

**Cordero Mercury Mine Site  
Removal Assessment of Two  
Roadway Areas**

**Sampling and Analysis Plan**

**Contract: EP-S5-08-01  
TDD No.: TO2-09-10-06-0002  
Job No.: 002693.2094.01RA**

**August 26, 2010**

**Prepared for:**

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
Emergency Response Section  
Region IX**

**Prepared by:**

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**Superfund Technical Assessment and Response Team**

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# List of Abbreviations and Acronyms

ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
COPC	contaminant of potential concern
DQO	Data Quality Objective
DQI	Data Quality Indicator
E & E	Ecology and Environment, Inc.
ERT	U.S. EPA Emergency Response Team
FOSC	Federal On-Scene Coordinator
GPS	Global Positioning System
IDW	investigation-derived waste
LCS	laboratory control sample
MS/MSD	matrix spike/matrix spike duplicate
PM	Project Manager
PPE	personal protective equipment
PSIR	Paiute Shoshone Indian Reservation
QA	Quality Assurance
QC	Quality Control
RPD	relative percent difference
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan

## List of Abbreviations and Acronyms (cont.)

SOP	standard operating procedure
START	Superfund Technical Assessment and Response Team
mg/kg	milligrams per kilogram
U.S. EPA	United States Environmental Protection Agency

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# 1

## Introduction

The United States Environmental Protection Agency (U.S. EPA) directed Ecology and Environment, Inc.'s (E & E's) Superfund Technical Assessment and Response Team (START) to prepare objectives and a Sampling and Analysis Plan (SAP) for a removal assessment of the Cordero Mine Site in Fort McDermitt, Nevada. These planning activities are in response to a coordinated effort between the U.S. EPA Superfund Division, through Federal On-Scene Coordinator (FOSC) Tom Dunkelman, and the Paiute Shoshone Indian Reservation (PSIR).

The site consists of two non-contiguous locations: one location (Area of Concern No. 1, AOC-1) is a dirt road approximately 1,630 feet long by 30 feet wide, located between the Paiute-Shoshone Indian Reservation administration offices and their municipal waste transfer facility; the other location (AOC-2) is a privately-owned driveway to a residence, 150 feet long by 30 feet wide, located adjacent to South Road approximately 0.5 miles east of State Highway 95 (Figure 1). The roadways are suspected of being constructed using waste rock from the Cordero Mercury Mine, located approximately eight miles to the southwest of Fort McDermitt. Mining operations occurred at the Cordero Mine between 1935 and the 1980s. The site was originally brought to the attention of the U.S. EPA by Mr. Duane Masters, Sr., the Paiute Shoshone Tribal Environmental Coordinator who reported that the two roadways were built using mine waste in approximately 1970. During a December 2009 site reconnaissance, U.S. EPA personnel conducted screening-level in-situ X-Ray Fluorescence (XRF) analysis of soil on the surface of AOC-1 and detected a maximum concentration of mercury of 60 milligrams per kilogram (mg/kg).

The specific field sampling and chemical analysis information in this SAP was prepared in accordance with the following U.S. EPA documents: EPA Requirements for Quality Assurance Project Plans (U.S. EPA QA/R 5, March 2001, U.S. EPA/240/B 01/003); Guidance for the Data Quality Objectives Process (U.S. EPA QA/G 4, February 2006, U.S. EPA/240/R 02/009); Guidance on Choosing a Sampling Design for Environmental Data Collection (U.S. EPA QA/G 5S, December 2002, U.S. EPA/240/R 02/005); and Uniform Federal Policy for Implementing Environmental Quality System (U.S. EPA/505/F-03/001, March 2005).

The scope of work outlined in this SAP is based on discussions with the U.S. EPA, the PSIR, and the START.

This SAP describes the project and data use objectives, data collection rationale, quality assurance goals, and requirements for sampling and analysis activities. It also defines the sampling and data collection methods that will be used for this project. This SAP is intended to reflect accurately the planned data-gathering activities for this investigation; however, site conditions, budget, and additional agency direction may warrant modifications. All significant changes are to be documented in site records.

## **1.1 Project Organization**

The following is a list of project personnel and their responsibilities:

**U.S. EPA Federal On-Scene Coordinator (FOSC)** – The U.S. EPA FOSC is Tom Dunkelman. Mr. Dunkelman is the primary decision-maker and will direct the project, specify tasks, and ensure that the project is proceeding on schedule and is within budget. Additional duties include gaining access to the site, coordination of communication with the START Project Manager (PM), the U.S. EPA Quality Assurance (QA) Office, and the PSIR.

**Project Manager (PM)** – Mr. Brian Milton of the START is the PM for the project. The PM is responsible for the following: implementing the SAP; coordination of project tasks; coordination of field sampling; project management; and, completion of all preliminary and final reporting.

**Principal Data Users** – Data generated during the implementation of this SAP will be utilized by the FOSC to make decisions regarding remediation and/or removal activities needed at the site.

**START Quality Assurance (QA) Coordinator** – Mr. Howard Edwards is the START QA Coordinator and a project team member. The QA Coordinator is responsible for the performance of tasks assigned by the START PM. Specifically, Mr. Edwards is responsible for: the documentation of initial project objectives; preparation of this SAP; and, coordinating plan-related activities with the U.S. EPA.

**Sample Analysis and Laboratory Support** – A START subcontracted laboratory or the U.S. EPA Region 9 Laboratory will be utilized for analysis of contaminant of potential concern (COPC). START will be responsible for data validation activities.

## **1.2 Distribution List**

Copies of the final SAP will be distributed to the following persons and organizations:

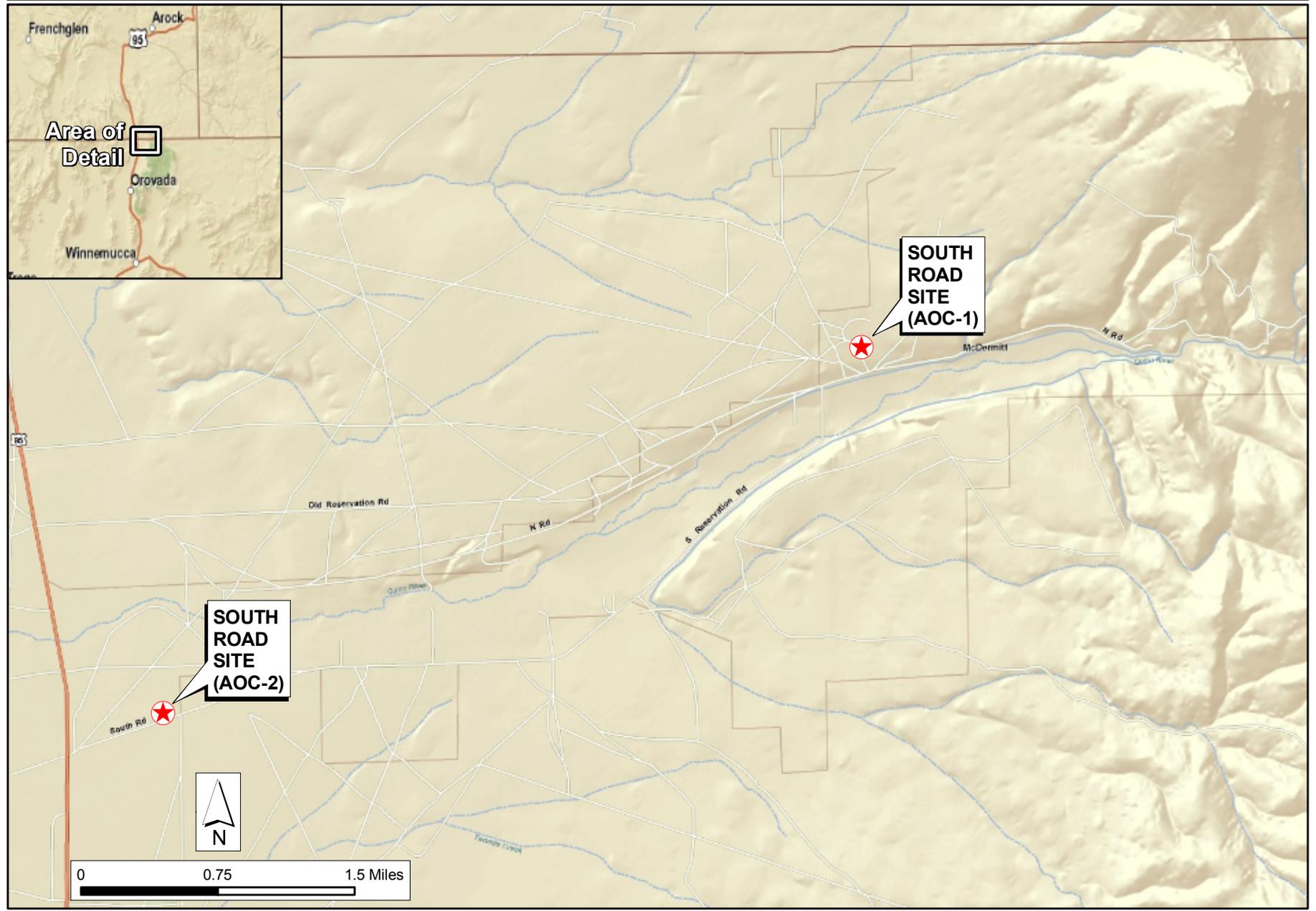
- Tom Dunkelman, U.S. EPA Region IX
- E & E START Field Team
- Ecology and Environment, Inc., files
- Duane Masters, Sr., PSIR

## **1.3 Statement of the Specific Problem**

The site is located in the Paiute-Shoshone Indian Reservation in Fort McDermitt, Humboldt County, Nevada. The site consists of two locations: a public dirt road and a privately owned residential driveway. The public road, which connects the Paiute Shoshone Indian Reservation administration office with their municipal landfill, is located approximately 5.2 miles east-southeast of Fort McDermitt, and 10.5 miles east from the Cordero Mercury Mine. The driveway is located on South Road, approximately 0.5 miles west of Highway 95 and 11 miles south of Fort McDermitt.

It is suspected that mercury-contaminated waste rock from the Cordero Mine was utilized in the construction of the road and the driveway. Both the road and the driveway are regularly used and there is a concern that mercury -laden dust particles and/or mercury vapor could be present at concentrations above those protective of human health and the environment. No laboratory sampling data exists for the site.

The assessment recommendations for this project are based on stated U.S. EPA objectives and available site information. The results of the investigation may be used to evaluate the extent of soil contamination to determine whether further assessment and/or remedial actions (e.g., soil removal or paving) are necessary.



**Figure 1**  
**Site Vicinity Map**  
**Cordero Mercury Mine Site**  
**Roadway Assessment**  
**McDermitt, NV 89421**

# 2

## Background

### 2.1 Location

The public road (AOC-1) is located at 111 North Street; the private driveway (AOC-2) is located on South Road, approximately 0.5 miles east of State Highway 95; on the Paiute Shoshone Indian Reservation, Fort McDermitt, Humboldt County, Nevada. AOC-1 is bounded to the west by vacant land, to the east by one structure and a water tower. AOC-2 is bordered to the west by the residence, to the south by South Road, and by vacant land to the east and north. The geographic coordinates of the approximate center of AOC-1 are latitude 41.972753° north and longitude 117.622236° west and for AOC-2 are latitude 41.945978° north and longitude 117.697672° west.

### 2.2 Site Description

AOC-1 is approximately 1,630 feet long by 30 feet wide (48,900 square feet) and AOC-2 is approximately 150 feet long by 30 feet wide (4,500 square feet). The combined surface area of the AOCs is approximately 53,400 square feet. Neither the driveway nor the road are gated or fenced. Figures 2-1a and 2-1b show the respective site features.

### 2.3 Topographic and Geologic Information

The elevation of the site is approximately 4,700 feet above sea level. According to the United States Department of Agriculture (USDA) soil survey, the site is underlain by several types of soil, with a 0-4% slope toward the west. The soil profile contains Chiara and similar soils (40%), Dacker and similar soils (30%), and Mcconnel and similar soils (10%). These three soil types generally consist of very fine sandy loam between the surface and 7 inches below ground surface (bgs), sandy and silty clay loam between 7 and 18 inches bgs, and gravelly loam between the 18 and 22 inches bgs. Soil below 22 inches bgs is considered indurated (USDA, 2010).

### 2.4 Site History

According to a representative of the PSIR, the two roadways were constructed using mine waste in approximately 1970. At the time this SAP was prepared there was no additional information available on the nature of the construction or the materials used.

**2.5 Previous Investigations and Regulatory Involvement**

In December 2009, FOOSC Tom Dunkelman and Carl Brickner, a U.S. EPA Site Assessment Manager, conducted a site reconnaissance of the Cordero Mine and the public roadway connecting the PSIR administration office and their landfill. According to Mr. Dunkelman, an XRF was utilized to conduct in-situ field screening for mercury concentrations at three surface locations along AOC-1. The locations were not recorded on a Global Positioning System (GPS) device. Results from the XRF field screening indicated a maximum concentration of mercury of 60 mg/kg in the road (U.S. EPA 2009). At the time of the site reconnaissance, the U.S. EPA was not informed by the PSIR that the private driveway was also constructed using mine waste. Therefore, the driveway was not assessed during the site reconnaissance.

Additionally, a CERCLA Site Inspection (SI) Report was conducted for the Cordero Mine by ICF Technology Incorporated in August 1988. The SI indicated several sources of waste rock at the mine site; however, the SI does not indicate that any of the waste rock was utilized in the construction of the roadways (ICF 1988). The Cordero Mine is located approximately 10 miles southwest of AOC-1 and 6 miles southwest of AOC-2.



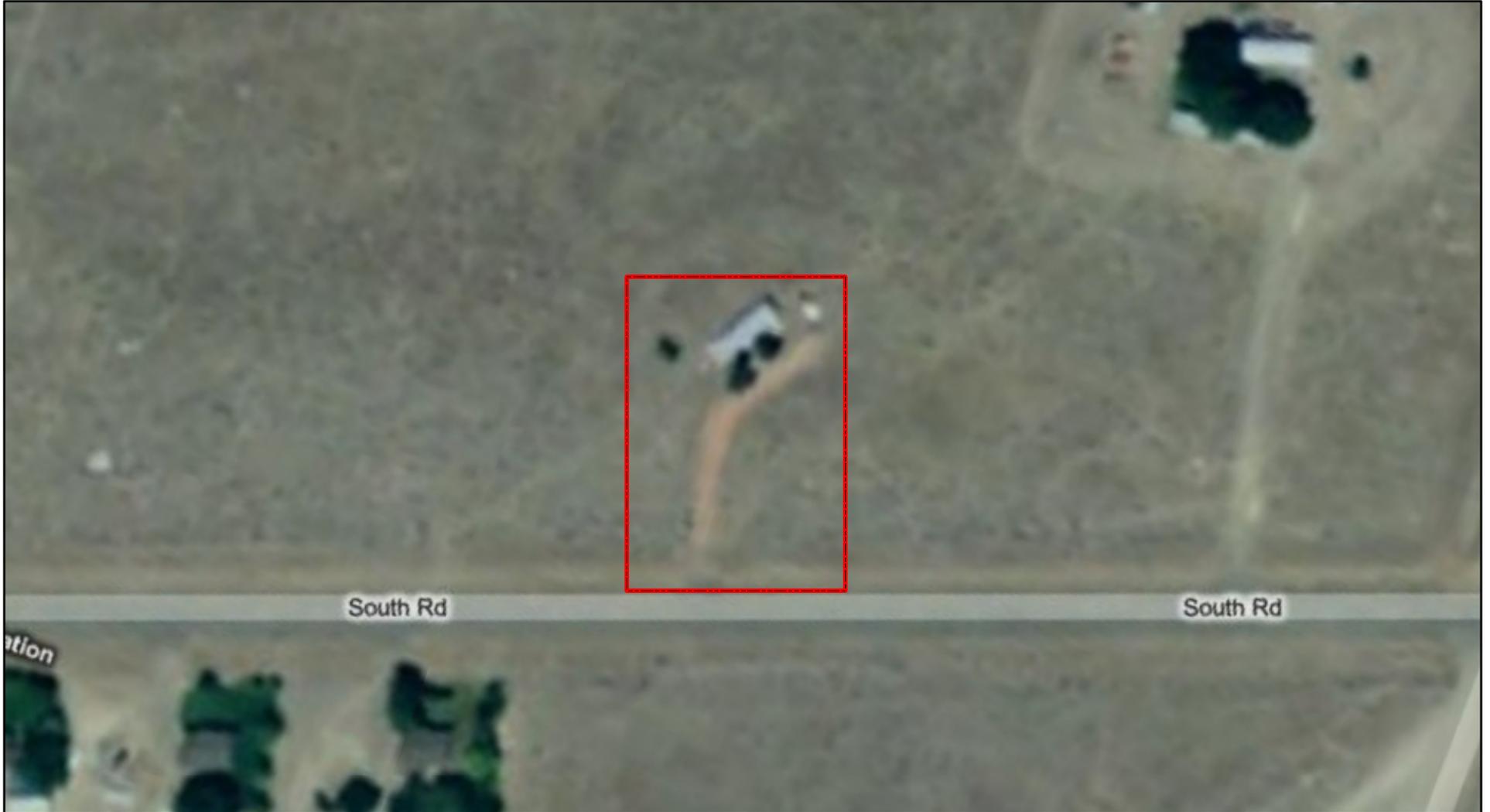
**LEGEND**

 Site boundary



0 300 600 Feet  


**Figure 2-1a**  
**Site Location Map - AOC-1**  
**Cordero Mercury Mine Site**  
**Roadway Assessment**  
**McDermitt, NV 89421**



**LEGEND**

 Site boundary



0 100 200 Feet

A horizontal scale bar with markings at 0, 100, and 200 feet.

**Figure 2-1b**  
**Site Location Map - AOC-2**  
**Cordero Mercury Mine Site**  
**Roadway Assessment**  
**McDermitt, NV 89421**

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# 3

## Project Objectives

### 3.1 Data Use Objectives

The data generated by implementing this SAP will be used to evaluate the environmental conditions on the subject properties and to estimate the extent of roadbed soil that may require removal or remediation. In general, sampling results will be reviewed to identify areas above relevant action levels.

### 3.2 Project Task/Sampling Objectives

The U.S. EPA directed the START to prepare this SAP to document mercury concentrations in AOCs at the site.

Soil sampling and analysis of mercury vapors in ambient air and emanating from soil in the roadways will be performed to accomplish the project objectives. Specific sampling objectives include the following:

- Determine the concentration of mercury in soil in the roadways.
- Determine the mercury concentration distributions and the estimated volume of contaminated soil that potentially need to be removed or remediated.
- Determine whether mercury vapors are currently emanating from the roadways and are present in ambient air in the breathing zone above the roadway at concentrations above the proposed action levels
- Determine whether mercury vapors have the potential to emanate from disturbed soil in the roadways at concentrations above the proposed action levels.

### 3.3 Proposed Action Levels

The proposed site action levels are based on human health threats and exposures resulting from mercury migration from the mine waste material. The action levels for this assessment were developed to identify the maximum concentrations of mercury at the site that would not be expected to adversely affect human health or the environment above acceptable risk levels, using conservative assumptions.

### 3. Project Objectives

The proposed site-specific action levels for soil assessment are 310 mg/kg for AOC 1, and 230 mg/kg for AOC-2, which are the U.S. EPA Regional Screening Levels (RSLs) for inorganic mercury in industrial and residential soils, respectively.

The proposed site-specific action levels for mercury vapors are 1,000 nanograms per cubic meter ( $\text{ng}/\text{m}^3$ ) in ambient air in the breathing zone above each AOC, and 10,000  $\text{ng}/\text{m}^3$  in vapors emanating directly from soil. The first (1,000  $\text{ng}/\text{m}^3$ ) is the Agency for Toxic Substances and Disease Registry's (ATSDR's) recommended maximum concentration for mercury vapor in ambient air in a residential scenario, and the second (10,000  $\text{ng}/\text{m}^3$ ) is the ATSDR's recommended maximum concentration for mercury vapor emanating directly from an object (ATSDR 1999).

