs, remove by washing with soap and water. Following eye contact, flush with water. In case of spillage onto clothing, the clothing should be removed as soon as practical, skin washed, and clothing laundered. Comply with all federal, state, and local regulations.

Federal regulations under the Toxic Substances Control Act require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be marked (check regulations, 40 CFR 761, for details).



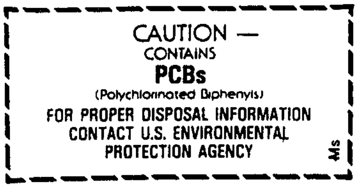
CAUTION
CONTAINS
PCBs
(Polychlorinated Biphenyls)

A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations 40 CFR 761 For Disposal Information contact the nearest U.S. E.P.A. Office.

In case of accident or spill, call toll free the U.S. Coast Guard National Response Center
800-424-8802

Also Contact ______________
Tel. No. ______________

M-2



CAUTION —
CONTAINS
PCBs
(Polychlorinated Biphenyls)
FOR PROPER DISPOSAL INFORMATION
CONTACT U.S. ENVIRONMENTAL
PROTECTION AGENCY

Ms

Storage: The storage of PCB items or equipment (those containing 50 ppm or greater PCBs) and PCB waste is strictly regulated by 40 CFR Part 761. The storage time is limited, the storage area must meet physical requirements, and the area must be labeled.

Avoid contact with eyes.
Wash thoroughly after handling.
Avoid breathing processing fumes or vapors.
Process using adequate ventilation.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection: Wear chemical splash goggles and have eye baths available where there is significant potential for eye contact.

Skin Protection: Wear appropriate protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine the appropriate type glove for a given application. Wear chemical goggles, face shield, and chemical resistant clothing such as a rubber apron when splashing is likely. Wash immediately if skin is contacted. Remove contaminated clothing promptly and launder before reuse. Clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly after handling.

ATTENTION! Repeated or prolonged skin contact may cause chloracne in some people.

Respiratory Protection: Avoid breathing vapor, mist, or dust. Use NIOSH/MSHA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended when airborne exposure limits are exceeded and, if used, replaces the need for face shield and/or chemical splash goggles. Consult respirator manufacturer to determine the type of equipment for a given application. The respirator use limitations specified by NIOSH/MSHA or the manufacturer must be observed. High airborne concentrations may require use of self-contained breathing apparatus or supplied air respirator. Respiratory protection programs must be in compliance with 29 CFR Part 1910.134.

ATTENTION! Repeated or prolonged inhalation may cause chloracne in some people.

Ventilation: Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of vapor or mist, such as open process equipment.

Airborne Exposure Limits:

Product: Chlorodiphenyl (42% chlorine)

OSHA PEL:	1 mg/m^3 8-hour time-weighted average - Skin*
ACGIH TLV:	1 mg/m^3 8-hour time-weighted average - Skin*

Product: Chlorodiphenyl (54% chlorine)

OSHA PEL:	0.5 mg/m^3 8-hour time-weighted average - Skin*
ACGIH TLV:	0.5 mg/m^3 8-hour time-weighted average - Skin*

*For Skin notation see Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Government Industrial Hygienists, 1995-1996.

9. PHYSICAL AND CHEMICAL PROPERTIES

PROPERTIES OF SELECTED AROCLORS®

PROPERTY	1016	1221	1232	1242	1248	1254	1260
Color (APHA)	40	100	100	100	100	100	150
Physical state	mobile oil	mobile oil	mobile oil	mobile oil	mobile oil	viscous liquid	sticky resin
Stability	inert	inert	inert	inert	inert	inert	inert
Density (lb/gal 25°C)	11.40	9.85	10.55	11.50	12.04	12.82	13.50
Specific gravity x/15.5°C	1.36-1.37 x-25°	1.18-1.19 x-25°	1.27-1.28 x-25°	1.30-1.39 x-25°	1.40-1.41 x-65°	1.49-1.50 x-65°	1.55-1.56 x-90°
Distillation range (°C)	323-356	275-320	290-325	325-366	340-375	365-390	385-420
Acidity mg KOH/g, maximum	.010	.014	.014	.015	.010	.010	.014
Fire point (°C)	none to boiling point	176	238	none to boiling point	none to boiling point	none to boiling point	none to boiling point
Flash point (°C)	170	141-150	152-154	176-180	193-196	none	none
Vapor pressure (mm Hg @ 100°F)	NA	NA	0.005	0.001	0.00037	0.00006	NA
Viscosity (Saybolt Univ. Sec. @ 100°F) (centistokes)	71-81 13-16	38-41 3.6-4.6	44-51 5.5-7.7	82-92 16-19	185-240 42-52	1800-2500 390-540	— —

NA—*Not Available*

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

10. STABILITY AND REACTIVITY

Stability: PCBs are very stable, fire-resistant compounds.
Materials to Avoid: None
Hazardous Decomposition
Products: PCBs may decompose to form CO, CO_2, HCl, phenolics, aldehydes, and other toxic combustion products under severe conditions such as exposure to flame or hot surface.
Hazardous Polymerization: Does not occur.

