# Appendix D
# Interim Removal Action Reports

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# Interim Removal Action Reports

## Contents

This appendix contains copies of the following Interim Removal Action reports:

- *Removal Action Completion Report* (Brown and Caldwell, 2007)
- *Iron King Mine – Humboldt Smelter Assessment Report, Dewey-Humboldt, Yavapai County, Arizona* (Ecology and Environment, Inc., 2011)
- *Iron King Mine – Humboldt Smelter Removal Report, Dewey-Humboldt, Yavapai County, Arizona* (Ecology and Environment, Inc., 2012)
- *Addendum to Iron King Mine – Humboldt Smelter Removal Report* (Ecology and Environment, Inc., 2013)
- *Technical Memorandum: Accelerated Residential Sampling, Iron King Mine and Humboldt Smelter Superfund Site, Dewey-Humboldt, Arizona* (Lockheed Martin SERAS, 2013c)

# D1. Removal Action Completion Report (Brown and Caldwell, 2007)

# POOR LEGIBILITY

ONE OR MORE PAGES IN THIS DOCUMENT ARE DIFFICULT TO READ
DUE TO THE QUALITY OF THE ORIGINAL

# REMOVAL ACTION COMPLETION REPORT

Prepared for
Ironite Products Company
Humboldt, Arizona

September 25, 2007

VOLUME 1 OF 2

BROWN AND CALDWELL

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September 27, 2007

BROWN AND CALDWELL

Mr. Harry Allen
Federal On-Scene Coordinator
Superfund Division, SFD-9-2
EPA Region 9
75 Hawthorne Street
San Francisco, California 94105

15-130508

Subject: Final Report, Humboldt Removal Action, Humboldt, Arizona
EPA Region 9
CERCLA Docket No. 2006-13

Dear Mr. Allen:

Brown and Caldwell, on behalf of Ironite Products Company, is submitting two copies of the final report for the referenced project. The final report conforms to the requirements of Section VIII.20 of the United States Environmental Protection Agency, Region 9 (EPA) Administrative Settlement Agreement and Order on Consent for Removal Action (Settlement Agreement), dated May 12, 2006.

Based on Brown and Caldwell's estimate to date, the cost to comply with the settlement agreement is $361,000. This estimate includes $185,000 of Brown and Caldwell's; $145,000 of Philip Transportation and Remediation's; $20,000 of resident relocations'; and $11,000 of backfill material's costs.

In accordance with Section XXIX.78 of the Settlement Agreement, Brown and Caldwell, on behalf of Ironite Products Company, requests EPA to issue a written notice of completion of work.

If you have any questions or require additional information, please contact me at (602) 567-3823.

Very truly yours,

BROWN AND CALDWELL

Pejman Eshraghi, P.E.
Project Coordinator

PE:tc

cc: David Wallis, Gallagher & Kennedy

# REMOVAL ACTION COMPLETION REPORT

Prepared for
Ironite Products Company
Post Office Box 218
Humboldt, Arizona 86329

September 25, 2007

Brown and Caldwell Project #: 130508

BROWN AND CALDWELL
201 E. Washington Street, Suite 500
Phoenix, Arizona, 85004

Contents

# TABLE OF CONTENTS

## LIST OF FIGURES



## LIST OF TABLES

# LIST OF APPENDICES

# LIST OF ACRONYMS

| | |
|---|---|
| µg/L | micrograms per liter |
| ADEQ | Arizona Department of Environmental Quality |
| AL | Action level |
| ASTM | American Society for Testing and Materials |
| bgs | Below ground surface |
| CFR | Code of Federal Regulations |
| COC | chain-of-custody |
| DQI | Data Quality Indicators |
| E&E | Ecology and Environment, Inc. |
| EPA | Environmental Protection Agency |
| GPS | Global Positioning System |
| IDW | investigation derived waste |
| LDC | Laboratory Data Consultants |
| mg/kg | milligrams per kilogram |
| MS/MSD | Matrix spike/matrix spike duplicate |
| OSC | On-Scene Coordinator |
| OSHA | Occupational Safety and Health Administration |
| PPE | personal protective equipment |
| ppm | parts per million |
| PSC | Philip Services Company |
| PVC | polyvinyl chloride |
| QAPP | Quality Assurance Project Plan |
| QC | quality control |
| RAC | Remedial Action Completion |
| RCRA | Resource Conservation and Recovery Act |
| RPD | relative percent difference |
| RTK | real-time kinematic |
| SAG | Stakeholder Advisory Group |
| SAP | Sampling and Analysis Plan |
| SRL | Soil Remediation Level |
| SSHP | Site Safety and Health Plan |
| TCLP | Toxicity Characteristic Leaching Procedure |
| UCL | Upper confidence limit |
| UDS | Underground Detection Services, Inc. |
| USCS | Unified Soil Classification System |

# 1. INTRODUCTION

Brown and Caldwell, on behalf of Ironite Products Company (Ironite), has prepared this Removal Action Completion (RAC) Report pursuant to the requirements of the Administrative Settlement Agreement and Order on Consent (Settlement Agreement) for removal action signed by Ironite and the United States Environmental Protection Agency (EPA) effective May 12, 2006 (Appendix A). This document summarizes the activities necessary to complete the removal of soil at four properties in the vicinity of the Ironite property in the Town of Dewey-Humboldt, Arizona (the "Site", Figure 1). These four properties, identified as Property #2, #3, #4, and #7 as identified in Section IV.8 of the Settlement Agreement, are located northeast of Ironite property along Chaparral Gulch (Figure 2).