The following benchmarks were considered prior to establishment of the site-specific action levels:

- U.S. EPA RSLs for Residential Soil, December 2009
- U.S. EPA RSLs for Industrial Soil, December 2009
- ATSDR Screening level for mercury vapor in residential air. The action levels for mercury vapor provided in this SAP are based on data available in ATSDR's *Toxicological Profile for Mercury (1999)*, *Hazardous Substance Databank of the Toxicology Data Network at the National Library of Medicine*, and data collected by the U.S. EPA

The U.S. EPA RSLs are risk-based concentrations that combine current U.S. EPA human health toxicity values with standard exposure factors and acceptable excess cancer risk levels to estimate contaminant concentrations in environmental media (soil, air, and water) that are considered protective of humans, including sensitive groups, over a designated length of exposure. The length of exposure is typically 24 hours a day for 30 years for residential scenarios, and 8 hours a day for 30 years for industrial scenarios. Chemical concentrations above these levels do not automatically designate a site as contaminated or trigger a response action; however, exceeding the RSLs suggests that, at a minimum, further evaluation of the potential risks that may be posed by site contaminants is appropriate.

<b>Table 3-1 Benchmarks and Data Quality Indicator Goals - Definitive Data for EPA Method 7471A</b> <b>Cordero Mercury Mine Site</b> <b>Humboldt County, Nevada</b>							
E & E Project No. 002693.2094.01RA				TDD No. TO2-09-10-06-0002			
Chemical of Potential Concern	Upper Estimated Regional Background Concentration	Site-Specific Action Levels for Assessment	U. S. EPA RSL (mg/kg)	Practical Quantifiable Reporting Limits	Accuracy (% Recovery for MS/ MSD)	Precision (RPD from MS/MSD and Duplicates)	Percent Completeness
Mercury in Soil from AOC-1	Unknown	310 <sup>1</sup> (mg/kg)	310 <sup>1</sup> (mg/kg)	0.15 mg/kg SW-846 Method 7471A	75 - 135	<35%	> 90%
Mercury in Soil from AOC-2	Unknown	230 <sup>2</sup> (mg/kg)	230 <sup>2</sup> (mg/kg)	0.15 mg/kg SW-846 Method 7471A	75 - 135	<35%	> 90%
Notes: mg/kg = milligrams per kilogram RSL = U.S. EPA Regional Screening Level (December 2009) MS/MSD = Matrix Spike/Matrix Spike Duplicate RPD = Relative Percent Difference 1 U.S. EPA RSL for inorganic mercury in soil in an industrial scenario 2 U.S. EPA RSL for inorganic mercury in soil in an residential scenario							
2010 ecology & environment, inc.							

<b>Table 3-2 Benchmarks and Data Quality Indicator Goals - Non-Definitive Data for Mercury Vapor Concentrations Using Lumex® Model 915 Mercury Vapor Analyzer Cordero Mercury Mine Site Humboldt County, Nevada</b>					
E & E Project No. 002693.2094.01RA			TDD No. TO2-09-10-06-0002		
Chemical of Potential Concern	Upper Estimated Regional Background Concentration (mg/kg)	Site-Specific Action Level for Assessment (mg/kg) <sup>1</sup>	Lumex® Model 915 Mercury Vapor Analyzer MDL (ng/m <sup>3</sup> )	Precision (RPD from Duplicates)	Percent Completeness
Mercury Vapor in Ambient Air in AOC-1	Unknown	1,000 (ng/m <sup>3</sup> )	2 ng/m <sup>3</sup>	<35%	>90%
Mercury Vapor in Ambient Air in AOC-2	Unknown	1,000 (ng/m <sup>3</sup> )	2 ng/m <sup>3</sup>	<35%	>90%
Mercury Vapor from Soil in AOC-1	Unknown	10,000 (ng/m <sup>3</sup> )	2 ng/m <sup>3</sup>	<35%	>90%
Mercury Vapor from Soil in AOC-2	Unknown	10,000 (ng/m <sup>3</sup> )	2 ng/m <sup>3</sup>	<35%	>90%
Notes: mg/kg = milligrams per kilogram RPD = Relative Percent Difference MDL = Method Detection Limit 1. Based on ATSDR- recommended exposure limits , (ATSDR 1999)					

Potential threat and exposure concerns are as follows:

- Direct exposure of human and/or environmental receptors (e.g. invertebrates, mammals, reptiles, plants, migratory birds) to contaminants in soil.
- Excavation or grading of contaminated soil could result in exposure to contaminated soil for on-site workers and community members in the form of particulate matter (dust) and /or direct inhalation of mercury vapor from metallic mercury.

### **3.4 Decision Rules**

The U.S. EPA FOOSC will use the data to assess extent of contamination and evaluate the costs of site cleanup. The primary purpose of this investigation is to more completely determine the overall concentration of mercury contamination in soil in the roadways and to determine if vapors are, or have the potential to, emanate from the road at hazardous concentrations. Specific decision rules for soil data are as follows:

Specific decision rules for the site area data:

- If it is determined that the extent and distribution of the COPC in soil has been defined, then the information will be used to determine what, if anything, will need to be excavated or otherwise remediated.
- If it is resolved that the extent and distribution of the COPC in soil has not been defined, then additional investigation will likely be required during remedial or removal activities.
- If it is determined that the distribution of mercury vapor in ambient air at concentrations above the action level has been defined, that information will be used to determine what, if anything, needs to be done to abate potential health risks (e.g., removal, encapsulation).
- If it is determined that mercury vapor has the potential to emanate from the roadway at concentrations above the proposed action levels, the information will be used to determine what actions, if any will be performed to mitigate the hazard (e.g. engineering controls, removal, encapsulation, etc).

### **3.5 Data Quality Objectives**

#### **3.5.1 Data Quality Objective (DQO) Process**

The DQO process, as set forth in the U.S. EPA document, *Guidance for the Data Quality Objectives Process, U.S. EPA QA/G-4*, was followed to establish the data

quality objectives for this project. An outline of the process and the outputs for this project are included in Appendix A.

### **3.5.2 DQO Data Type**

Based upon the DQO process, this investigation will involve the generation of quantitatively and qualitatively definitive data for mercury in soil (between the surface and 1.5 feet bgs). The specific requirements for this data category are detailed in Section 9.0. Analytical methods approved by the U.S. EPA will be used to generate the analytical data used to support this project.

This investigation will also involve the generation of semi-quantitative, non-definitive field screening data to document mercury vapor concentrations.

### **3.5.3 Data Quality Indicators**

Data Quality Indicator (DQI) goals for this project were developed following guidelines in *U.S. EPA Guidance for Quality Assurance Project Plans* (U.S. EPA QA/G-5). All sampling procedures detailed in Section 6.2 and standard operating procedures (SOPs) in Appendix C will be followed to ensure representativeness of sample results by obtaining characteristic samples. Approved U.S. EPA methods and standard reporting limits will be used. All data not rejected will be considered complete. Tables 3-1 and 3-2 summarize the project's DQI goals for mercury.

## **3.6 Schedule of Sampling Activities**

The field sampling activities are scheduled to begin on September 13, 2010.

## **3.7 Special Training Requirements/Certifications**

Field sampling personnel should be trained and have experience with soil sampling at hazardous waste sites using respiratory protective equipment. One field sampler should be trained and familiar with GPS data collection. All field sampling personnel must have appropriate training that complies with 29 Code of Federal Regulations 1910.120. The site-specific health and safety plan approved by Ecology and Environment, Inc. management for this project is to be appended to this plan by project management (Appendix B).

Laboratories and laboratory personnel require specialized training, certification and experience. Project management must determine and verify requirements prior to use of a laboratory resource.

Data validation training requires specialized training and experience. Project management must determine and verify requirements prior to use of a data validation resource.

# 4

## Sampling Rationale and Design

The START reviewed information from the 1988 SI and the December 2009 site reconnaissance to determine past site activities and previously identified contaminants potentially still present at the site. This information was used to determine the most effective sampling design to meet project objectives within time and budgetary constraints. The planned sample locations are illustrated on Figure 4-1.

### 4.1 Sampling Design

#### 4.1.1 Surface and Subsurface Samples

A systematic sample design is the most appropriate sampling design that will meet the project objective. The systematic sampling will be divided into two approaches. The first approach will occur along the length of the public road (AOC-1). The sampling will begin at the west side of AOC-1 at the intersection with North Road. The latitude and longitude of each sample location will be recorded using the GPS technology. At each sample location, one sample will be collected from 0-0.5 feet bgs. In selected locations, samples will also be collected from 0.5-1.0 feet bgs and from 1.0-1.5 feet bgs. The decision on how many subsurface samples will be collected will be made by the FOOSC in the field based on observed changes in lithology and soil type. After collecting samples at the first location, the sample team will travel 200 feet north, record the GPS coordinates, and collect soil samples from the middle of the roadway. The sample team will travel 200 feet north to the east side of the roadway, record the GPS coordinates, and collect soil samples from the east side of the road. The sample team will then travel 200 feet and return to the middle of the road to collect the next set of samples. The back-and-forth pattern of soil sampling will extend the 1,630-foot length of the road. A total of nine location and from 9 to 27 unique soil samples will be collected at AOC-1 using this approach. Figure 4-1a of the SAP shows the approximate number and locations of the samples for this approach.

At each location, after collecting an aliquot for laboratory analysis, approximately 12 ounces of additional sample material will be placed in a sealed plastic baggie and mixed. The Lumex® 915 will be used to measure the mercury vapor concentration in ambient air between 3 feet and 5 feet from the ground, and in the

## **4. Sampling Rationale and Design**

headspace of each sample bag. Mercury vapor concentrations will be recorded in the field notebook.

The sampling approach at AOC-2 will be similar to that used at AOC-1; however the horizontal distance between each sample location will be 40 feet rather than 200 feet. The sample team will begin at the west side of the driveway at the intersection of South Road and continue the back-and-forth pattern, collecting samples at the surface and at selected depth intervals every 40 feet. A total of six location and from 6 to 18 samples will be collected using this approach. Proposed sample locations for this approach are presented in Figure 4-1b.

At each location, after collecting an aliquot for laboratory analysis, approximately 12 ounces of additional sample material will be placed in a sealed plastic baggie and mixed. The Lumex® 915 will be used to measure the mercury vapor concentration in ambient air between 3 feet and 5 feet from the ground, and in the headspace of each sample bag. Mercury vapor concentrations will be recorded in the field notebook.

Samples will be collected following the protocol described in section 6.2.

### **4.1.2 Background Samples**

To compare the concentrations of mercury in soil and ambient air from the two roadways, two background sample locations will be selected for each AOC. Locations of background samples will be determined by the sampling team in the field based on locations not expected to be impacted by the AOCs or the Cordero Mine site. Samples will be collected following the protocol described in section 6.2 of this SAP.



**LEGEND**

- Proposed sample location



0 300 600 Feet

A horizontal scale bar with three segments. The first segment is labeled '0', the second '300', and the third '600 Feet'.

**Figure 4-1a**  
**Proposed Sample Locations**  
**at AOC-1**  
**Cordero Mercury Mine Site**  
**Roadway Assessment**  
**McDermitt, NV 89421**



**LEGEND**

- Proposed sample location



0 100 200 Feet



**Figure 4-1b**  
**Proposed Sample Locations**  
**at AOC-2**  
**Cordero Mercury Mine Site**  
**Roadway Assessment**  
McDermitt, NV 89421



## **4.2 Analytes of Concern**

The only analytes of concern for this removal assessment is total mercury and elemental mercury as vapor. The site-specific action level for total mercury in soil is 310 mg/kg at AOC-1 and 230 mg/kg at AOC-2. The U.S. EPA Region IX Laboratory reporting limit is 0.15 mg/kg using Method 7471A.

The site-specific action level for total mercury vapor in ambient air is 1,000 ng/m<sup>3</sup> and is 10,000 ng/m<sup>3</sup> for mercury vapor in soil. The practical detection limit for mercury vapor using the Lumex 915 is 2 ng/m<sup>3</sup>.

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# 5

## Request for Analyses

Soil samples will be analyzed at the U.S. EPA Region 9 Laboratory in Richmond, California by U.S. EPA SW-846 Method 7471A for mercury. Water samples generated as equipment blanks or other QA/QC-related samples will be analyzed by EPA Method 7471A.

Soil vapor concentrations will be determined in the field using the field portable Lumex® 915.

### 5.1 Laboratory Analysis

All soil samples will be submitted to a laboratory for total mercury analysis using U. S. EPA Method 7471A.

Sample containers, preservatives, holding times, and estimated number of field samples, confirmation samples, and Quality Control (QC) samples are summarized in Table 5-1.

To provide analytical quality control for the analytical program, the following measures will be utilized:

- Additional sample volume will be collected for at least 5% of samples per each analytical method, to be utilized for matrix spike/matrix spike duplicate analysis.
- Nationally certified environmental laboratories will conduct all soil and water sample analyses.
- One laboratory blind duplicate sample will be collected for every ten samples of soil.
- An equipment blank for non-dedicated equipment will be collected for each day of sampling.

<b>Table 5-1 Analytical Summary For Soil Matrix Cordero Mine Site Assessment</b>		
E&E Project No.: 002693.2094.01RA		TDD No.: TO2-09-10-06-0002
<b>ANALYSES REQUESTED</b>		
ANALYTES TYPE	Mercury	Mercury Vapor
SPECIFIC ANALYSES REQUESTED	U.S. EPA Method 7471A	N/A
PRESERVATIVES	Chill with ice to 4°C	None
ANALYTICAL HOLDING TIME(S)	60 days	N/A
EXPECTED CONCENTRATION	Low-Medium	Low
Sample Area	4 oz. glass Jar	Real-time in Air or Collection Bag
Estimated number of samples per area/type		
Surface samples	15	
Subsurface samples	10-30	
Sub total environmental samples	25-45	
Background Samples	4-8	
Duplicates	4	
Equipment Blanks	2	
Total Number of Samples Submitted to Laboratory	29-59	
2010 ecology & environment, inc.		

# 6

## Field Methods and Procedures

### 6.1 Field Procedures

#### 6.1.1 Equipment

##### 6.1.1.1 Equipment Used

The equipment listed below may be utilized to obtain environmental samples in accordance with U.S. EPA Emergency Response Team (ERT) SOP #2012 for Soil Sampling or equivalent SOP. The ERT SOP is included in Appendix C.

The following is a partial list of equipment that is anticipated to come in contact with samples:

- Shovels, hand augers, trowels, scoops
- Paper or stainless steel buckets
- Glass sample containers
- Sealable plastic bags

##### 6.1.1.2 Equipment Maintenance

Field instrumentation for the collection of soil samples will be operated, calibrated, and maintained by the sampling team in accordance with the SOPs listed in Section 6.1.1.1 or their equivalent. Field instrumentation utilized for health and safety purposes will be operated, calibrated, and maintained by the sampling team according to the manufacturer's instruction. Calibration and field use data will be recorded in the instrument log books.

##### 6.1.1.3 Inspection/Acceptance Requirements for Supplies and Consumables

There are no project-specific inspection/acceptance criteria for supplies and consumables. It is standard operating procedure that personnel will not use broken or defective materials; items will not be used past their expiration date; supplies and consumables will be checked against order and packing slips to verify the

correct items were received; and the supplier will be notified of any missing or damaged items.

### **6.1.2 Field Notes**

#### **6.1.2.1 Logbooks**

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. A separate logbook will be maintained for each project. Logbooks are bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions. The following information will be recorded, if applicable, during the collection of each sample:

- Sample location and description
- Site sketch showing sample location
- Sampler's name(s)
- Date and time of sample collection
- Type of sample (matrix)
- Type of sampling equipment used
- Onsite measurement data (e.g., temperature, pH, conductivity)
- Field observations and details important to analysis or integrity of samples (rain, odors, etc.)
- Type(s) of preservation used
- Instrument reading (Lumex® 915 mercury vapor concentration) at each location and for each soil sample
- Shipping arrangements (air bill numbers)
- Receiving laboratory(ies)

In addition to sampling information, the following specifics may also be recorded in the field logbook for each day of sampling:

- Team members and their responsibilities

- Time of arrival on site and time of departure
- Other personnel on site
- A summary of any meetings or discussions with any potentially responsible parties, or representatives of any federal, state, or other regulatory agency
- Deviations from sampling plans, site safety plans, and SAP procedures
- Changes in personnel and responsibilities as well as reasons for the change
- Levels of safety protection
- Calibration information for equipment used on site
- Record of photographs

**6.1.2.2 Photographs**

Photographs will be taken at representative sampling locations and at other areas of interest on site. They will serve to verify information entered in the field logbook. When a photograph is taken, the following information will be written in the logbook or will be recorded in a separate field photography log:

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

**6.1.2.3 Electronic Sample Logging**

The sampling team may utilize field management software to prepare sample labels and chain-of-custody forms.

The following information should be entered for each sample after collection:

- Sample name
- Sample date and time
- Number of Sample bottles
- Type of Preservation
- Analyses

In addition to these items, the software may also be used to keep track of other information, such as sample depth, field measurements (e.g., pH), and split samples.

The field team will generate chain-of-custody forms for each cooler of samples packaged and sent to a laboratory. Each chain-of-custody form will refer to the shipping method and tracking number. Printed chain-of-custody forms will be submitted to the laboratory with the samples.

The use of this software will require that the field team has access to a computer, a printer, computer paper, and labels while in the field. Field team members will have received specific training in use of the software.

### **6.1.3 Field Measurements - Mapping**

Sample points and site features will be documented with a GPS unit. The GPS will be used to assign precise latitude and longitude positions to sample locations on the site. GPS mapping will be done by personnel trained in the use of the equipment and will be completed in accordance with the manufacturer's instructions. Expected output from the use of GPS mapping will be site maps with sample locations and major site features.

## **6.2 Sampling Procedures**

All sample locations will be recorded in the field logbook as sampling is completed. A sketch, if needed, of the sample location will be entered into the logbook and any physical reference points will be labeled. If possible, distances to reference points will be given.

### **6.2.1 Surface and Background Soil Sampling**

Surface soil samples will be collected from a depth of 0 to 0.5 feet bgs from the site utilizing a using a shovel, hand auger, and/or trowels.

The proposed surface soil sampling locations indicated in Section 4.1 and shown in Figures 4-1a and 4.1b will be followed to the extent practicable. Soil sampling locations will be recorded in the field logbook as sampling is completed. Sample locations will also be recorded using GPS.

Background soil samples will be collected from between the surface and 0.5 feet bgs. Sample locations will be determined by the START sampling team during the sampling event. Once sample locations are determined, locations will be recorded using GPS.

Surface and background soil samples will be placed in a sample-dedicated, stainless or glass container for homogenization (if needed). Samples will then be transferred from the bucket, with the trowel, to the appropriate sample containers (i.e. glass soil jar or plastic baggie. For the glass jars the sample containers will be

filled to the top, taking care not to allow soil to remain in the lid threads prior to being closed to prevent potential contaminant migration to or from the sample. As soon as they are filled, sample containers will be closed, chilled, and processed for shipment to the laboratory.

### **6.2.2 Subsurface Soil Sampling**

All samples will be collected in accordance with appropriate SOPs (Appendix C). The proposed sampling locations shown in Figures 4-1a and 4-1b will be followed to the extent practicable. Subsurface soil samples will be collected from an interval between a depth of 0.5 and 1.5 feet bgs as previously described. A hand auger will be used to collect soil cores. Samples will be collected at locations indicated in Section 4.1. Subsurface sampling locations will be recorded in the field logbook as sampling is completed. All boring locations will also be recorded using GPS technology.