11. TOXICOLOGICAL INFORMATION

Data from laboratory studies conducted by Monsanto and from the available scientific literature are summarized below.
Single exposure (acute) studies indicate:
Oral - Slightly Toxic (Rat LD50 - 8.65 g/kg for 42% chlorinated; 11.9 g/kg for 54% chlorinated)

The liquid products and their vapors are moderately irritating to eye tissues. Animal experiments of varying duration and at different air concentrations show that for similar exposure conditions, the 54% chlorinated material produces more liver injury than the 42% chlorinated material.

There are literature reports that PCBs can impair reproductive functions in monkeys. The National Cancer Institute (NCI) performed a study in 1977 using Aroclor 1254 with both sexes of rats. NCI stated that the PCB, Aroclor 1254, was not carcinogenic under the conditions of their bioassay. There is sufficient evidence in the scientific literature to conclude that Aroclor 1260 can cause liver cancer when fed to rodents at high doses. Similar experiments with less chlorinated PCB products have produced negative or equivocal results.

The consistent finding in animal studies is that PCBs produce liver injury following prolonged and repeated exposure by any route, if the exposure is of sufficient degree and duration. Liver injury is produced first, and by exposures that are less than those reported to cause cancer in rodents. Therefore, exposure by all routes should be kept sufficiently low to prevent liver injury.

Numerous epidemiological studies of humans, both occupationally exposed and nonworker environmentally exposed population, have not demonstrated any causal relationship between PCB exposure and chronic human illnesses such as cancer or neurological or cardiovascular effects. PCBs at high dosage can cause skin symptoms; however, these subside upon removal of the exposure source.

PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1987)-Group 2A and in the National Toxicology Program (NTP) Seventh Annual Report on Carcinogens.

12. ECOLOGICAL INFORMATION

Care should be taken to prevent entry of PCBs into the environment through spills, leakage, use, vaporization or disposal of liquid or solids. PCBs can accumulate in the environment and can adversely affect some animals and aquatic life. In general, PCBs have low solubility in water, are strongly bound to soils and sediments, and are slowly degraded by natural processes in the environment.

13. DISPOSAL CONSIDERATIONS

The disposal of PCB items or equipment (those containing 50 ppm or greater PCBs) and PCB wastes is strictly regulated by 40 CFR Part 761. For example, all wastes and residues containing PCBs (wiping cloths, absorbent material, used disposable protective gloves and clothing, etc.) should be collected, placed in proper containers, marked and disposed of in the manner prescribed by EPA regulations (40 CFR Part 761) and applicable state and local regulations.

14. TRANSPORT INFORMATION

The data provided in this section are for information only. Please apply the appropriate regulations to properly classify a shipment for transportation.

DOT Classification:	IF WEIGHT OF PCBs TO BE SHIPPED IS OVER ONE POUND, THE FOLLOWING CLASSIFICATION AND LABEL APPLY.
DOT Label:	LIQUID: Environmentally Hazardous Substance, liquid, n.o.s. (Contains PCB), 9, UN 3082, III SOLID: Environmentally Hazardous Substance, solid, n.o.s. (Contains PCB), 9, UN 3077, III
DOT Label:	Class: 9
DOT Reportable Quantity:	One Pound
IMO Classification:	Polychlorinated Biphenyls, IMO Class 9, UN 2315, II IMO Page 9034, EMS 6.1-02
IATA/ICAO Classification:	Polychlorinated Biphenyls, 9, UN2315, II

15. REGULATORY INFORMATION

For regulatory purposes, under the Toxic Substances Control Act, the term "PCBs" refers to a chemical substance limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contain such a substance (40 CFR Part 761).

TSCA Inventory: not listed.

Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370): Immediate, Delayed.
SARA Section 313 Toxic Chemical(s): Listed-1993 (De Minimis concentration 0.1%.)

Reportable Quantity (RQ) under DOT (49 CFR) and CERCLA Regulations: 1 lb. (polychlorinated biphenyls) PCBs.

Release of more than 1 (one) pound of PCBs to the environment requires notification to the National Response Center (800-424-8802 or 202-426-2675).

Various state and local regulations may require immediate reporting of PCB spills and may also define spill cleanup levels. Consult your attorney or appropriate regulatory officials for information relating to spill reporting and spill cleanup.

16. OTHER INFORMATION

Reason for revision: Conversion to the 16 section format. Supersedes MSDS dated 10/88.