Soil borings will be located in the same locations as the surface soil sampling locations described in section 4.1. Individual boring locations may be modified if refusal is encountered during augering, or to include visible areas of potential contamination (e.g., stained soils) or similar features that may indicate a potential location of hazardous substance disposal or spill.

Once soil has been removed from the auger it will be placed in a bucket or stainless steel bowl for homogenization (if necessary) as described in Section 6.2.1 above. The soil will be placed into jars as indicated in Table 5-1, labeled, and placed in a cooler chilled to 4°C for shipping. An additional aliquot will be placed into a plastic bag as described above.

### **6.2.2 Mercury Vapor Monitoring in Ambient Air**

For mercury vapor analysis of ambient air, the time, date, location, and observed concentration of each ambient air measurement will be recorded in the field logbook. Ambient air measurements will be made at each soil sampling location (including background locations) prior to disturbing any soil. Pertinent weather data will also be recorded (i.e. strong or variable winds, rain or snow, etc.) at the time of sampling.

For background ambient air mercury vapor concentrations, measurements will also be taken from an area upwind and downwind of each AOC.

### **6.2.3 Mercury Vapor Monitoring in Soil**

For analysis of mercury vapor in soil, approximately 12 ounces of soils will be collected into a sealed plastic bag each time a soil sample is collected for concurrent laboratory analysis by U.S. EOPA Method 7471A. The bag will be sealed and the soil will be mixed by hand-kneading. After approximately one minute of mixing, the sample inlet of the Lumex® 915 will be inserted into the

bag. To the extent possible, the opening will be sealed around the inlet. The vapor phase concentrations will be allowed to stabilize. The time, date, location, associated soil sample ID, sampler's initials and observed vapor-phase concentration will be recorded in the field logbook.

### **6.3 Decontamination Procedures**

All non-dedicated equipment that comes into contact with potentially contaminated soil will be decontaminated. Equipment will be decontaminated in a predesignated area on pallets, racks, or plastic sheeting, and clean equipment will be stored in an uncontaminated area. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur after each use of a piece of equipment. The non-dedicated equipment that will require decontamination includes the following: stainless steel buckets, hand augers, trowels and any other non-disposable tools that contact the sample.

Decontamination steps for the non-dedicated soil sampling equipment and accessories are as follows:

- Non-phosphate detergent and distilled-water wash using a brush to scrub solids from the surface
- Distilled water rinse
- Air dry

Rinsate blanks will be used to confirm the adequacy of the decontamination procedures.

# 7

## Disposal of Investigation-Derived Waste

In the process of collecting environmental samples at this site, several different types of potentially contaminated investigation-derived wastes (IDW) will be generated, including the following:

- Used personal protective equipment (PPE)
- Disposable sampling equipment
- Decontamination fluids
- Excess soil cuttings

The U.S. EPA's National Contingency Plan requires that management of IDW generated during site investigations comply with all relevant or appropriate requirements to the extent practicable. This sampling plan will follow the U.S. EPA Office of Emergency and Remedial Response Directive 9345.3-02 (May 1991), which provides the guidance for management of IDW during site investigations. Listed below are the procedures that will be followed for handling IDW. The procedures are flexible enough to allow the site investigation team to use its professional judgment on the proper method for the disposal of each type of IDW generated at each sampling location.

Used PPE and disposable sampling equipment will be double bagged in plastic trash bags and disposed of in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any PPE or dedicated equipment that is to be disposed of that can still be reused will be rendered inoperable before disposal.

Decontamination fluids will consist of water that potentially has residual contaminants and/or non-phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the property by releasing onto the ground.

The volume of unused core/soil cuttings from sampling is expected to be minor. All unused soil will be returned to the area from which they were obtained.

# 8

## Sample Identification, Documentation, and Shipment

### 8.1 Sample Nomenclature

#### Boreholes

A unique, identifiable name will be assigned to each borehole location. The prefix will be “COR” for location, followed by a sequential location number that starts at “01.”

#### Soil Samples

A unique, identifiable name will be assigned to each soil sampling location. All soil samples taken from boreholes at the site will use the borehole location name “COR” as a prefix. The prefix is followed by a hyphen, then either “01” for the surface soil sample collected from 0-0.5 feet bgs, “02” for a borehole subsurface soil sample collected from 0.5-1.0 feet bgs, or “03” for a borehole subsurface soil sample collected from 1.0-1.5 feet bgs, etc. (e.g., COR-02-01, COR-02-02, or COR-02-03). Duplicate samples will use the prefix “COR”, followed by a hyphen, then the borehole number, followed by a hyphen, and then ‘10’ to indicate duplicate, followed by the depth indicator (e.g., COR-04-1003). Background samples will use the prefix ‘BKGD’ followed by a hyphen, followed by the depth indicator (e.g., BKGD-02). Matrix spike and matrix spike duplicate samples will be labeled with “MS/MSD” at the end of the sample identification (e.g., COR-09-01-MS/MSD). Equipment rinsate samples will be labeled with the same name as that of the sample that the equipment was used to collect, except that the letters “EB” will be added to the sample name. For example, when collecting equipment decontamination rinsate after sample COR-04-03, this equipment blank would be labeled COR-04-03-EB.

### 8.2 Container Preservation and Holding Time Requirements

All sample containers used will have been delivered to the field team in a pre-cleaned condition. Container preservation and holding time requirements are summarized in Table 5-1 and Section 5.1.

## **8. Sample Identification, Documentation, and Shipment**

### **8.3 Sample Labeling, Packaging, and Shipping**

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. Sample labels will be affixed to the sample containers and secured with clear tape. Samples will have pre-assigned, identifiable and unique numbers in accordance with Section 8.1. The sample labels will contain the following information where appropriate:

- Sample number
- Date and time of collection
- Site name
- Analytical parameter and method of preservation

Soil samples will be stored on ice in a secure location onsite pending shipment to the analytical laboratory. Sample coolers will be retained in the custody of site personnel at all times or secured so as to deny access to anyone else. The procedures for shipping samples are as follows:

- Ice in plastic bags or Blue Ice
- The drain plug of the cooler will be taped shut to prevent leakage.
- The bottom of the cooler will be lined with bubble wrap to prevent breakage during shipment.
- Screw caps will be checked for tightness.
- All glass sample containers will be wrapped in bubble wrap.
- All containers containing a water sample will be sealed in resealable plastic bags.

Samples will be placed in coolers with the appropriate chain-of-custody document. All forms will be enclosed in plastic bags and affixed to the underside of the cooler lid. Bags of ice will be placed on top of and around samples. Empty space in the cooler will be filled with bubble wrap or styrofoam peanuts to prevent movement and breakage during shipment. Each ice chest will be securely taped shut with strapping tape, and custody seals will be affixed to the front and back of each cooler.

## **8. Sample Identification, Documentation, and Shipment**

Samples will be shipped for immediate delivery to the selected laboratory(ies). The laboratory will be provided with the following information by phone, fax or e-mail once the samples are en route:

- Sampling contractor's name
- The name of the site
- Case number
- Shipment date and expected delivery date
- Total number of samples by matrix, and relative level of contamination (i.e., low, medium, or high)
- Carrier, air bill number(s), and method of shipment (e.g., priority)
- Irregularities or anticipated problems associated with the samples
- Whether additional samples will be sent, or if this is the last shipment

### **8.4 Chain-of-Custody Forms and QA/QC Summary Forms**

A chain-of-custody form will be maintained for all samples to be submitted for analysis, from the time the sample is collected until its final deposition. Every transfer of custody must be noted and a signature affixed. Corrections on sample paperwork will be made by drawing a single line through the mistake and initialing and dating the change. The correct information will be entered above, below, or after the mistake. When samples are not under the direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. The chain-of- custody form must include the following:

- Sample identification numbers
- Identification of sample to be used for Matrix Spike/ Matrix Spike Duplicate (MS/MSD) purposes
- Site name
- Sample date
- Number and volume of sample containers
- Required analyses



## **8. Sample Identification, Documentation, and Shipment**

- Signature and name of samplers
- Signature(s) of any individual(s) with control over samples
- Note(s) indicating special holding times and/or detection limits

The chain-of-custody form will be completed and sent with the samples for each laboratory and each shipment. Each sample cooler should contain a chain-of-custody form for all samples within the sample cooler.

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# 9

## Quality Assurance and Control (QA/QC)

### 9.1 Field Quality Control Samples

The QA/QC samples described in the following subsections, which are also listed in Table 5-1, will be collected during this investigation.

#### 9.1.1 Assessment of Field Contamination (Blanks)

##### 9.1.1.1 Equipment Blank Samples

Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring deionized water over the decontaminated sampling equipment. At least one equipment blank will be collected to document decontamination of non-dedicated soil sampling equipment. One equipment blank will be collected for each day soil sampling occurs. The equipment blanks will be analyzed for the same COPC as the samples collected using the same type of equipment.

The blanks will be preserved, packaged, and sealed in the manner described for the environmental samples.

##### 9.1.1.2 Temperature Blanks

For each cooler that is shipped or transported to an analytical laboratory, a container filled with organic-free water will be included that is marked “temperature blank.” This blank will be used by the sample custodian to check the temperature of samples upon receipt.

#### 9.1.2 Assessment of Sample Variability (Field Duplicate or Co-located Samples)

Duplicate soil samples will be collected at sample locations determined in the field. Due to the lack of information on the site, these locations will be assigned arbitrarily and may be changed in the field based on field observations indicating locations where detectable levels of the COPC are expected to be present. Duplicate samples are assigned at a rate of one for every ten field samples.

### 9.2 Background Samples

At least two background soil samples will be collected at each AOC using the methods described in Section 6.2. The samples will be analyzed for mercury using

## 9. Quality Assurance and Control (QA/QC)

U. S. EPA Method 7471A. The locations will be determined in the field during sampling activities and will be collected from areas not expected to have been impacted by COCs from either the AOCs or the Cordero Mine site. Sample results will be compared to results collected from soil at proposed soil boring locations.

### 9.3 Laboratory Quality Control Samples

The use of matrix spike and matrix spike duplicate (MS/MSD) is a requirement for EPA Method 7471A. One blind MS/MSD sample will be used as laboratory QC samples for analysis. The sample will be chosen at random during the sampling activities at the site. Extra sample material will be submitted as necessary.

### 9.4 Analytical and Data Package Requirements

It is required that all samples be analyzed in accordance with the methods listed in Table 5-1. The laboratory is required to supply documentation to demonstrate that their data meet the requirements specified in the method. Preliminary laboratory data are requested within 21 to 35 days after submission of samples. A full, validated data package is requested within 30 days of the submission of samples to the laboratories. The package requirement will conform to the requirements described in U.S. EPA Region IX document: Laboratory Documentation Requirements for Data Evaluation, R9QA/004.1, March 2001.

The data validation package shall include all original documentation generated in support of this project. In addition, the laboratory will provide original documentation to support that all requirements of the methods have been met. This includes, but is not limited to, custody records, shipping information, sample preparation/extraction records, and instrument printouts such as mass spectra. Standard preparation logs should also be included in the packages, including certificates of analysis for stock standards. Copies of information and documentation required in this document are acceptable. The following deliverables are required. Note that the following data requirements are included to specify and emphasize general documentation requirements and are not intended to supersede or change requirements of each method.

- A copy of the chain-of-custody, sample log-in records, and a case narrative describing the analyses and methods used
- Analytical data (results) up to three significant figures for all samples, method blanks, MS/MSD, Laboratory Control Samples (LCS), duplicates, Performance Evaluation (PE) samples, and field QC samples.
- QC summary sheets—forms that summarize the following:
  1. MS/MSD/LCS recovery summary
  2. Method/preparation blank summary

## 9. Quality Assurance and Control (QA/QC)

3. Initial and continuing calibration summary (including retention time windows)
  4. Sample holding time and analytical sequence (i.e., extraction and analysis)
  5. Calibration curves and correlation coefficients
  6. Duplicate summary
  7. Detection limit information
- Analyst bench records describing dilution, weighing of samples, percent moisture (solids), sample size, sample extraction and cleanup, final extract volumes and amount injected.
  - Detailed explanation of the quantitation and identification procedure used for specific analyses, giving examples of calculations from the raw data.
  - The final deliverable report will consist of sequentially numbered pages.
  - Internal/surrogate recoveries
  - Gas Chromatograph/Mass Spectrometer (GC/MS) tuning conditions.
  - Reconstructed ion current chromatogram and quantitation reports for all sample standards, blanks, MS/MSD, and PE samples.
  - For every compound identified and each field sample, provide raw versus enhanced spectra and enhanced versus reference spectra.
  - For target analytes, the reference spectrum shall be the check standard for that sample. For TICs, the reference mass spectrum shall be the best fit spectrum from a search of the spectral library.
  - Confirmation analysis data - second column confirmation required for all TICs. Provide all associated raw data and summary sheets for the confirmation analyses.

### 9.5 Data Validation

A laboratory independent reviewer, following U.S. EPA's Region IX Superfund Data Evaluation/Validation Guidance R9QA/006.1 for Tier 2 evaluation, will perform the validation and evaluation of analytical data generated by the analytical laboratories. The evaluation Tier 2 will be performed on 100% of the generated data. The data validator will follow qualification guidelines stated in the National Functional Guidelines procedures for Data Validation.

This procedure follows guidelines derived from:

## 9. Quality Assurance and Control (QA/QC)

- U.S. EPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review, (U.S. EPA 540/R-99-008, October 1999) or U.S. EPA CLP National Functional Guidelines for Inorganic Data Review, (U.S. EPA 540/R-94/013, February 1994).
- Quality Assurance/Quality Control Guidance for Removal Activities, Sampling QA/QC Plan and Data Validation Procedures (U.S. EPA/540/G-90/004, OSWER Directive 9360.4-01, dated April 1990).

If during or after the evaluation of the project's analytical data it is found that the data contains excess quality assurance/quality control problems or if the data do not meet the DQI goals, then the independent reviewer may determine that additional data evaluation is necessary.

### 9.6 Field Variances

As conditions in the field may vary, it may become necessary to implement minor modifications to this plan. Modifications to the original plan will be documented in the final report.

### 9.7 Assessment of Project Activities

#### 9.7.1 Assessment Activities

The project manager will ensure all project deliverables (Data Summaries, Data Validation Reports, Investigation Report) are peer-reviewed prior to release to the U.S. EPA. In time-critical situations, the peer review may be concurrent with the release of a draft document to the U.S. EPA. Errors discovered by the reviewer during the peer review process will be reported to the originator of the document, who will be responsible for corrective action.

#### 9.7.2 Project Status Reports to Management

The START will report to the U.S. EPA any issues that arise during the course of the project that could affect: data quality; data use objectives; the project objectives; or, project schedules.

#### 9.7.4 Reconciliation of Data with DQOs

Assessment of data quality is an ongoing activity throughout all phases of a project. The following outlines the methods to be used for evaluating the results obtained from the project.

- Review of the DQO outputs and the sampling design will be conducted by the U.S. EPA FOOSC prior to completion of the SAP. The reviewer will submit comments to the START for action, comment, or clarification. This process will be iterative.



## **9. Quality Assurance and Control (QA/QC)**

- A preliminary data review will be conducted by the project manager. The purpose of this review is to look for problems or anomalies in the implementation of the sample collection and analysis procedures and to examine QC data for information to verify assumptions underlying the DQOs and the SAP. When appropriate to sample design, basic statistical quantities will be calculated and the data will be graphically represented.
  
- The decision-maker should examine the underlying assumptions of the statistical hypothesis test in light of the environmental data.

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# 10

## References

Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Mercury, Hazardous Substance Databank of the Toxicology Data Network at the National Library of Medicine*, 1999.

EPA Requirements for Quality Assurance Project Plans (U.S. EPA QA/R 5, March 2001, U.S. EPA/240/B 01/003);

Guidance for the Data Quality Objectives Process (U.S. EPA QA/G 4, February 2006, U.S. EPA/240/R 02/009);

Guidance on Choosing a Sampling Design for Environmental Data Collection (U.S. EPA QA/G 5S, December 2002, U.S. EPA/240/R 02/005); and

ICF Incorporated, *CERCLA Site Inspection Report*, 1988.

Uniform Federal Policy for Implementing Environmental Quality System (U.S. EPA/505/F-03/001, March 2005)

U.S. EPA Office of Emergency and Remedial Response Directive 9345.3-02 (May 1991)

United States Department of Agriculture, Natural Resource Conservation Service (USDA), Preliminary Findings for Subsurface Soil Profile, December 2009.

United States Environmental Protection Agency (U.S. EPA), 1992 Supplemental Guidance to RAGS: Calculating the Concentration Term, May 1992 (Publication 9285.7-81), May.

United States Environmental Protection Agency (U.S. EPA) 1988, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final, October 1988, U.S. EPA/540/G-89/004, OSWER Directive 9355.3-01.

U.S. EPA Region IX document: Laboratory Documentation Requirements for Data Evaluation, R9QA/004.1, March 2001



## 10. References

United States Environmental Protection Agency (U.S. EPA) 2009, *Cordero Mine Trip Report*, December

Website: United States Department of Agriculture, National Resources Conservation Service, Web Soil Survey, 2010  
<http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>

**A**

**Data Quality Objective Process  
Worksheet**

**United States Environmental Protection Agency, Region 9  
Emergency Response Section  
Generic Data Quality Objectives Process Document  
for  
Soil and Mercury Vapor Sampling**

**Cordero Mercury Mine Site**

**Removal Assessment of Two Roadway Areas**

**Data Quality Objectives (DQO) Process Document  
Objective Outputs**

**Contract: EP-S5-08-01  
TDD No.: TO2-09-10-06-0002  
Job No.: 002693.2094.01RA**

**STEP 1.  
THE PROBLEM**

Background

The site is the subject of a United States Environmental Protection Agency (U.S. EPA) Region IX Emergency Response Section Removal Assessment. The site consists of two locations: a public road approximately 1,600 feet long and 30 feet wide located at 111 North Road, and a privately owned residential driveway approximately 160 feet long and 30 feet wide, both located on the Paiute-Shoshone Indian Reservation, Fort McDermitt, Nevada. The width of the roadways was estimated at 30 feet.. The public road is located approximately 5.2 miles east-southeast of Fort McDermitt, and 10.5 miles east from the Cordero Mine, which operated as a mercury mine between 1935 and the 1980s. The driveway is located near the intersection of South Road and State Highway 95, approximately 11 miles south of Fort McDermitt. The public road is a dirt road which connects the Paiute Shoshone Indian Reservation administration office with their municipal landfill. It has been suspected that mercury-contaminated waste rock material from the Cordero Mine was utilized in the construction of the road and the driveway.

Based on conditions described above, the U.S. EPA is concerned about the possibility of exposure of mercury-contaminated dust to human health and the environment as a result of site use. The objectives discussed herein are for the length and width of the site suspected of containing mine waste.

Planning Team

Mr. Tom Dunkelman, U.S. EPA FOOSC

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Mr. Duane Masters, Sr., Paiute Shoshone Tribal Environmental Coordinator

The names and affiliations of the actual field team will be documented in the field logbook.

### Conceptual Site Model

- The mediums of concern are soil, specifically roadbed materials, and ambient air above the roadways.
- The principal Contaminant of Primary Concern (COPC) is mercury; both inorganic salts and elemental mercury vapor.
- The road bed material contains elevated concentrations of the COPC which originated as waste rock from a mercury mining operation (Cordero Mine).

### Exposure Scenario

- Concerns based on current conditions include (1) direct exposure of human and/or environmental receptors (e.g. invertebrates, mammals, reptiles, plants, migratory birds) to contaminants in road bed material, and (2) exposure of receptors through ingestion by inhalation to vapors and particulate matter (dust) that contain mercury above health-protective concentrations.

### Resources

The current START budget for objective planning and development of a U.S. EPA-approved Sampling and Analysis Plan (SAP) is approximately \$8,000.

The available budget for the Removal Assessment currently allocated to the START is \$28,000. Other budget constraints on U.S. EPA resources for this project have not been specified. The primary decision-maker for the project is Federal On-Scene Coordinator (FOSC) Tom Dunkelman.

### Roles and Responsibilities

- The U.S. EPA FOSC will be the primary decision-maker and will direct the project, specify tasks, and ensure that the project is proceeding on schedule and within budget. Additional duties include coordination of all preliminary and final reporting and communication with the START Project Manager and U.S. EPA Quality Assurance (QA) Office.
- Brian Milton, the START Project Manager, will coordinate with the planning team to develop objectives and complete an approved SAP.
- Howard Edwards, START QA Officer, will oversee development and preparation of the SAP and other START deliverables. Mr. Edwards will provide overall project quality assurance and, if necessary, audit functions.
- START will be responsible for implementation of the SAP, coordination of project tasks, coordination of field sampling, project management, and completion of all preliminary and final reporting.
- The START has arranged for the U.S. EPA Region IX Laboratory in Richmond, California to perform the confirmation sample analysis.
- START or a START contractor will be responsible for data validation.

### Other Considerations and Constraints Related to Problem and Resources

- Soil analyses available for assessment are not always useful for determining disposal and remediation requirements and costs. Additional waste testing of excavated soil is usually

necessary to determine disposal requirements.

- Contamination not found during the soil investigation might be revealed during excavation activities.

## **STEP 2. THE DECISION**

### Principal Study Questions

*It is suspected that mercury mine waste was used in the construction of a public road and a private driveway on the Paiute Shoshone Indian Reservation. It appears as though no samples have been collected from either roadway.*

Primary Study Question #1: Does mercury-contaminated soil exist at or above the site-specific action level within the top 18 inches of the roadways?

Primary Study Question #2: What is the spatial distribution of mercury within the roadways?

Primary Study Question #3: Are there mercury vapors currently, or is there a potential for mercury vapors to emanate from, the roadway at concentrations that are above the applicable action levels?

Secondary Study Question #1: Based on the answers to the primary questions, what is the rough estimated volume of soil with contamination that exceeds the action level?

### Actions that Could Result from the Resolution of Study Questions

If the new data suggests that mercury concentrations in the roadway are at or above the project action level; then the site will be considered as needing additional study and/or remediation.

If the new data suggests that mercury concentrations in the roadway are below the action level; then the site will not be considered as needing removal or remediation.

If the new data suggests that there is mercury concentrations in portions of the roadway that are at or above the project action level; then associated roadway sections will be considered as needing additional study and/or remediation.

If the new data suggests that mercury concentrations in the roadway are at levels around the action level, then the site may be considered as needing additional study.

### Decision Statements (Directives)

Determine whether mercury concentrations in soil in the top 18-inches of roadway, and mercury vapor concentrations in ambient air above the roadway, exceed the project action levels in order to determine whether the site needs remediation/removal, additional study, or no further action.

### **STEP 3. DECISION INPUTS**

#### Environmental data required to resolve the decision statements

- Total mercury data for soils between 0 and 1.5 feet bgs.
- Mercury vapor concentrations in the breathing zone above the road, and in nearby ambient air.
- Sample location data.

#### Sources for Study Information

- Visual survey data and global positioning system (GPS) data
- Field analysis of roadway soil samples for total mercury.
- Laboratory analysis of roadway soil samples for total mercury.
- Field analysis of mercury vapor

#### Information Needed to Establish Action Level

- Information on whether mercury is in elemental form or mercury salts.
- Information on expected and/or potential exposure pathways to receptors.
- Information on expected and or actual duration of potential exposure.
  
- Several benchmarks exist that could be used as project action levels
  - EPA Region 9 industrial soil RSL for elemental mercury.
  - EPA Region 9 industrial soil RSL for inorganic mercury salts, including mercury oxides and mercury sulfides.
  - EPA Region 9 residential soil RSL for elemental mercury.
  - EPA Region 9 residential soil RSL for inorganic mercury salts, including mercury oxides and mercury sulfides.
  - ASTDR action level for mercury vapor in a residential and/or industrial scenario

#### Collection methods

Soil samples can be collected using a trowel, disposable scoop, power auger, hand auger, or shovel.

Mercury vapor concentrations can be measured directly using a mercury vapor analyzer, or by placing soil in a sealed bag and mixing it, then measuring the vapor phase mercury concentrations in the head space inside the bag.

#### Measurement methods

Collected soil samples can be analyzed to determine COPC concentrations using the following definitive US EPA SW-846 method; U.S. EPA Method 7471A for total mercury or the non-definitive U.S. EPA Method 6200 for total mercury.

Mercury vapor analysis and/or mercury speciation methods can be used to establish whether mercury is in elemental form or as an inorganic mercury salt (ionic). Specifically, a Lumex® Model 915+ Mercury Vapor Analyzer could be used to measure vapor-phase mercury

concentrations.

Confirm that appropriate analytical methods exist to provide the necessary data:

For soil analysis, the definitive U.S. EPA method has sufficient sensitivity, accuracy, precision, and other quality parameters to generate necessary data, provided the data are not needed within a critical timeframe.

The non-definitive has sufficient sensitivity, accuracy, precision and other quality parameters to generate necessary data, except if the action level is for residential elemental mercury. Data can be generated in periods close to real time.

Mercury vapor analysis and/or mercury speciation methods are semi-quantitative, but are appropriate to provide the necessary data.

#### **STEP 4. STUDY BOUNDARIES**

##### Define the Population Being Studied

The roadway materials within the site boundary, and the ambient air above and nearby the roadway, are the populations being studied

##### Spatial Boundary of Investigation

The boundary of the investigation is the roadway and driveway area specified in the site map. However, it will also be necessary to establish background concentrations of mercury vapor in ambient air and soil near, but not at, the suspected areas of impact.

##### Temporal Boundary of Investigation

The decisions will apply to determinations of risk associated with long-term exposure to contaminated surface soil and/or mercury vapor from direct exposure. However, decisions may also apply to short-term (acute) exposure to contaminated soil or vapor due to future development activities.

Inorganic mercury salts in soil or roadway material are environmentally persistent and migrate slowly, so the concentration of mercury in roadway material generally does not vary greatly over time. Elemental mercury is less environmentally persistent and will migrate as a vapor and as a dense liquid. Given the age of the roadway, elemental mercury would not be expected to be present at elevated concentrations in shallow and/or exposed surface materials. Given the location and relative inaccessibility of potential contamination, threats to the environment, surface water, and existing communities are not expected to be immediate or imminent. However, the migration of airborne particulate matter containing inorganic mercury salts and mercury vapor is dependent upon weather conditions and roadway use. Increased roadway use would be expected to increase the potential for exposure to mercury laden dust and, if present, mercury vapor.

Thus, the following assessment time-frame has been proposed:

- The SAP will be submitted to U.S. EPA FOSSC by September 1, 2010, and should be reviewed and revised by September 13, 2010, the first day of proposed work.

- Sample collection will take place following SAP approval by the U.S. EPA.
- Preliminary data should be available approximately 3 weeks from the date of sample delivery to the laboratory.
- Data packages and final data should be reported to project management approximately 5 weeks after sample delivery to the laboratory.
- Laboratory data should be evaluated following U.S. EPA Region 9 Tier 2 guidance. Evaluated data should be reported to project management approximately 6-7 weeks after sample delivery to the laboratory.
- Decision statement resolutions are expected to occur approximately 6-7 weeks after sampling and should take place prior to development decisions.

#### Scale of decision-making

The scale of decision-making will cover the entire delineated site area (e.g. all the roadways). If mercury in specific locations and samples are found at concentrations that are significantly lower than at other sample locations, those locations and the corresponding soil may be considered separate decision units.

#### Constraints on Data Collection

- The turnaround times on data are always estimated and cannot be assured. Sample and system problems may indiscriminately increase data turnaround times.
- Definitive data will undergo a U.S. EPA Region 9 Tier 2 validation review prior to final reporting. Problems identified during this review may initiate additional data reviews, which will increase the time needed before data are finalized.
- Specific data may be qualified or rejected based on the results of the data review process.
- Civil constraints such as site access agreements, tribal requirements, and permit requirements may exist and, if so, will need to be addressed prior to sampling.

## **STEP 5. DECISION RULE**

#### Statistical Parameter

The geographic distribution of contamination and the range of contaminant concentrations define the statistical population of interest. In order to locate a contamination hot spot of a specific size, it will be necessary to consider an individual sampling data point (which is not a statistical parameter) as representing the contaminant concentration at a specific location.

#### Action Levels

The proposed action levels for the study will be 310 mg/kg or 230 mg/kg, which are the respective regional screening levels (RSLs) for industrial and residential exposure scenarios (i-RSL) for inorganic mercury for industrial soil. However, START field teams will also utilize a Lumex 915+ Mercury Vapor Analyzer (Lumex®) to screen mercury vapor in ambient air in the breathing zone above the roadways, and in the headspace of soil sample containers. The U.S. EPA will consider screening results from the Lumex® to determine the presence or absence of elemental mercury vapors and whether a lower action level is warranted, (e.g. the 34 mg/kg residential RSL for elemental mercury).

The RSL for industrial and residential soil were proposed as the site-specific removal assessment  
**August 10, 2010**

action levels because the RSLs are based on exposure risks which, for industrial soil, is typically an 8-hour day. The RSLs for residential soil is determined using a continuous 24-hour exposure scenario.

#### Decision Rules

- If the data indicate that a soil sample at a specific location has a mercury concentration above the applicable action level, then it will be assumed that there is a contamination hot-spot and that area, and the associated area will be considered in need of remediation or additional study/assessment.
- If the data indicate that a sample at a specific location has a mercury concentration below the action level, then it will be assumed that there is not a contamination hot-spot and the associated area will not be considered as in need of remediation or additional study.

**STEP 6.**  
**LIMITS ON DECISION ERRORS**

Range of the Parameters of Interest

For all investigation areas the range of interest for mercury concentration that could effect decision is between ½ the action level and twice the action level. Quantitatively precise and accurate determinations of contaminant concentrations that are significantly above the action level are not necessary.

The Null Hypothesis or Baseline Condition

The COC concentrations in soil and ambient air exceed the applicable action levels.

Alternative Hypothesis

The COC concentrations in soil and soil vapor are less than the applicable action levels.

<p align="center"><b>Table 2 - DECISION ERRORS</b>  <b>Cordero Mine Site</b>  <b>Fort McDermitt, Nevada</b></p>		
E & E Project No.: 002693.2094.01RA		TDD No.: TO2-09-10-06-0002
<b>Decision Error</b>	Deciding that the sample concentration <u>exceeds</u> the action level when it does not.	Deciding that the sample concentration <u>does not exceed</u> the action level when it does.
<b>True Nature of Decision Error</b>	The sample concentrations are either not representative or are biased high.	The sample concentrations are either not representative or are biased low.
<b>The Consequence of Error</b>	Areas of soil represented by the sample will undergo additional investigation or may be immediately excavated or treated. Each situation would cost the EPA, Region 9, additional resources of time, money, and manpower.	The community could be directly exposed to COCs in areas of contaminated soil. Exposure would be an imminent threat to human health and the environment.
<b>Which Decision Error Has More Severe Consequences near the Action Level?</b>	<b>LESS SEVERE</b> to human health, but with appreciable economic consequences	<b>MORE SEVERE</b> because the contaminated soil may pose risks to human health and/or the environment.
<b>Error Type Based on Consequences</b>	<b>False Negative Decision</b> A decision that the soil contaminant concentrations are greater than the action level when they actually are not.	<b>False Positive Decision</b> A decision that the soil contaminant concentrations are less than the action level when they actually are greater.
<p><b>Definitions</b>                      False Negative Decision = A false negative decision error occurs when the null hypothesis is not rejected when it is false.                      False Positive Decision = A false positive decision error occurs when the null hypothesis is rejected when it is true.                      See the EPA document titled, <i>Guidance for the Data Quality Objective Process</i>, Chapter 6, (EPA QA/G-4) for additional guidance regarding decision error.</p>		
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## Decision Error Limits Goals

For this project the goal is to locate a circular mercury contamination hot-spot that has a radius greater than 120 feet with a probability of 95 % (0.95).

If all the samples through out the entire site are found to have mercury levels either above or below the action level, then Table 3.

<b>Table 3 - Decision Error Limits Goals (Soil)</b> <b>Cordero Mine Site</b>		
E & E Project No.: 002693.2094.01RA		TDD No.: TO2-09-10-06-0002
<b>True Concentration of Sample (% of Action Level)</b>	<b>Typical Decision Error Probability Goals (Based on Professional Judgment)</b>	<b>Type of Decision Error</b>
0 -75	Less than 5%	False negative
75--100	Gray area <sup>1</sup>	False negative
100-125	Less than 5%	False positive
> 125	Less than 1%	False positive
<b>If the coefficient of variability is 30 % the required number of samples is expected to be 21 samples.</b>		
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**STEP 7.  
DESIGN FOR OBTAINING DATA**

**Specific Design Optimization**

Based on the project’s goals and objectives, the START Planning Team considered the following design elements as necessary to achieve DQOs:

- Collection and analysis of soil samples for mercury
- Generation of data that will indicate the geographical distribution of contamination (GPS data)
- Systematic representative soil sampling over the entire delineated area

A systematic sample design is the most appropriate sampling design that will meet the project objective. The systematic sampling will be divided into two approaches. The first approach will occur along the length of the public road. The sampling will begin at the west side of the public road at the intersection with North Road and collect one sample from 0-0.5 feet bgs. At the direction of the FOOSC, additional subsurface soil samples would be collected from 0.5-1.0 feet bgs, and/or from 1.0-1.5 feet bgs at each surface sampling location. The sample team will travel 200 feet north and collect samples from the middle of the roadway using the method described above. The sample team will travel 200 feet north to the east side of the roadway and collect three samples from the east side. The sample team will then travel 200 feet and return to the middle of the road to collect the next set of samples. The back-and-forth pattern of roadway soil sampling will extend the 1,630-foot length of the road. Approximately 24 samples will be collected using this approach. Figures 4-1a and 4-1b of the SAP show the approximate number and locations of the samples

For a single point sample in a grid sector of 200 ft<sup>2</sup> by 30 ft<sup>2</sup>, the algorithm used to calculate the probability of a hit (which makes possible the calculation of the hot spot size or the number of samples) was developed by Singer and Wickman (1969) and Singer (1972) with refinements by Davidson (1995). For this design, the smallest hot spot that could be detected was calculated based on the given grid size and other parameters.

The inputs to the algorithm that result in the smallest hot spot that could be detected are:

<b>Parameter</b>	<b>Description</b>	<b>Value</b>
<b>Inputs</b>		
	<b>Probability of detection</b>	<b>95%</b>
<b>Grid Type</b>	<b>Grid pattern (Square, Triangular or Rectangular)</b>	<b>Rectangular</b>
<b>Grid Size</b>	<b>Spacing between samples</b>	<b>200 feet by 30 feet</b>
<b>Grid Area</b>	<b>Area represented by one grid</b>	<b>4,000 ft<sup>2</sup></b>
<b>Sample Type</b>	<b>Point samples</b>	<b>Points</b>
<b>Hot Spot Shape</b>	<b>Hot spot height to width ratio</b>	<b>1</b>
<b>Outputs</b>		
<b>Hot Spot Size</b>	<b>Length of hot spot semi-major axis</b>	<b>97 feet</b>

The second approach will be along the private driveway. The second approach will be similar to the first; however the interval between each sample location will be 40 feet rather than 200 feet. The sample team will begin at the west side of the driveway at the intersection of S Road and continue the back-and-forth pattern, collecting three samples at the aforementioned depths every 20 feet. Approximately 12 samples will be collected using this approach.

Samples will be collected from the surface to 0.5 feet bgs, from 0.5-1.0 feet bgs, and from 1.0-1.5 bgs. Three samples per location will be collected. Samples will be homogenized in a stainless steel bowl and then placed into the appropriate sample containers using stainless steel sampling scoops. Samples will be collected using disposable plastic scoops and placed in a 4-ounce jar in preparation for analysis. Samples will be placed in coolers and chilled with ice to 4° C for storage and shipping.

For a single point sample in a grid sector of 40 ft<sup>2</sup> by 30 ft<sup>2</sup>, the algorithm used to calculate the probability of a hit (which makes possible the calculation of the hot spot size or the number of samples) was developed by Singer and Wickman (1969) and Singer (1972) with refinements by Davidson (1995). For this design, the smallest hot spot that could be detected was calculated based on the given grid size and other parameters.

The inputs to the algorithm that result in the smallest hot spot that could be detected are:

<b>Parameter</b>	<b>Description</b>	<b>Value</b>
<b>Inputs</b>		
	<b>Probability of detection</b>	<b>95%</b>
<b>Grid Type</b>	<b>Grid pattern (Square, Triangular or Rectangular)</b>	<b>Rectangular</b>
<b>Grid Size</b>	<b>Spacing between samples</b>	<b>40 feet by 30 feet</b>
<b>Grid Area</b>	<b>Area represented by one grid</b>	<b>1,200 ft<sup>2</sup></b>
<b>Sample Type</b>	<b>Point samples</b>	<b>Points</b>
<b>Hot Spot Shape</b>	<b>Hot spot height to width ratio</b>	<b>1</b>
<b>Outputs</b>		
<b>Hot Spot Size</b>	<b>Length of hot spot semi-major axis</b>	<b>21.4 feet</b>

Approximately 4 background samples will be collected during the sampling event from areas not expected to have been impacted by mine waste. Background sample locations will be determined in the field by the START during the event based on observed and reported historical wind conditions. Duplicates, equipment blanks, and other appropriate quality assurance/quality control samples should be collected and are specified in the SAP. Data review, independent of the laboratory, should be performed on all analytical data that may be used in decision-making. The GPS coordinates (latitude and longitude) of each sampling location will be determined and documented during sampling.

**Analysis:**

All soil samples collected will be analyzed for the COPC by the following methods:

- U. S. EPA Method 7471A for Mercury.

If it is expected that the site is to become a U.S. EPA funded removal project, then EPA method 6200 may also be warranted.

In order to document whether mercury vapor is present in the roadway, the roadway, and soil samples can be screened in the field using the Lumex®915.

**Decision Error Minimization**

In order to meet the decision limit error goal stated in step 6 of this DQO, all single point samples must have 10 % duplicate analysis and data should not be qualified.

**Data from individual sample locations**

The decision-maker should consider data uncertainty when making decisions using sampling data and associated estimated values from a single location. An individual data value reported below the action level may be biased low, while a data value reported above the action level may be biased high. The probability of decision error increases when COPC concentrations are near the action level due to both data uncertainty and data bias. Data that exceeds the action level by several times will likely not be in error.

For any reported COPC concentrations near the method detection limit, the uncertainty is relatively large, increasing the probability of decision error.

There are insufficient data to determine with any confidence whether any single sampling location can represent a larger area. Therefore, it is unknown whether data from any individual sample location in a search grid is representative of the entire grid sector. Thus the decision-maker should consider discrete data points as potentially not representative of any greater area.

**Contamination Distribution Map**

Data from sampling locations can be used to create a contaminant distribution map. The mapped COPC concentrations within an area should generally be based on the sample data from that area and the sample data from adjacent locations, particularly if discrete sample data are being used. The generated map model could be used to estimate the concentration of contamination throughout the property. The decision-maker should consider the data source and statistical sophistication of the distribution map prior to making decisions based on the map. The uncertainty for estimated data (data based on extrapolations and interpolations) is typically greater than for actual data. Therefore the probability of a decision error is greatly increased when extrapolated data are used.