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Pyranol® is a registered trademark of General Electric Company
Inerteen® is a registered trademark of Westinghouse Electric Corporation

FOR ADDITIONAL NONEMERGENCY INFORMATION, CONTACT:

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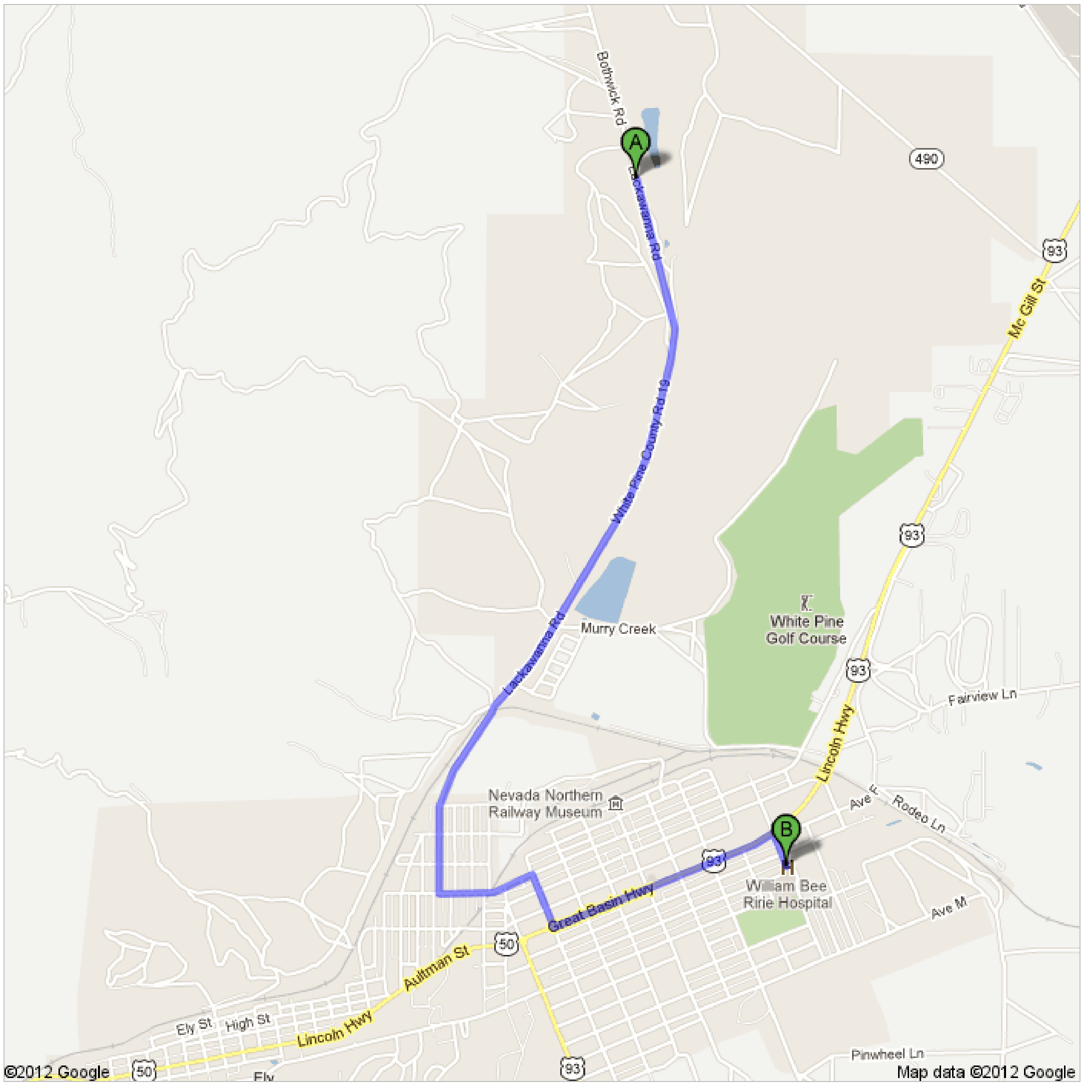
APPENDIX C

Route to Nearest Medial Assistance

Directions to 1500 Ave H, Ely, NV 89301
3.6 mi – about **12 mins**
Directions from Lackawanna Mill Site to William Bee Ririe Hospital



A	Bothwick Rd/Lackawanna Rd	
	1. Head **south** on **Bothwick Rd/Lackawanna Rd** Continue to follow Lackawanna Rd About 5 mins	go 2.1 mi total 2.1 mi
	2. Continue onto **Ogden Ave** About 1 min	go 0.3 mi total 2.3 mi
↰	3. Turn left onto **North St** About 1 min	go 0.2 mi total 2.5 mi
	4. Continue onto **Ave C**	go 456 ft total 2.6 mi
↱	5. Turn right onto **E 8th St** About 1 min	go 0.2 mi total 2.8 mi
↰	6. Turn left onto **Aultman St** About 3 mins	go 0.7 mi total 3.5 mi
↱	7. Turn right onto **E 15th St** Destination will be on the left	go 0.1 mi total 3.6 mi
B	1500 Ave H, Ely, NV 89301	