### **General requirement for generating usable data**

All activities and documentation related to the project should proceed under a Quality Management Plan (QMP). All sampling, analytical and quality assurance activities will proceed under a U.S. EPA-approved SAP. A record of sampling activities and deviation from the SAP must be documented in a bound field log book. Prior to sample collection, all project sampling personnel will review relevant sampling procedures and relevant quality assurance and control (QA/QC) requirements for selected analytical methods.

# B

## Site Specific Health and Safety Plan

**Ecology and Environment, Inc.**

**SITE-SPECIFIC  
HEALTH AND SAFETY PLAN**

Project: Cordero Mine Site \_\_\_\_\_

Project No.: 002693.2094.01RA \_\_\_\_\_

TDD/PAN No.: TO2-09-10-06-0002 \_\_\_\_\_

Project Location: McDermitt, Nevada \_\_\_\_\_

Proposed Date of Field Activities: August 2-6, 2010 \_\_\_\_\_

Project Director: Cindy McLeod \_\_\_\_\_

Project Manager: Brian Milton *Brian Milton* 9/13/10 \_\_\_\_\_

Prepared by: Adam Smith \_\_\_\_\_ Date Prepared: July 20, 2010 \_\_\_\_\_

Approved by: Mike Folan *Mike Folan* \_\_\_\_\_ Date Approved: July 21, 2010 \_\_\_\_\_



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# 1. INTRODUCTION

## 1.1 POLICY

It is E & E's policy to ensure the health and safety of its employees, the public, and the environment during the performance of work it conducts. This site-specific health and safety plan (SHASP) establishes the procedures and requirements to ensure the health and safety of E & E employees for the above-named project. E & E's overall safety and health program is described in *Corporate Health and Safety Program (CHSP)*. After reading this plan, applicable E & E employees shall read and sign E & E's Site-Specific Health and Safety Plan Acceptance form.

This SHASP has been developed for the sole use of E & E employees and is not intended for use by firms not participating in E & E's training and health and safety programs. Subcontractors are responsible for developing and providing their own safety plans.

This SHASP has been prepared to meet the following applicable regulatory requirements and guidance:

Applicable Regulation/Guidance
29 CFR 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER)
Other:

## 1.2 SCOPE OF WORK

Description of Work: The START will conduct a site assessment of two roadways, one public road and one private driveway, reportedly constructed with mercury mine waste located on the Paiute Shoshone Indian Reservation. The assessment will include collection of surface and subsurface soil sampling and field analysis of metals using the X-Ray Fluorescence (XRF).

Equipment/Supplies: Attachment 1 contains a checklist of equipment and supplies that will be needed for this work.

The following is a description of each numbered task:

Task Number	Task Description
1	Soil sampling
2	Field analysis with the XRF
3	Photo Documentation

## 1.3 SITE DESCRIPTION

Site Map: A site map or sketch is attached at the end of this plan.

Site History/Description (see project work plan for detailed description): The site consists of two locations: a public road approximately 1,600 feet long and 30 feet wide located at 111 N Road, and a privately owned residential driveway approximately 160 feet long and 30 feet wide, both located on the Paiute Shoshone Indian Reservation, Fort McDermitt, Nevada. Each roadway is estimated to be 30 feet wide. The public road is located approximately 5.2 miles east-southeast of Fort McDermitt, and 10.5 miles east from the Cordero Mine, which operated as a mercury mine between 1935 and the 1980s. The driveway is located near the intersection of S Road and State Highway 95, approximately 11 miles south of Fort McDermitt. The public road is a dirt road which connects the Paiute Shoshone Indian Reservation administration office with their municipal landfill. It has been suspected that mercury-contaminated waste rock material from the Cordero Mine was utilized in the construction of the road and the driveway.

Is the site currently in operation?  Yes  No

Locations of Contaminants/Wastes: Wastes are located in surface and subsurface soil on both roadways.

Types and Characteristics of Contaminants/Wastes:

- Liquid                       Solid                       Sludge                       Gas/Vapor  
 Flammable/Ignitable       Volatile                       Corrosive                       Acutely Toxic  
 Explosive                       Reactive                       Carcinogenic                       Radioactive  
 Medical/Pathogenic      Other: \_\_\_\_\_

**2. ORGANIZATION AND RESPONSIBILITIES**

E & E team personnel shall have on-site responsibilities as described in E & E's standard operating procedure (SOP) for Site Entry Procedures (GENTECH 2.2). The project team, including qualified alternates, is identified below.

Name	Site Role/Responsibility
Brian Milton	Project/Task Manager
Adam Smith	Site Safety Officer
Also on site: Tom Dunkelman, U.S. EPA	U.S. EPA Federal On-Scene Coordinator

**3. TRAINING**

Prior to work, E & E team personnel shall have received training as indicated below. As applicable, personnel shall have read the project work plan, sampling and analysis plan, and/or quality assurance project plan prior to project work.

Training	Required
40-Hour OSHA HAZWOPER Initial Training and Annual Refresher (29 CFR 1910.120)	X
Annual First Aid/CPR	X
Hazard Communication (29 CFR 1910.1200)	X
40-Hour Radiation Protection Procedures and Investigative Methods	

Training	Required
8-Hour General Radiation Health and Safety	
Radiation Refresher	
DOT and Biannual Refresher	
Other: _____	

#### 4. MEDICAL SURVEILLANCE

##### 4.1 MEDICAL SURVEILLANCE PROGRAM

E & E field personnel shall actively participate in E & E's medical surveillance program as described in the CHSP and shall have received, within the past year, an appropriate physical examination and health rating.

E & E's health and safety record (HSR) form will be maintained on site by each E & E employee for the duration of his or her work. E & E employees should inform the site safety officer (SSO) of any allergies, medical conditions, or similar situations that are relevant to the safe conduct of the work to which this SHASP applies.

Is there a concern for radiation at the site?  Yes  No

If no, go to 5.1.

##### 4.2 RADIATION EXPOSURE

###### 4.2.1 External Dosimetry

Thermoluminescent Dosimeter (TLD) Badges: TLD badges are to be worn by all E & E field personnel on certain required sites.

Pocket Dosimeters: \_\_\_\_\_

Other: \_\_\_\_\_

###### 4.2.2 Internal Dosimetry

Whole body count  Bioassay  Other

Requirements: \_\_\_\_\_

###### 4.2.3 Radiation Dose

Dose Limits: E & E's radiation dose limits are stated in the CHSP. Implementation of these dose limits may be designated on a site specific basis.

Site-Specific Dose Limits: \_\_\_\_\_

ALARA Policy: Radiation doses to E & E personnel shall be maintained as low as reasonably achievable (ALARA), taking into account the work objective, state of technology available, economics of improvements in dose reduction with respect to overall

health and safety, and other societal and socioeconomic considerations.

## 5. SITE CONTROL

### 5.1 SITE LAYOUT AND WORK ZONES

Site Work Zones: Soil sampling and photo documentation are proposed along both roadways. XRF analysis will most likely occur offsite.(See attached sample location map).

Site Access Requirements and Special Considerations: Access to the site is being organized by the Paiute Shoshone Indian Reservation. The site is in open-air and is not fenced. The public will have access to the site during site activities.

Illumination Requirements: No special requirements are currently known to exist. All work will be conducted in daylight.

Sanitary Facilities (e.g., toilet, shower, potable water): The presence or availability of these facilities will be evaluated during the 8/2/10 site reconnaissance and related information will be added to this Safety Plan, if necessary, following the site reconnaissance.

On-Site Communications: Primary method: verbal. Secondary method: cell phones or radios.

Other Site-Control Requirements: To be determined based on the results of the site reconnaissance.

### 5.2 SAFE WORK PRACTICES

Daily Safety Meeting: A daily safety meeting will be conducted for all E & E personnel and documented on the Daily Safety Meeting Record form or in the field logbook. The information and data obtained from applicable site characterization and analysis will be addressed in the safety meetings and also used to update this SHASP, as necessary.

Work Limitations: Work shall be limited to a maximum of 12 hours per day. If 12 consecutive days are worked, at least one day off shall be provided before work is resumed. Work will be conducted in daylight hours unless prior approval is obtained and the illumination requirements in 29 CFR 1910.120(m) are satisfied.

Weather Limitations: Work shall not be conducted during electrical storms. Work conducted in other inclement weather (e.g., rain, snow) will be approved by project management and the regional safety coordinator or designee.

Other Work Limitations: \_\_\_\_\_

Buddy System: Field work will be conducted in pairs of team members according to the buddy system.

Line of Sight: Each field team member shall remain in the line of sight and within verbal communication of at least one other team member.

Eating, Drinking, and Smoking: Eating, drinking, smoking, and the use of tobacco products shall be prohibited in the exclusion and contamination reduction areas, at a minimum, and shall only be permitted in designated areas.

Contamination Avoidance: Field personnel shall avoid unnecessary contamination of personnel, equipment, and materials to the extent practicable.

Sample Handling: Protective gloves of a type designated in Section 7 will be worn when containerized samples are

handled for labeling, packaging, transportation, and other purposes.

Other Safe Work Practices: \_\_\_\_\_

## 6. HAZARD EVALUATION AND CONTROL

### 6.1 PHYSICAL HAZARD EVALUATION AND CONTROL

Potential physical hazards and their applicable control measures are described in the following table for each task.

Hazard	Task Number	Hazard Control Measures
Biological (flora, fauna, etc.)	1-3	<ul style="list-style-type: none"> <li>■ Potential hazard:</li> <li>■ Establish site-specific procedures for working around identified hazards.</li> <li>■ Other:</li> </ul>
Cold Stress		<ul style="list-style-type: none"> <li>■ Provide warm break area and adequate breaks.</li> <li>■ Provide warm noncaffeinated beverages.</li> <li>■ Promote cold stress awareness.</li> <li>■ See <i>Cold Stress Prevention and Treatment</i> (attached at the end of this plan if cold stress is a potential hazard).</li> </ul>
Compressed Gas Cylinders		<ul style="list-style-type: none"> <li>■ Use caution when moving or storing cylinders.</li> <li>■ A cylinder is a projectile hazard if it is damaged or its neck is broken.</li> <li>■ Store cylinders upright and secure them by chains or other means.</li> <li>■ Other:</li> </ul>
Confined Space		<ul style="list-style-type: none"> <li>■ Ensure compliance with 29 CFR 1910.146.</li> <li>■ See SOP for Confined Space Entry. Additional documentation is required.</li> <li>■ Other:</li> </ul>
Drilling		<ul style="list-style-type: none"> <li>■ See SOP for Health and Safety on Drilling Rig Operations. Additional documentation may be required.</li> <li>■ Landfill caps will not be penetrated without prior discussions with corporate health and safety staff.</li> <li>■ Other:</li> </ul>
Drums and Containers		<ul style="list-style-type: none"> <li>■ Ensure compliance with 29 CFR 1910.120(j).</li> <li>■ Consider unlabeled drums or containers to contain hazardous substances and handle accordingly until the contents are identified.</li> <li>■ Inspect drums or containers and assure integrity prior to handling.</li> <li>■ Move drums or containers only as necessary; use caution and warn nearby personnel of potential hazards.</li> </ul>
		<ul style="list-style-type: none"> <li>■ Open, sample, and/or move drums or containers in accordance with established procedures; use approved drum/container-handling equipment.</li> </ul>

Hazard	Task Number	Hazard Control Measures
Electrical		<ul style="list-style-type: none"> <li>■ Other:</li> <li>■ Ensure compliance with 29 CFR 1910 Subparts J and S.</li> <li>■ Locate and mark energized lines.</li> <li>■ De-energize lines as necessary.</li> <li>■ Ground all electrical circuits.</li> <li>■ Guard or isolate temporary wiring to prevent accidental contact.</li> <li>■ Evaluate potential areas of high moisture or standing water and define special electrical needs.</li> <li>■ Other:</li> </ul>
Excavation and Trenching		<ul style="list-style-type: none"> <li>■ Ensure that excavations comply with and personnel are informed of the requirements of 29 CFR 1926 Subpart P.</li> <li>■ Ensure that any required sloping or shoring systems are approved as per 29 CFR 1926 Subpart P.</li> <li>■ Identify special personal protective equipment (PPE) (see Section 7) and monitoring (see Section 8) needs if personnel are required to enter approved excavated areas or trenches.</li> <li>■ Maintain line of sight between equipment operators and personnel in excavations/trenches. Such personnel are prohibited from working in close proximity to operating machinery.</li> <li>■ Suspend or shut down operations at signs of cave in, excessive water, defective shoring, changing weather, or unacceptable monitoring results.</li> <li>■ Other:</li> </ul>
Fire and Explosion		<ul style="list-style-type: none"> <li>■ Inform personnel of the location(s) of potential fire/explosion hazards.</li> <li>■ Establish site-specific procedures for working around flammables.</li> <li>■ Ensure that appropriate fire suppression equipment and systems are available and in good working order.</li> <li>■ Define requirements for intrinsically safe equipment.</li> <li>■ Identify special monitoring needs (see Section 8).</li> <li>■ Remove ignition sources from flammable atmospheres.</li> <li>■ Coordinate with local fire-fighting groups regarding potential fire/explosion situations.</li> <li>■ Establish contingency plans and review daily with team members.</li> <li>■ Other:</li> </ul>
Heat Stress	1-3	<ul style="list-style-type: none"> <li>■ Provide cool break area and adequate breaks.</li> <li>■ Provide cool noncaffeinated beverages.</li> <li>■ Promote heat stress awareness.</li> <li>■ Use active cooling devices (e.g., cooling vests) where specified.</li> <li>■ See <i>Heat Stress Prevention and Treatment</i> (attached at the end of this plan if heat stress is a potential hazard).</li> </ul>

Hazard	Task Number	Hazard Control Measures
Heavy Equipment Operation		<ul style="list-style-type: none"> <li>■ Define equipment routes, traffic patterns, and site-specific safety measures.</li> <li>■ Ensure that operators are properly trained and equipment has been properly inspected and maintained. Verify back-up alarms.</li> <li>■ Ensure that ground spotters are assigned and informed of proper hand signals and communication protocols.</li> <li>■ Identify special PPE (Section 7) and monitoring (Section 8) needs.</li> <li>■ Ensure that field personnel do not work in close proximity to operating equipment.</li> <li>■ Ensure that lifting capacities, load limits, etc., are not exceeded.</li> <li>■ Other:</li> </ul>
Heights (Scaffolding, Ladders, etc.)		<ul style="list-style-type: none"> <li>■ Ensure compliance with applicable subparts of 29 CFR 1910.</li> <li>■ Identify special PPE needs (e.g., lanyards, safety nets, etc.)</li> <li>■ Other:</li> </ul>
Noise		<ul style="list-style-type: none"> <li>■ Establish noise level standards for on-site equipment/operations.</li> <li>■ Inform personnel of hearing protection requirements (Section 7).</li> <li>■ Define site-specific requirements for noise monitoring (Section 8).</li> <li>■ Other:</li> </ul>
Overhead Obstructions		<ul style="list-style-type: none"> <li>■ Wear hard hat.</li> <li>■ Other:</li> </ul>
Power Tools		<ul style="list-style-type: none"> <li>■ Ensure compliance with 29 CFR 1910 Subpart P.</li> <li>■ Other:</li> </ul>
Sunburn	1-3	<ul style="list-style-type: none"> <li>■ Apply sunscreen.</li> <li>■ Wear hats/caps and long sleeves.</li> <li>■ Other:</li> </ul>
Utility Lines		<ul style="list-style-type: none"> <li>■ Identify/locate existing utilities prior to work.</li> <li>■ Ensure that overhead utility lines are at least 25 feet away from project activities.</li> <li>■ Contact utilities to confirm locations, as necessary.</li> <li>■ Other:</li> </ul>
Weather Extremes		<ul style="list-style-type: none"> <li>■ Potential hazards:</li> <li>■ Establish site-specific contingencies for severe weather situations.</li> <li>■ Provide for frequent weather broadcasts.</li> <li>■ Weatherize safety gear, as necessary (e.g., ensure eye wash units cannot freeze, etc.).</li> <li>■ Identify special PPE (Section 7) needs.</li> <li>■ Discontinue work during severe weather.</li> <li>■ Other:</li> </ul>
Other:		<ul style="list-style-type: none"> <li>■</li> <li>■</li> </ul>
Other:		<ul style="list-style-type: none"> <li>■</li> <li>■</li> </ul>

**6.2 CHEMICAL HAZARD EVALUATION AND CONTROL**

**6.2.1 Chemical Hazard Evaluation**

Potential chemical hazards are described by task number in Table 6-1. Hazard Evaluation Sheets for major known contaminants are attached at the end of this plan.

**6.2.2 Chemical Hazard Control**

An appropriate combination of engineering/administrative controls, work practices, and PPE shall be used to reduce and maintain employee exposures to a level at or below published exposure levels (see Section 6.2.1).

Applicable Engineering/Administrative Control Measures: No engineering/administrative controls specific to this site have been identified.

PPE: See Section 7.

**6.3 RADIOLOGICAL HAZARD EVALUATION AND CONTROL**

**6.3.1 Radiological Hazard Evaluation**

Potential radiological hazards are described below by task number. Hazard Evaluation Sheets for major known contaminants are attached at the end of this plan.

Task Number	Radionuclide	DAC (µCi/ml)	Route(s) of Exposure	Major Radiation(s)	Energy(s) (MeV)	Half-Life

**6.3.2 Radiological Hazard Control**

Engineering/administrative controls and work practices shall be instituted to reduce and maintain employee exposures to a level at or below the permissible exposure/dose limits (see sections 4.2.3 and 6.3.1). Whenever engineering/administrative controls and work practices are not feasible or effective, any reasonable combination of engineering/administrative controls, work practices, and PPE shall be used to reduce and maintain employee exposures to a level at or below permissible exposure/dose limits.

Applicable Engineering/Administrative Control Measures: \_\_\_\_\_

\_\_\_\_\_

PPE: See Section 7.



## 7. LEVEL OF PROTECTION AND PERSONAL PROTECTIVE EQUIPMENT

### 7.1 LEVEL OF PROTECTION

The following levels of protection (LOPs) have been selected for each work task based on an evaluation of the potential or known hazards, the routes of potential hazard, and the performance specifications of the PPE. On-site monitoring results and other information obtained from on-site activities will be used to modify these LOPs and the PPE, as necessary, to ensure sufficient personnel protection. The authorized LOP and PPE shall only be changed with the approval of the regional safety coordinator or designee. Level A is not included below because Level A activities, which are performed infrequently, will require special planning and addenda to this SHASP.

Task Number	B	C	D	Modifications Allowed
1		(X)	X	
2		(X)	X	
3		(X)	X	

Note: Use "X" for initial levels of protection. Use "(X)" to indicate levels of protection that may be used as site conditions warrant.

### 7.2 PERSONAL PROTECTIVE EQUIPMENT

The PPE selected for each task is indicated below. E & E's PPE program complies with 29 CFR 1910.120 and 29 CFR 1910 Subpart I and is described in detail in the CHSP. Refer to 29 CFR 1910 for the minimum PPE required for each LOP.

PPE	Task Number/LOP					
	1	2	3			
Full-face APR	(X)	(X)	(X)			
PAPR						
Cartridges:						
P100						
GMC-P100						
GME-P100						
Other: Mersorb P100	(X)	(X)	(X)			
Positive-pressure, full-face SCBA						
Spare air tanks (Grade D air)						
Positive-pressure, full-face, supplied-air system						
Cascade system (Grade D air)						

PPE	Task Number/LOP					
	1	2	3			
Manifold system						
5-Minute escape mask						
Safety glasses	(X)	(X)	(X)			
Monogoggles						
Coveralls/clothing						
Protective clothing:						
Tyvek	(X)	(X)	(X)			
Saranex						
Other:						
Splash apron						
Inner gloves:						
Cotton						
Nitrile	X	X	(X)			
Latex						
Other:						
Outer gloves:						
Viton						
Rubber						
Neoprene						
Nitrile						
Other:						
Work gloves	(X)					
Safety boots (as per ANSI Z41)	X	X	X			
Neoprene safety boots (as per ANSI Z41)						
Boot covers (type: _____)						
Hearing protection (type: _____)						
Hard hat	X	X	X			
Face shield						
Other:						
Other:						

## 8. HEALTH AND SAFETY MONITORING

Health and safety monitoring will be conducted to ensure proper selection of engineering/administrative controls, work practices, and/or PPE so that employees are not exposed to hazardous substances at levels that exceed permissible exposure/dose limits or published exposure levels. Health and safety monitoring will be conducted using the instruments, frequency, and action levels described in Table 8-1. Health and safety monitoring instruments shall have been appropriately calibrated and/or performance-checked prior to use.

## 9. DECONTAMINATION PROCEDURES

All equipment, materials, and personnel will be evaluated for contamination upon leaving the exclusion area. Equipment and materials will be decontaminated and/or disposed and personnel will be decontaminated, as necessary. Decontamination will be performed in the contamination reduction area or any designated area such that the exposure of uncontaminated employees, equipment, and materials will be minimized. Specific procedures are described below.

Equipment/Material Decontamination Procedures (specified by work plan): Wipe electronic equipment used with phosphate-based detergent wipes. Non-dedicated sampling equipment will be decontaminated using a three step 5-gallon bucket process utilizingalconox and distilled water.

Ventilation: All decontamination procedures will be conducted in a well-ventilated area.

Personnel Decontamination Procedures: Dry decontamination Baby wipes with spot-decontamination to be performed using disinfectant hand wipes if necessary.

PPE Requirements for Personnel Performing Decontamination: Level D using nitrile gloves and safety glasses.

Personnel Decontamination in General: Following appropriate decontamination procedures, all field personnel will wash their hands and face with soap and potable water. Personnel should shower at the end of each work shift.

Disposition of Disposable PPE: Disposable PPE must be rendered unusable and disposed as indicated in the work plan.

Disposition of Decontamination Wastes (e.g., dry wastes, decontamination fluids, etc.): N/A

TABLE 8-1

HEALTH AND SAFETY MONITORING

Instrument	Task Number	Contaminant(s)	Monitoring Location	Monitoring Frequency	Action Levels <sup>a</sup>
<input type="checkbox"/> PID (e.g., RAE mini RAE) <input type="checkbox"/> FID (e.g., OVA 128-) <input type="checkbox"/> TVA 1000					<b>Unknown Vapors</b> Background to 1 ppm above background: Level D 1 to 5 ppm above background: Level C 5 to 500 ppm above background: Level B >500 ppm above background: Level A
Oxygen Meter/Explosimeter					<b>Oxygen</b> <19.5% or >22.0%: Evacuate area; eliminate ignition sources; reassess conditions. 19.5 to 22.0%: Continue work in accordance with action levels for other instruments.
Radiation Alert Monitor (Rad-mini or RAM-4)					<0.1 mR/hr: Continue work in accordance with action levels for other instruments. ≥0.1 mR/hr: Evacuate area; reassess work plan and contact radiation safety specialist.
Mini-Ram Particulate Monitor					<b>General/Unknown</b> Evaluate health and safety measures when dust levels exceed 2.5 milligrams per cubic meter. ≥4 ppm: Leave area and consult with SSO.
HCN/H <sub>2</sub> S (Monitox)					<b>Contaminant-Specific</b>
Draeger Colorimetric Tubes					<b>Tube</b> Action Level Action
Air Monitor/Sampler Type: _____ Sampling medium: _____					Action Level Action

TABLE 8-1

HEALTH AND SAFETY MONITORING

Instrument	Task Number	Contaminant(s)	Monitoring Location	Monitoring Frequency	Action Levels <sup>a</sup>	Action
Personal Sampling Pump Type: _____ Sampling medium: _____						
Micro R Meter	1				<2 mR/hr: Continue work in accordance with action levels for other instruments. 2 to 5 mR/hr: In conjunction with a radiation safety specialist, continue work and perform stay-time calculations to ensure compliance with dose limits and ALARA policy. >5 mR/hr: Evacuate area to reassess work plan and evaluate options to maintain personnel exposures ALARA and within dose limits.	
Ion Chamber					See micro R meter action levels above.	
Radiation Survey Ratemeter/Scaler with External Detector(s)					<b>Detector</b> <b>Action Level</b>	<b>Action</b>
Noise Dosimeter (Sound Level Meter)					≤85 decibels as measured using the A-weighted network (dBA): Use hearing protection if exposure will be sustained throughout work shift. >85 dBA: Use hearing protection. >120 dBA: Leave area and consult with safety personnel.	
Other: Lumex	1, 2, 3	Mercury	Within the study areas	Continuous during site recon; Initial (before and at the start of site work) and periodic thereafter	> 1,000 ng/m <sup>3</sup> : Leave area and consult with SSO 12,500 ng/m <sup>3</sup> : Respiratory upgrade to APR w/ mersorb cartridges	
Other:						

**TABLE 8-1**  
**HEALTH AND SAFETY MONITORING**

Instrument	Task Number	Contaminant(s)	Monitoring Location	Monitoring Frequency	Action Levels <sup>a</sup>
------------	-------------	----------------	---------------------	----------------------	----------------------------

<sup>a</sup> Unless stated otherwise, airborne contaminant concentrations are measured as a time-weighted average in the worker's breathing zone. Acceptable concentrations for known airborne contaminants will be determined based on OSHA/NIOSH/ACGIH and/or NRC exposure limits. As a guideline, 1/2 the PEL/REL/TLV, whichever is lower should be used.

## 10. EMERGENCY RESPONSE

This section contains additional information pertaining to on-site emergency response and does not duplicate pertinent emergency response information contained in earlier sections of this plan (e.g., site layout, monitoring equipment, etc.). Emergency response procedures will be rehearsed regularly, as applicable, during project activities.

### 10.1 EMERGENCY RESPONSIBILITIES

All Personnel: All personnel shall be alert to the possibility of an on-site emergency; report potential or actual emergency situations to the team leader and SSO; and notify appropriate emergency resources, as necessary.

Team Leader: The team leader will determine the emergency actions to be performed by E & E personnel and will direct these actions. The team leader also will ensure that applicable incidents are reported to appropriate E & E and client project personnel and government agencies.

SSO: The SSO will recommend health/safety and protective measures appropriate to the emergency.

Other: \_\_\_\_\_

### 10.2 LOCAL AND SITE RESOURCES (including phone numbers)

Ambulance: 911 \_\_\_\_\_

Hospital: Humboldt General Hospital \_\_\_\_\_

Directions to Hospital (map attached at the end of this plan): Humboldt General Hospital, 118 N. Haskell St., Winnemucca, NV \_\_\_\_\_

Poison Control: 911 \_\_\_\_\_

Police Department: Winnemucca PD – Winnemucca, NV 475 W. Haskell Road. 775-945-2434 \_\_\_\_\_

Fire Department: Winnemucca FD – Winnemucca, NV 90 W 4<sup>th</sup> Street. 775-623-6396 \_\_\_\_\_

Client Contact: \_\_\_\_\_

Site Contact: \_\_\_\_\_

On-Site Telephone Number: \_\_\_\_\_

Cellular Telephone Number: \_\_\_\_\_

Radios Available: \_\_\_\_\_

Other: \_\_\_\_\_

### 10.3 E & E EMERGENCY CONTACTS

E & E Emergency Operations Center (24 Hours): 716/684-8060

Corporate Health and Safety Director, Dr. Paul Jonmaire: 716/684-8060 (office)  
716/655-1260 (home)

Regional Office Contact: \_\_\_\_\_ (office)  
\_\_\_\_\_ (home)

Other: \_\_\_\_\_ (office)

- a. E & E Emergency Response Center: 716/684-8060
- b. Corporate Health and Safety Director, Dr. Paul Jonnaire: 716/684-8060 (office)  
716/655-1260 (home)
- c. Assistant Corporate Safety Director, Tom Siener, CIH: 716/684-8060 (office)  
716/662-4740 (home)  
716/597-5868 (Cell)

**10.4 OTHER EMERGENCY RESPONSE PROCEDURES**

On-Site Evacuation Signal/Alarm (must be audible and perceptible above ambient noise and light levels): Three car horn blasts.

On-Site Assembly Area: At vehicles.

Emergency Egress Route to Get Off Site: To be determined upon initial viewing of site during 8/2/10 site reconnaissance

Off-Site Assembly Area: Across the street.

Preferred Means of Reporting Emergencies: Call 911

Site Security and Control: In an emergency situation, personnel will attempt to secure the affected area and control site access.

Spill Control Procedures: To be determined upon initial viewing of site during 8/2/10 site reconnaissance

Emergency Decontamination Procedures: Remove and secure any contaminated PPE or clothing. Perform additional gross decontamination or any localized decontamination as necessary. Inform medical personnel of any known or suspected contamination or exposure.

PPE: Personnel will don appropriate PPE when responding to an emergency situation. The SSO and Section 7 of this plan will provide guidance regarding appropriate PPE.

Emergency Equipment: Appropriate emergency equipment is listed in Attachment I. Adequate supplies of this equipment shall be maintained in the support area or other approved work location.

Incident Reporting Procedures: All injuries and/or exposures will be reported to the Regional Safety Coordinator and the Corporate HSD as soon as possible. Affected personnel or the E&E site supervisor will complete an Incident Report and submit to the RSC and Corporate HSD



ATTACHMENT 1

EQUIPMENT/SUPPLIES CHECKLIST

	No.
<b>INSTRUMENTATION</b>	
FID	
Thermal desorber	
O <sub>2</sub> /explosimeter w/cal. Kit	
Photovac tip	
PID (probe: _____ eV)	
Magnetometer	
Pipe locator	
Weather station	
Draeger tube kit (tubes: _____)	
Brunton compass	
Real-time cyanide monitor	
Real-time H <sub>2</sub> S monitor	
Heat stress monitor	
Noise equipment	
Personal sampling pumps and supplies	
MiniRam dust monitor	2
Mercury monitor	1
Spare batteries (type: 9-V _____)	2
<b>RADIATION EQUIPMENT/SUPPLIES</b>	
Documentation forms	
Portable ratemeter	
Scaler/ratemeter	
1" NaI gamma probe	
2" NaI gamma probe	
ZnS alpha probe	
GM pancake probe	
Tungsten-shielded GM probe	
Micro R meter	
Ion chamber	
Alert monitor	
Pocket dosimeter	
Dosimeter charger	
Radiation warning tape	

	No.
Radiation decon supplies	
Spare batteries (type: _____)	
<b>SAMPLING EQUIPMENT</b>	
8-oz. bottles	
Half-gallon bottles	
VOA bottles	
String	
Hand bailers	
Thieving rods with bulbs	
Spoons	
Knives	
Filter paper	
Bottle labels	
<b>MISCELLANEOUS</b>	
Pump	
Surveyor's tape	1
100' Fiberglass tape	
300' Nylon rope	
Nylon string	
Surveying flags	
Camera	1
Film	
Bung wrench	
Soil auger	2
Pick	1
Shovel	1
Catalytic heater	
Propane gas	
Banner tape	
Surveying meter stick	
Chaining pins and ring	
Logbooks ( ___ 1 ___ large, ___ 1 ___ small)	2



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# C

## Standard Operating Procedures



<b>Title:</b>	SOIL SAMPLING
<b>Category:</b>	ENV 3.13
<b>Revised:</b>	August 1997

**STANDARD OPERATING PROCEDURE**

# SOIL SAMPLING

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**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

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## 1. Introduction

This document describes the procedures for the collection of representative soil samples. Representative sampling ensures the accurate characterization of site conditions. Analysis of soil samples may determine pollutant concentrations and the accompanying risks to public health, welfare, or the environment.

## 2. Scope

Included in this discussion are procedures for obtaining representative samples, quality assurance/quality control (QA/QC) measures, proper documentation of sampling activities, and recommendations for personnel safety.

## 3. Method Summary

Soil samples may be recovered using a variety of methods and equipment. These are dependent on the depth of the desired sample, the type of sample required (disturbed vs. undisturbed), and the soil type.

Samples of near-surface soils may be easily obtained using a spade, stainless-steel spoon, trowel, or scoop. Sampling at greater depths may be performed using a hand auger; a power auger; or, if a test pit is required, a backhoe.

All sampling devices should be cleaned using pesticide-grade acetone (assuming that acetone is not a target compound) or methanol, then wrapped in clean aluminum foil, and custody sealed for identification. The sampling equipment should remain in this wrapping until it is needed. Each sampler should be used for one sample only. However, dedicated tools may be impractical if there is a large number of soil samples required. In this case, samplers should be cleaned in the field using standard decontamination procedures as outlined in E & E's Standard Operating Procedure (SOP) for Sampling Equipment Decontamination (see ENV 3.15).

## 4. Sample Preservation, Containers, Handling, and Storage

The chemical preservation of solids is not generally recommended. Refrigeration is usually the best approach, supplemented by a minimal holding time.

Soil samples should be handled according to the procedures outlined in E & E's SOP for Sample Packaging (see ENV 3.16).



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## 5. Potential Problems

Potential problems with soil sampling include cross-contamination of samples and improper sample collection. Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment and bottles. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection is generally the result of the use of contaminated equipment; the disturbance of the matrix, resulting in compaction of the sample; and inadequate homogenization of the sample where required, resulting in variable, nonrepresentative results. Specific advantages and disadvantages of soil sampling equipment are presented in Table 5-1.

**Table 5-1 Soil Sampling Equipment**

Equipment	Applicability	Advantages and Disadvantages
Trier	Soft surface soil	Inexpensive; easy to use and decontaminate; difficult to use in stony, dry, or sandy soil.
Scoop, trowel, spoon, or spatula	Soft surface soil	Inexpensive; easy to use and decontaminate; trowels with painted surfaces should be avoided.
Tulip bulb planter	Soft soil, 0 to 6 inches	Easy to use and decontaminate; uniform diameter and sample volume; preserves soil core (suitable for volatile organic analysis (VOA) and undisturbed sample collection); limited depth capability; not useful for hard soils.
Spade or shovel	Medium soil, 0 to 12 inches	Easy to use and decontaminate; inexpensive; can result in sample mixing and loss of volatile organic compounds (VOCs).
Vehimeyer soil outfit	Soil, 0 to 10 feet	Difficult to drive into dense or hard material; can be difficult to pull from ground.
Soil coring device and auger	Soft soil, 0 to 24 inches	Relatively easy to use; preserves soil core (suitable for VOA and undisturbed sample collection); limited depth capability; can be difficult to decontaminate.
Thin-walled tube sampler	Soft soil, 0 to 10 feet	Easy to use; preserves soil core (suitable for VOA and undisturbed sample collection); may be used to help maintain integrity of VOA samples; easy to decontaminate; can be difficult to remove cores from sampler.
Split-spoon sampler	Soil, 0 inches to bed-rock	Excellent depth range; preserves soil core (suitable for VOA and undisturbed sample collection); acetate sleeve may be used to help maintain integrity of VOA samples; useful for hard soils; often used in conjunction with drill rig for obtaining deep cores.



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**Table 5-1 Soil Sampling Equipment**

Equipment	Applicability	Advantages and Disadvantages
Shelby tube sampler	Soft soil, 0 inches to bedrock	Excellent depth range; preserves soil core (suitable for VOA and undisturbed sample collection); tube may be used to ship sample to lab undisturbed; may be used in conjunction with drill rig for obtaining deep cores and for permeability testing; not durable in rocky soils.
Laskey sampler	Soil, 0 inches to bedrock	Excellent depth range; preserves soil cores; used in conjunction with drill rig for obtaining deep core; can be difficult to decontaminate.
Bucket auger	Soft soil, 3 inches to 10 feet	Easy to use; good depth range; uniform diameter and sample volume; acetate sleeve may be used to help maintain integrity of VOA samples; may disrupt and mix soil horizons greater than 6 inches in thickness.
Hand-operated power auger	Soil, 6 inches to 15 feet	Good depth range; generally used in conjunction with bucket auger for sample collection; destroys soil core (unsuitable for VOA and undisturbed sample collection); requires two or more equipment operators; can be difficult to decontaminate; requires gasoline-powered engine (potential for cross-contamination).
Continuous-flight auger	Soil, 0 inches to bedrock	Excellent depth range; easy to decontaminate; can be used on all soil samples; results in soil mixing and loss of VOCs.
Dutch auger	Designed specifically for wet, fibrous, or rooted soils (e.g., marshes)	
Eijkelcamp stoney soil auger	Stoney soils and asphalt	
Backhoe	Soil, 0 inches to 10 feet	Good depth range; provides visual indications as to depth of contaminants; allows for recovery of samples at specific depths; can result in loss of VOCs and soil mixing; shoring required at depth.

Note: Samplers may not be suitable for soils with coarse fragments.  
 Augers are suitable for soils with limited coarse fragments; only the stoney auger will work well in very gravelly soil.

## 6. Soil Sampling Equipment

### Soil Sampling Equipment List

- Stainless-steel spoon
- Trier
- Scoop
- Trowel



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- Spatula
- Stainless-steel tulip bulb planter
- Spade or shovel
- Vehimeyer soil sampler outfit
  - tubes
  - points
  - drive head
  - drop hammer
  - fuller jack and grip
- Soil-coring device
- Thin-walled tube sampler
- Split-spoon sampler
- Shelby tube sampler
- Laskey sampler
- Bucket auger
- Hand-operated power auger
- Continuous-flight auger
- Dutch auger
- Eijkelcamp stoney soil auger
- Backhoe
- Hand auger with replaceable sleeves

### **Sampling Support Equipment and Documentation List**

- Sampling plan
- Sample location map
- Safety equipment, as specified in the Health and Safety Plan
- Decontamination supplies and equipment, as described in the Work Plan
- Compass
- Tape measure
- Survey stakes or flags
- Camera
- Stainless-steel buckets or bowls
- Sample containers, precleaned (e.g., I-Chem)
- Logbook
- Chain-of-custody forms
- Plastic sheet
- Soil gas probes
- Infiltrometer
- Pounding sleeve
- Extension rods
- T-handle



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## Labeling, Packaging, and Shipping Supplies

- Coolers
- Labels for sample containers and coolers (e.g., “fragile”)
- Ice
- Plastic bags for sample containers and ice
- ESC paint cans and clamps for polychlorinated biphenyl sampling
- Vermiculite (only if certified asbestos free) or other absorbent
- Duct and strapping tape
- Federal Express airbills and pouches

## 6.1 Geophysical Equipment

Geophysical techniques can be integrated with field analytical and soil sampling equipment to help define areas of subsurface contamination. For a description of the geophysical techniques and associated applications, refer to E & E’s SOP for Surface Geophysical Techniques (see GEO 4.2).

## 7. Reagents

This procedure does not require the use of reagents except for decontamination of equipment, as required. Refer to E & E’s SOP for Sampling Equipment Decontamination (see ENV 3.15) and the Site-Specific Work Plan for proper decontamination procedures and appropriate solvents.

## 8. Procedures

### 8.1 Office Preparation

1. The preparation of a Health and Safety Plan is required prior to any sampling. The plan must be approved and signed by the Corporate Health and Safety Officer or his/her designee (i.e., the Regional Safety Coordinator).
2. Prepare a Sampling Plan to meet the data quality objectives of the project in accordance with contract requirements. Review available background information (i.e., topographic maps, soil survey maps, geologic maps, other site reports, etc.) to determine the extent of the sampling effort, the sampling method to be employed, and the type and amounts of equipment and supplies required.
3. Obtain necessary sampling and monitoring equipment (see Section 6), decontaminate or preclean the equipment, and ensure that it is in working order.



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4. Contact the delivery service to confirm the ability to ship all equipment and samples. Determine whether shipping restrictions exist.
5. Prepare schedules and coordinate with staff, clients, and regulatory agencies, if appropriate.

## 8.2 Field Preparation

1. Identify local suppliers of sampling expendables (e.g., ice and plastic bags) and overnight delivery services (e.g., Federal Express).
2. Decontaminate or preclean all equipment before soil sampling, as described in E & E's SOP for Sampling Equipment Decontamination (see ENV 3.15), or as deemed necessary.
3. A general site survey should be performed prior to site entry in accordance with the Health and Safety Plan, followed by a site safety meeting.
4. Identify and stake all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations will be utility-cleared by the property owner or field team prior to soil sampling.

## 8.3 Representative Sample Collection

The objective of representative sampling is to ensure that a sample or group of samples adequately reflects site conditions.

### 8.3.1 Sampling Approaches

It is important to select an appropriate sampling approach for accurate characterization of site conditions. Each approach is defined below. Table 8-1 summarizes the following sampling approaches and ranks them from most to least suitable based on the sampling objective.

#### 8.3.1.1 Judgmental Sampling

Judgmental sampling is based on the subjective selection of sampling locations relative to historical site information, on-site investigation (site walk-over), etc. There is no randomization associated with this sampling approach because samples are collected primarily at areas of suspected highest contaminant concentrations. Therefore, any statistical calculations based on the sampling results would be unfairly biased.



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**Table 8-1 Representative Sampling Approach Comparison**

Sampling Objective	Judgmental	Random	Stratified Random	Systematic Grid	Systematic Random	Search	Transect
Establish Threat	1	4	3	2 <sup>a</sup>	3	3	2
Identify Sources	1	4	2	2 <sup>a</sup>	3	2	3
Delineate Extent of Contamination	4	3	3	1 <sup>b</sup>	1	1	1
Evaluate Treatment and Disposal Options	3	3	1	2	2	4	2
Confirm Cleanup	4	1 <sup>c</sup>	3	1 <sup>b</sup>	1	1	1 <sup>c</sup>

- 1 Preferred approach.
- 2 Acceptable approach.
- 3 Moderately acceptable approach.
- 4 Least acceptable approach.
- a Should be used with field analytical screening.
- b Preferred only where known trends are present.
- c Allows for statistical support of cleanup verification if sampling over entire site.

### 8.3.1.2 Random Sampling

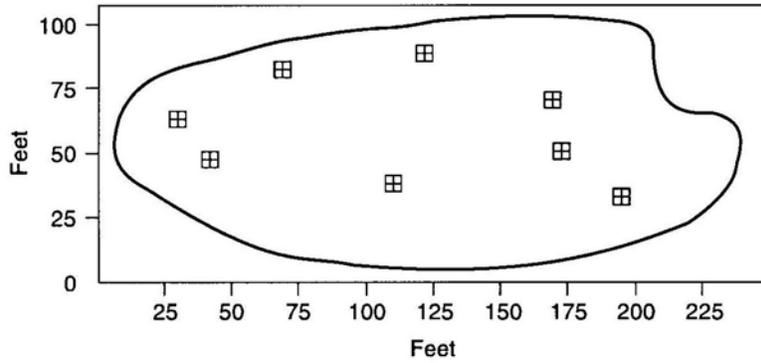
Random sampling involves the arbitrary collection of samples within a defined area. Refer to EPA 1984 and EPA 1989 for a random number table and guidelines on selecting sample coordinates. The arbitrary selection of sample locations requires each sample location to be chosen independently so that results in all locations within the area of concern have an equal chance of being selected. To facilitate statistical probabilities of contaminant concentration, the area of concern must be homogeneous with respect to the parameters being monitored. Thus, the higher the degree of heterogeneity, the less the random sampling approach will reflect site conditions (see Figure 8-1).

### 8.3.1.3 Stratified Random Sampling

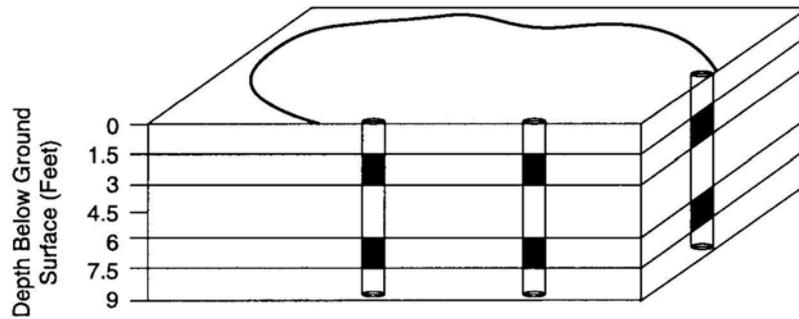
Stratified random sampling relies primarily on historical information and prior analytical results to divide the area of concern into smaller sampling areas, or “strata.” Strata can be defined by several factors, including sampling depth, contaminant concentration levels, and contaminant source areas. Sampling locations should be selected within a strata using random selection procedures (see Figure 8-2).

### 8.3.1.4 Systematic Grid Sampling

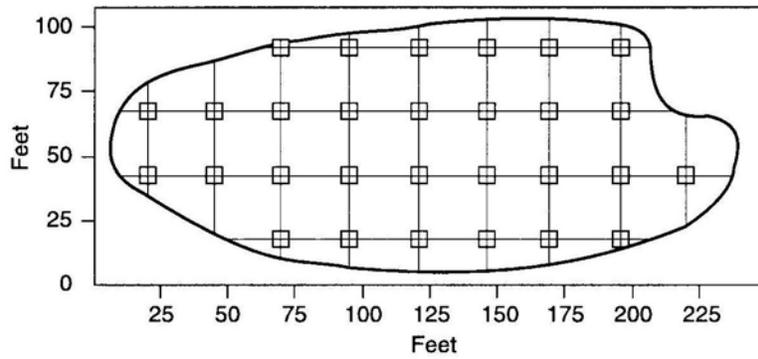
Systematic grid sampling involves the division of the area of concern into smaller sampling areas using a square or triangular grid. Samples are then collected from the intersections of the grid lines, or “nodes.” The origin and direction for placement of the grid should be selected by using an initial random point. The distance between nodes is dependent upon the size of the area of concern and the number of samples to be collected (see Figure 8-3).



**Figure 8-1 Random Sampling\*\***



**Figure 8-2 Stratified Random Sampling**



**Figure 8-3 Systematic Grid Sampling\*\***

\*\* After EPA, February 1989

Legend	
—	Sample Area Boundary
⊠	Selected Sample Location
■	Sample Location



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### 8.3.1.5 Systematic Random Sampling

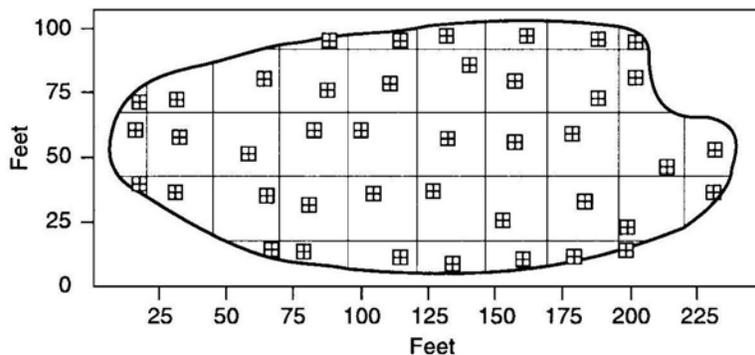
Systematic random sampling involves dividing the area of concern into smaller sampling areas as described in Section 8.3.1.4. Samples are collected within each grid cell using random selection procedures (see Figure 8-4).

### 8.3.1.6 Biased-Search Sampling

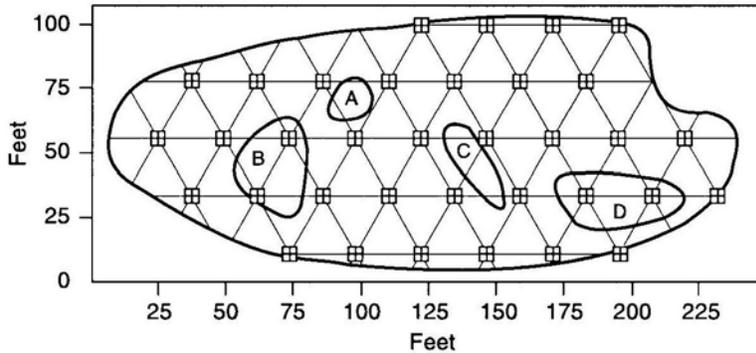
Search sampling utilizes a systematic grid or systematic random sampling approach to define areas where contaminants exceed cleanup standards (i.e., hot spots). The distance between the grid lines and number of samples to be collected are dependent upon the acceptable level of error (i.e., the chance of missing a hot spot). This sampling approach requires that assumptions be made regarding the size, shape, and depth of hot spots (see Figure 8-5).

### 8.3.1.7 Transect Sampling

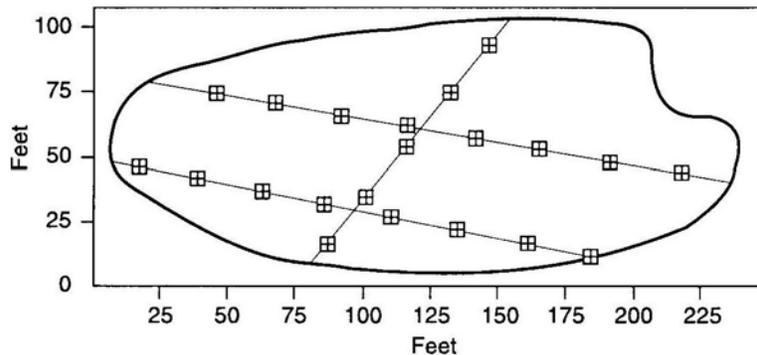
Transect sampling involves establishing one or more transect lines, parallel or nonparallel, across the area of concern. If the lines are parallel, this sampling approach is similar to systematic grid sampling. The advantage of transect sampling over systematic grid sampling is the relative ease of establishing and relocating transect lines as opposed to an entire grid. Samples are collected at regular intervals along the transect line at the surface and/or at a specified depth(s). The distance between the sample locations is determined by the length of the line and the number of samples to be collected (see Figure 8-6).



**Figure 8-4 Systematic Random Sampling**

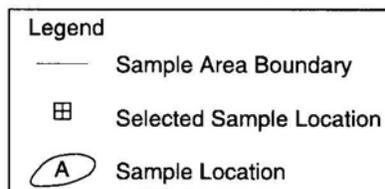


**Figure 8-5 Search Sampling**



**Figure 8-6 Transect Sampling**

After EPA, February 1989



### 8.3.2 Surface Soil Samples

Collection of samples from near-surface soil can be accomplished with tools such as spades, spoons, shovels, and scoops. The surface material can be removed to the required depth with this equipment; stainless-steel or plastic scoops can then be used to collect the sample.

This method can be used in most soil types, but is limited to sampling near-surface areas. Accurate, representative samples can be collected with this procedure, depending on the care and precision demonstrated by the sampling technician. The use of a flat, pointed mason trowel to cut a block of the desired soil can be helpful when undisturbed profiles are required (e.g., for volatile organic analyses [VOAs]). A stainless-steel scoop, lab spoon, or plastic spoon will suf-



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fice in most other applications. Care should be exercised to avoid the use of devices plated with chrome or other materials, as is common with garden implements such as potting trowels.

Soil samples are collected using the following procedure:

1. Carefully remove the top layer of soil to the desired sample depth with a precleaned spade;
2. Using a precleaned, stainless-steel scoop, spoon, trowel, or plastic spoon, remove and discard the thin layer of soil from the area that came into contact with the shovel;
3. Transfer the sample into an appropriate container using a stainless-steel or plastic lab spoon or equivalent. If composite samples are to be collected, place the soil sample in a stainless-steel or plastic bucket and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Place the soil samples into labeled containers. (**Caution: Never composite VOA samples**);
4. VOA samples should be collected directly from the bottom of the hole before mixing the sample to minimize volatilization of contaminants;
5. Check to ensure that the VOA vial Teflon liner is present in the cap, if required. Fill the VOA vial fully to the top to reduce headspace. Secure the cap tightly. The chemical preservation of solids is generally not recommended. Refrigeration is usually the best approach, supplemented by a minimal holding time;
6. Ensure that a sufficient sample size has been collected for the desired analysis, as specified in the Sampling Plan;
7. Decontaminate equipment between samples according to E & E's SOP for Sampling Equipment Decontamination (see ENV 3.15); and
8. Fill in the hole and replace grass turf, if necessary.

QA/QC samples should be collected as specified, according to the Work Plan.

### 8.3.3 Sampling at Depth with Augers and Thin-Walled Tube Samplers

This system consists of an auger, a series of extensions, a T-handle, and a thin-walled tube. The auger is used to bore a hole to a desired sampling depth and is then withdrawn. The auger tip is then replaced with a tube core sampler, lowered down the borehole, and driven into the soil to the completion depth. The core is then withdrawn and the sample is collected.

Several augers are available, including bucket type, continuous-flight (screw), and post-hole augers. Because they provide a large volume of sample in a short time, bucket types are better for direct sample recovery. When continuous-flight augers are used, the sample can be collected directly off the flights, usually at 5-foot intervals. The continuous-flight augers are sat-



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isfactory for use when a composite of the complete soil column is desired. Posthole augers have limited utility for sample collection because they are designed to cut through fibrous, rooted, swampy soil.

The following procedures will be used for collecting soil samples with the hand 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, and litter). It may be advisable to remove the first 3 to 6 inches of surface soil from an area approximately 6 inches in radius around the drilling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a canvas or 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 boring. When sampling directly from the auger, collect the sample after the auger is removed from the boring and proceed to Step 11.
5. A precleaned stainless-steel auger sleeve can also be used to collect a sample. After reaching the desired sampling depth, remove the auger and place the sleeve inside the auger. Collect the sample with the auger. Remove the auger from the boring. The sample will be collected only from the sleeve. The soil from the auger tip should never be used for the sample.
6. Remove the auger tip from the drill rods and replace with a precleaned thin-walled tube sampler. Install the proper cutting tip.
7. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring, because the vibrations may cause the boring walls to collapse.
8. Remove the tube sampler and unscrew the drill rods.
9. Remove the cutting tip and core from the device.
10. Discard the top of the core (approximately 1 inch), because this represents material collected before penetration of the layer in question. Place the remaining core into the sample container.



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11. If required, ensure that a Teflon liner is present in the cap. Secure the cap tightly onto the sample container. Place the sample bottle in a plastic bag and put on ice to keep the sample at 4°Celsius.
12. Carefully and clearly label the container with the appropriate sample tag, addressing all the categories or parameters listed in E & E's SOP for Sample Packaging and Shipping (see ENV 3.16).
13. Use the chain-of-custody form to document the types and numbers of soil samples collected and logged. Verify that the chain-of-custody form is correctly and completely filled out.
14. Record the time and date of sample collection, as well as a description of the sample, in the field logbook.
15. If another sample is to be collected in the sample hole, but at a greater depth, re-attach 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.
16. Abandon the hole according to applicable regulations. Generally, shallow holes can simply be backfilled with the removed soil material.
17. Decontaminate the sampling equipment per E & E's SOP for Sampling Equipment Decontamination (see ENV 3.15).

### **8.3.4 Sampling at Depth with a Trier**

1. Insert the trier into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes the spillage of sample material. Extraction of samples may require tilting of the containers.
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. Transfer the sample into a suitable container with the aid of a spatula and brush.
5. If required, ensure that a Teflon liner is present in the cap. Secure the cap tightly onto the sample container. Samples are handled in accordance with E & E's SOP for Sample Packaging and Shipping (see ENV 3.16).
6. Carefully and clearly label the container with the appropriate sample tag, addressing all the categories or parameters listed in E & E's SOP for Sample Packaging and Shipping (see ENV 3.16).



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7. Use the chain-of-custody form to document the types and numbers of soil samples collected and logged.
8. Record the time and date of sample collection as well as a description of the sample and any associated air monitoring measurements in the field logbook.
9. Abandon the hole according to applicable regulations. Generally, shallow holes can simply be backfilled with the removed soil material.
10. Decontaminate sampling equipment per E & E's SOP for Sampling Equipment Decontamination (see ENV 3.15).

### **8.3.5 Sampling at Depth with a Split-Spoon (Barrel) Sampler**

The procedure for split-spoon sampling describes the extraction of undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be sampled to give a complete soil column, 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 extraction.

This sampling device may be used to collect information such as soil density. All work should be performed in accordance with American Society for Testing and Materials (ASTM) D 1586-84, *Penetration Test and Split Barrel Sampling of Soils*.

1. Assemble the sampler by aligning both sides of the barrel and then screwing the bit on the bottom and the heavier head piece on top. Install a retaining cap in the head piece if necessary.
2. Place the sampler in a perpendicular position on the sample material.
3. Using a sledge hammer or well ring, if available, drive the tube. Do not drive past the bottom of the head piece because compression of the sample will result.
4. Record 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 split spoon and open by unscrewing the bit and head. If a split sample is desired, a clean stainless-steel knife should be used to divide the tube contents in half, lengthwise. This sampler is available in 2- and 3.5-inch diameters. The required sample volume may dictate the use of the larger barrel. If needed, stainless-steel or Teflon sleeves can be used inside the split-spoon. If sleeves removed from the split-spoon are capped immediately, volatilization of contaminants can be reduced. When split-spoon sampling is performed to gain geologic information, all work should be performed in accordance with ASTM D 1586-67 (reapproved in 1974).



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6. Cap the sample container, place in a double plastic bag, and attach the label and custody seal. Record all pertinent data in the field logbook and complete the sample analysis request form and chain-of-custody record before collecting the next sample.
7. If required, preserve or place the sample on ice.
8. Follow proper decontamination procedures and deliver samples to the laboratory for analysis.

### 8.3.6 Test Pit/Trench Excavation

These relatively large excavations are used to remove sections of soils when detailed examination of soil characteristics (horizontal, structure, color, etc.) is required. It is the least cost-effective sampling method because of the relatively high cost of backhoe operation.

1. Prior to any excavations with a backhoe, it is important to ensure that all sampling locations are clear of utility lines and poles (subsurface as well as above surface).
2. Using the backhoe, a trench is dug to approximately 3 feet in width and approximately 1 foot below the cleared sampling depth. Place removed or excavated soils on canvas or plastic sheets, if necessary. Trenches greater than 4 feet deep must be sloped or protected by a shoring system, as required by Occupational Safety and Health Administration (OSHA) regulations.
3. A shovel is used to remove a 1- to 2-inch layer of soil from the vertical face of the pit where sampling is to be done.
4. Samples are collected 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 soil for sampling. Samples are removed and placed in an appropriate container.
5. If required, ensure that a Teflon liner is present in the cap. Secure the cap tightly onto the sample container. Samples are handled in accordance with E & E's SOP for Sample Packaging and Shipping (see ENV 3.16).
6. Carefully and clearly label the container with the appropriate sample tag, addressing all the categories or parameters listed in E & E's SOP for Sample Packaging and Shipping (see ENV 3.16).
7. Use the chain-of-custody form to document the types and numbers of soil samples collected and logged.
8. Record the time and date of sample collection as well as a description of the sample and any associated air monitoring measurements in the field logbook.



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9. Abandon the hole according to applicable state regulations. Generally, excavated holes can simply be backfilled with the removed soil material.
10. Decontaminate sampling equipment, including the backhoe bucket, per E & E's SOP for Sampling Equipment Decontamination (see ENV 3.15).

## 8.4 Sample Preparation

In addition to sampling equipment, representative sample collection includes sample quantity, volume, preservation, and holding time (see Table 8-2). *Sample preparation* refers to all aspects of sample handling after collection. How a sample is prepared can affect its representativeness. For example, homogenizing can result in a loss of volatiles and is therefore inappropriate when volatile contaminants are the concern.

### 8.4.1 Sample Quantity and Volume

The volume and number of samples necessary for site characterization will vary according to the budget, project schedule, and sampling approach.

### 8.4.2 Sample Preservation and Holding Time

Sample preservation and holding times are as discussed in Section 4.

### 8.4.3 Removing Extraneous Material

Discard materials in a sample that are not relevant for site or sample characterization (e.g., glass, rocks, and leaves), because their presence may introduce an error in analytical procedures.

### 8.4.4 Homogenizing Samples

Homogenizing is the mixing of a sample to provide a uniform distribution of the contaminants. Proper homogenization ensures that the containerized samples are representative of the total soil sample collected. All samples to be composited or split should be homogenized after all aliquots have been combined. Do not homogenize samples for volatile compound analysis.

**Table 8-2 Standard Sampling Holding Times, Preservation Methods, and Volume Requirements**

Protocol Parameter	Holding Time		Minimum Volume Required		Container Type		Preservation	
	Soil	Water	Soil	Water	Soil	Water	Soil	Water
<b>SW-846</b>								
VOA <sup>e</sup>	14 days from date sampled	14 days from date sampled	15 g	One 40-mL vial; no air space	Two 40-mL vials; no air space	Two 40-mL vials; no air space	Cool to 4°C (ice in cooler)	Add HCl until pH <2 and cool to 4° (ice in cooler)
Semi-VOA (BNAs) <sup>e</sup>	14 days to extract from date sampled	7 days to extract from date sampled	30 g	1 L	8-oz. glass jar with Teflon-lined cap	½-gallon amber glass bottle	Cool to 4°C (ice in cooler)	Cool to 4°C (ice in cooler)
PCBs <sup>d,e</sup>	14 days to extract from date sampled	7 days to extract from date sampled	30 g	1 L	4-oz. glass jar with Teflon-lined cap	½-gallon amber glass bottle	Cool to 4°C (ice in cooler)	Cool to 4°C (ice in cooler)
Pesticides/PCBs <sup>d,e</sup>	14 days to extract from date sampled	7 days to extract from date sampled	30 g	1 L	8-oz. glass jar with Teflon-lined cap	½-gallon amber glass bottle	Cool to 4°C (ice in cooler)	Cool to 4°C (ice in cooler)
Metals <sup>c</sup>	6 months from date sampled	6 months from date sampled	10 g	300 mL	8-oz. glass jar with Teflon-lined cap	1-L polyethylene bottle with polyethylene-lined cap	Cool to 4°C (ice in cooler)	Add HNO <sub>3</sub> until pH <2 and cool to 4°C (ice in cooler)
Cyanide <sup>c</sup>	14 days from date sampled	14 days from date sampled	10 g	100 mL	8-oz. glass jar with Teflon-lined cap	1-L polyethylene bottle with polyethylene-lined cap	Cool to 4°C (ice in cooler)	Add NaOH until pH >12 and cool to 4°C (ice in cooler)
Hexavalent chromium <sup>a</sup>	24 hours from time sampled	24 hours from time sampled	10 g	50 mL	8-oz. glass jar with Teflon-lined cap	125-mL polyethylene bottle with polyethylene-lined cap	Cool to 4°C (ice in cooler)	Cool to 4°C (ice in cooler)
Total Organic Carbon (TOC) <sup>a</sup>	NA	28 days from date sampled	5 g	10 mL	8-oz. glass jar with Teflon-lined cap	125-mL polyethylene bottle with polyethylene-lined cap	Cool to 4°C (ice in cooler)	Add H <sub>2</sub> SO <sub>4</sub> until pH <2 and cool to 4°C (ice in cooler)
Total Organic Halides (TOX)	NA	7 days from date sampled	100 g	200 mL	8-oz. glass jar with Teflon-lined cap	1-L amber glass bottle	Cool to 4°C (ice in cooler)	Add H <sub>2</sub> SO <sub>4</sub> until pH <2 and cool to 4°C (ice in cooler)


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**Table 8-2 Standard Sampling Holding Times, Preservation Methods, and Volume Requirements**

Protocol Parameter	Holding Time		Minimum Volume Required		Container Type		Preservation	
	Soil	Water	Soil	Water	Soil	Water	Soil	Water
Total Recoverable Petroleum Hydrocarbons <sup>e</sup>	28 days from date sampled	28 days from date sampled	50 g	1 L	8-oz. glass jar with Teflon-lined cap	1-L amber glass bottle	Cool to 4°C (ice in cooler)	Add H <sub>2</sub> SO <sub>4</sub> until pH <2 and cool to 4°C (ice in cooler)
<b>EPA-CLP</b>								
VOA <sup>e</sup>	10 days from date received	10 days from date received	15 g	One 40-mL vial; no air space	Two 40-mL vials; no air space	Two 40-mL vials; no air space	Cool to 4°C (ice in cooler)	Add HCl until pH <2 and cool to 4°C (ice in cooler)
Semi-VOA (BNAs) <sup>e</sup>	10 days to extract from date received	5 days to extract from date received	30 g	1 L	8-oz. glass jar with Teflon-lined cap	½-gallon amber glass bottle	Cool to 4°C (ice in cooler)	Cool to 4°C (ice in cooler)
PCBs <sup>d,e</sup>	10 days to extract from date received	5 days to extract from date received	30 g	1 L	4-oz. glass jar with Teflon-lined cap	½-gallon amber glass bottle	Cool to 4°C (ice in cooler)	Cool to 4°C (ice in cooler)
Pesticides/PCBs <sup>d,e</sup>	10 days to extract from date received	5 days to extract from date received	30 g	1 L	8-oz. glass jar with Teflon-lined cap	½-gallon amber glass bottle	Cool to 4°C (ice in cooler)	Cool to 4°C (ice in cooler)
Metals <sup>c</sup>	6 months from date sampled	6 months from date sampled	10 g	300 mL	8-oz. glass jar with Teflon-lined cap	1-L polyethylene bottle with polyethylene-lined cap	Cool to 4°C (ice in cooler)	Add HNO <sub>3</sub> to pH <2 and cool to 4°C (ice in cooler)
Cyanide <sup>c</sup>	12 days from date received	12 days from date received	10 g	100 mL	8-oz. glass jar with Teflon-lined cap	1-L polyethylene bottle with polyethylene-lined cap	Cool to 4°C (ice in cooler)	Add NaOH to pH >12 and cool to 4°C (ice in cooler)
<b>NYSDEC-CLP</b>								
VOA <sup>e</sup>	7 days from date received	10 days from date received	15 g	One 40-mL vial; no air space	Two 40-mL vials; no air space	Two 40-mL vials; no air space	Cool to 4°C (ice in cooler)	Add HCl until pH <2 and cool to 4°C (ice in cooler)
Semi-VOA (BNAs) <sup>e</sup>	5 days to extract from date received	5 days to extract from date received	30 g	1 L	8-oz. glass jar with Teflon-lined cap	½-gallon amber glass bottle	Cool to 4°C (ice in cooler)	Cool to 4°C (ice in cooler)



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**Table 8-2 Standard Sampling Holding Times, Preservation Methods, and Volume Requirements**

Protocol Parameter	Holding Time		Minimum Volume Required		Container Type		Preservation	
	Soil	Water	Soil	Water	Soil	Water	Soil	Water
PCBs <sup>d,e</sup>	5 days to extract from date received	5 days to extract from date received	30 g	1 L	4-oz. glass jar with Teflon-lined cap	½-gallon amber glass bottle	Cool to 4°C (ice in cooler)	Cool to 4°C (ice in cooler)
Pesticides/PCBs <sup>d,e</sup>	5 days to extract from date received	5 days to extract from date received	30 g	1 L	8-oz. glass jar with Teflon-lined cap	½-gallon amber glass bottle	Cool to 4°C (ice in cooler)	Cool to 4°C (ice in cooler)
Metals <sup>c</sup>	6 months from date sampled	6 months from date sampled	10 g	300 mL	8-oz. glass jar with Teflon-lined cap	1-L polyethylene bottle with polyethylene-lined cap	Cool to 4°C (ice in cooler)	Add HNO <sub>3</sub> to pH <2 and cool to 4°C (ice in cooler)
Cyanide <sup>c</sup>	12 days from date received	12 days from date received	10 g	100 mL	8-oz. glass jar with Teflon-lined cap	1-L polyethylene bottle with polyethylene-lined cap	Cool to 4°C (ice in cooler)	Add NaOH to pH >12 and cool to 4°C (ice in cooler)
<b>EPA Water and Waste</b>								
Total Dissolved Solids (TDS)	NA	7 days from date sampled	NA	200 mL	NA	1-L polyethylene bottle with polyethylene-lined cap	NA	Cool to 4°C (ice in cooler)

Note: All sample bottles will be prepared in accordance with EPA bottle-washing procedures. These procedures are incorporated in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, July 1987.

- <sup>a</sup> Technical requirements for sample holding times have been established for water matrices only. However, they are also suggested for use as guidelines in evaluating soil data.
- <sup>b</sup> Holding time for GC/MS analysis is 7 days if samples are not preserved.
- <sup>c</sup> Maximum holding time for mercury is 28 days from time sampled.
- <sup>d</sup> If one container has already been collected for PCB analysis, then only one additional container need be collected for extractable organic, BNA, or pesticides/PCB analysis.
- <sup>e</sup> Extra containers required for MS/MSD.

Key:

NA = Not applicable.



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### 8.4.5 Compositing Samples

Compositing is the process of physically combining and homogenizing several individual soil aliquots of the same volume or weight. Compositing samples provides an average concentration of contaminants over a certain number of sampling points. Compositing dilutes high-concentration aliquots; therefore, detection limits should be reduced accordingly. If the composite area is heterogeneous in concentration and its composite value is to be compared to a particular action level, then that action level must be divided by the total number of aliquots making up the composite for accurate determination of the detection limit.

### 8.4.6 Splitting Samples

Splitting samples (after preparation) is performed when multiple portions of the same samples are required to be analyzed separately. Fill the sample containers simultaneously with alternate spoonfuls of the homogenized sample (see Figure 8-7).

## 8.5 Post-Operations

### 8.5.1 Field

Decontaminate all equipment according to E & E's SOP for Sampling Equipment Decontamination (see ENV 3.15).

### 8.5.2 Office

Organize field notes into a report format and transfer logging information to appropriate forms.

## 9. Calculations

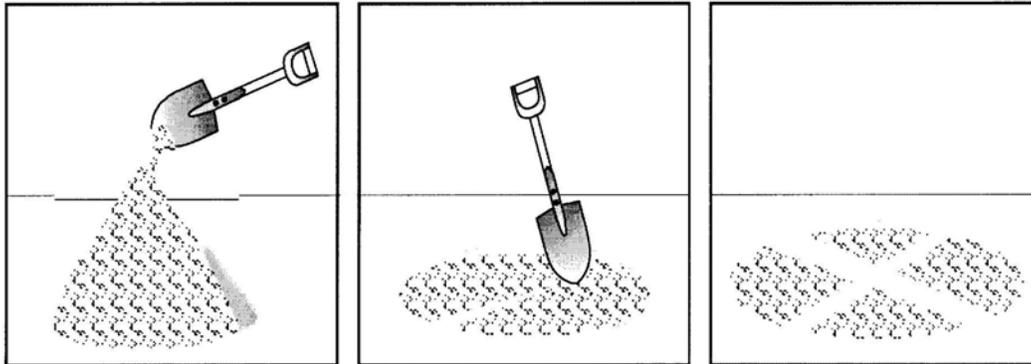
There are no specific calculations required for these procedures.

## 10. Quality Assurance/Quality Control

The objective of QA/QC is to identify and implement methodologies that limit the introduction of error into sampling and analytical procedures.



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**Step 1:**

- Cone Sample on hard, clean surface
- Mix by forming new cone

**Step 2:**

- Quarter after flattening cone

**Step 3:**

- Divide sample into quarters

**Step 4:**

- Remix opposite quarters
- Reform cone
- Repeat a minimum of 5 times

**After:** ASTM Standard C702-87

**Figure 8-7** Quartering to Homogenized and Split Samples

## 10.1 Sampling Documentation

### 10.1.1 Soil Sample Label

All soil samples shall be documented in accordance with E & E's SOP for Sample Packaging and Shipping (see ENV 3.16). The soil sample label is filled out prior to collecting the sample and should contain the following:

1. Site name or identification.
2. Sample location and identifier.
3. Date samples were collected in a day, month, year format (e.g., 03 Jan 88 for January 3, 1988).
4. Time of sample collection, using 24-hour clock in the hours:minutes format.
5. Sample depth interval. Units used for depths should be in feet and tenths of feet.
6. Preservatives used, if any.
7. Analysis required.



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8. Sampling personnel.
9. Comments and other relevant observations (e.g., color, odor, sample technique).

### 10.1.2 Logbook

A bound field notebook will be maintained by field personnel to record daily activities, including sample collection and tracking information. A separate entry will be made for each sample collected. These entries should include information from the sample label and a complete physical description of the soil sample, including texture, color (including notation of soil mottling), consistency, moisture content, cementation, and structure.

### 10.1.3 Chain of Custody

Use the chain-of-custody form to document the types and numbers of soil samples collected and logged. Refer to E & E's SOP for Sample Packaging and Shipping (see ENV 3.16) for directions on filling out this form.

## 10.2 Sampling Design

1. Sampling situations vary widely; thus, no universal sampling procedure can be recommended. However, a Sampling Plan should be implemented before any sampling operation is attempted, with attention paid to contaminant type and potential concentration variations.
2. Any of the sampling methods described here should allow a representative soil sample to be obtained, if the Sampling Plan is properly designed.
3. Consideration must also be given to the collection of a sample representative of all horizons present in the soil. Selection of the proper sampler will facilitate this procedure.
4. A stringent QA Project Plan should be outlined before any sampling operation is attempted. This should include, but not be limited to, properly cleaned samplers and sample containers, appropriate sample collection procedures, chain-of-custody procedures, and QA/QC samples.

## 11. Data Validation

The data generated will be reviewed according to the QA/QC considerations that are identified in Section 10.



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## 11.1 Quality Assurance/Quality Control Samples

QA/QC samples are used to identify error due to sampling and/or analytical methodologies and chain-of-custody procedures.

### 11.1.1 Field Duplicates (Replicates)

Field duplicates are collected from one location and treated as separate samples throughout the sample handling and analytical processes. These samples are used to assess total error for critical samples with contaminant concentrations near the action level.

### 11.1.2 Collocated Samples

Collocated samples are generally collected 1.5 to 3.0 feet away from selected field samples to determine both local soil and contaminant variations on site. These samples are used to evaluate site variation within the immediate vicinity of sample collection.

### 11.1.3 Background Samples

Background or “clean” samples are collected from an area upgradient from the contamination area and representative of the typical conditions. These samples provide a standard for comparison of on-site contaminant concentration levels.

### 11.1.4 Rinsate (Equipment) Blanks

Rinsate blanks are collected by pouring analyte-free water (i.e., laboratory de-ionized water) on decontaminated sampling equipment to test for residual contamination. These samples are used to assess potential cross contamination due to improper decontamination procedures.

### 11.1.5 Performance Evaluation Samples

Performance evaluation samples are generally prepared by a third party, using a quantity of analyte(s) known to the preparer but unknown to the laboratory. The percentage of analyte(s) identified in the sample is used to evaluate laboratory procedural error.

### 11.1.6 Matrix Spike/Matrix Spike Duplicates (MS/MSDs)

MS/MSD samples are spiked in the laboratory with a known quantity of analyte(s) to confirm percent recoveries. They are primarily used to check sample matrix interferences.

### 11.1.7 Field Blanks

Field blanks are prepared in the field with certified clean sand, soil, or water. These samples are used to evaluate contamination error associated with sampling methodology and laboratory procedures.



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### 11.1.8 Trip Blanks

Trip blanks are prepared prior to going into the field using certified clean sand, soil, or water. These samples are used to assess error associated with sampling methodology and analytical procedures for volatile organics.

## 12. Health and Safety

### 12.1 Hazards Associated with On-Site Contaminants

Depending on site-specific contaminants, various protective programs must be implemented prior to soil sampling. The site Health and Safety Plan should be reviewed with specific emphasis placed on a protection program planned for direct-contact tasks. Standard safe operating practices should be followed, including minimization of contact with potential contaminants in both the vapor phase and solid matrix by using both respirators and disposable clothing.

Use appropriate safe work practices for the type of contaminant expected (or determined from previous sampling efforts):

- Particulate or Metals Contaminants
  - Avoid skin contact with, and ingestion of, soils and dusts.
  - Use protective gloves.
  
- Volatile Organic Contaminants
  - Pre-survey the site with an HNu 101 or OVA 128 prior to collecting soil samples.
  - 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.

## 13. References

ASTM D 1586-67 (reapproved 1974), ASTM Committee on Standards, Philadelphia, PA.

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

U.S. Environmental Protection Agency (EPA), 1984, *Characterization of Hazardous Waste Sites – A Methods Manual: Volume II, Available Sampling Methods*, (2nd ed.), 1984, EPA-600/4-84-076.

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\_\_\_\_\_, 1984, *Characterization of Hazardous Waste Sites – A Methods Manual: Volume I, Site Investigations*, Section 7: Environmental Monitoring Systems Laboratory, Las Vegas, Nevada, EPA/600/4-84/075.

\_\_\_\_\_, February 1989, *Methods for Evaluating the Attainment of Cleanup Standards: Volume I, Soils and Solid Media*, EPA/230/02-89/042.



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## A SAMPLING AUGERS

### A. Sampling Augers



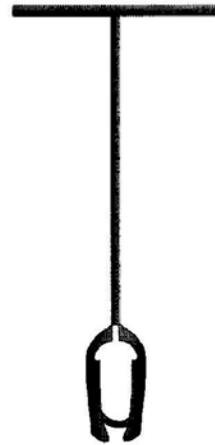
(a)  
Ship Auger



(b)  
Closed-Spiral Auger



(c)  
Open-Spiral Auger

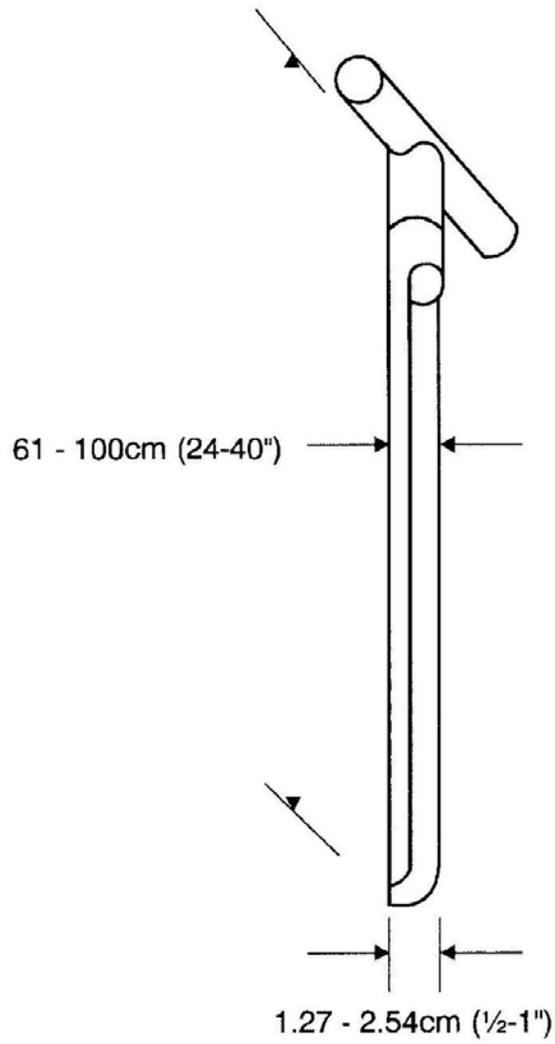


(d)  
Iwan Auger



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### B SAMPLING TRIER





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### C SPLIT-SPOON SAMPLER