## 1.1 Purpose and Scope

The purpose and scope of this report is to provide EPA with documentation of the following activities performed in compliance with Section VIII.14 of the Settlement Agreement:

- Completion of preparation/planning/reporting documents related to delineation and removal of soil (Section 3.0).
- Collection of arsenic delineation samples (Section 4.0).
- Laboratory analyses of delineation samples and data evaluation (Section 5.0 and 6.0).
- Determination of the removal action boundaries based on conditions in the Settlement Agreement and data presented herein (Section 7.0).
- Completion of arsenic removal and associated actions (Section 8.0 and 9.0).
- Evaluation of the effectiveness of the removal action and certification of compliance with the Settlement Agreement (Section 10.0).

Supporting documentation with this report includes copies of project planning, access, and safety documents, laboratory analytical reports, and a photographic record of removal activities. Background information containing details of the previous investigations, or guidance for the completion of the activities in this report, is presented separately in documents summarized in Section 12.0.

## 1.2 Site Name or Sampling Area

The Work Plan referred to the Site as consisting of the Ironite property and residential Properties #2, #3, #4, and #7 (Figure 2). For purposes of discussion in this document, the Iron King Mine and each residential property are referred to specifically. All field activities, including sampling and removal actions, were conducted either on residential property or at the Ironite Mine Site.

## 1.3 Responsible Agency

Federal regulatory oversight was provided by EPA.

## 1.4 Project Organization

The organization for the project as presented in the Work Plan is summarized below:

| TITLE/RESPONSIBILITY | NAME | PHONE NUMBER |
|---|---|---|
| | EPA | |
| On-Scene Coordinator (OSC) | Harry Allen | Office (415) 972-3063<br>Mobile (415) 218-7406 |
| On-Scene Alternate Coordinator | Daniel Suter | (415) 972-3050 |
| On-Scene Alternate Coordinator | Hedy Salter | (415) 972-3046 |
| | CONTRACTOR (BROWN AND CALDWELL) | |
| Principal In Charge | Eric Mears, R.G. | Office (602) 567-3859<br>Mobile (602) 615-0433 |
| Project Coordinator | Pejman Eshraghi, P.E. | Office (602) 567-3823<br>Mobile (602) 370-3443 |
| Field Manager | Mathew Nation, R.G. | Office (602) 567-3866<br>Mobile (480) 234-3734 |
| Quality Control Manager | John Kim | (602) 567-3884 |

There were no modifications or additions to the individuals or entities cited above for the duration of the project.

# 2. PROJECT BACKGROUND

The basis for the Settlement Agreement was a determination that arsenic concentrations in soil at Properties #2, #3, #4, and #7 were greater than the screening level of 100 milligrams per kilograms (mg/kg). This determination relied on a Site Assessment of 17 properties in the Humboldt area conducted on behalf of EPA by Ecology and Environment, Inc. (E&E). The Site Assessment included the collection of surface soil samples from nine locations each at Property #2, #3, #4, and #7. The results of E&E's Site Assessment is documented in a report titled *"Iron King Mine Site, Humboldt, Arizona, Final Report"* dated October 2005. In addition, sampling had previously been conducted by the Arizona Department of Environmental Quality (ADEQ) in 2002 at specific locations along Chaparral Wash and data was included in the E&E report. The results of the Site Assessment were subsequently incorporated in Section IV.8.d of the Settlement Agreement as supporting documentation to require a removal action.

As a requirement of the Settlement Agreement (Section VIII.15), Brown and Caldwell prepared a Work Plan describing the activities to be performed for EPA review and approval (Section 3.1).

## 2.1 Decision Statement

The Decision Statement in the Work Plan required the completion of the following:

1. Determine the amount of arsenic-impacted surficial soils that will require removal at the referenced properties to a concentration of 23 mg/kg, or an alternative concentration as approved by EPA, at the surface of the excavation zone as stated in Section (VIII)(14)(a) of the Settlement Agreement.
2. Excavate arsenic-impacted surficial soils to depths determined after completion of item 1, but will not exceed a depth of 4 feet below ground surface (bgs) at the referenced properties. The delineation depth of 4 feet is being proposed pursuant to ADEQ's letter to the EPA titled *"Proposed EPA Removal at Iron King Mine Site in Humboldt, Arizona"* dated April 3, 2006 (Appendix B). In the letter, ADEQ recommended that *"... remediation remove the contaminated soil to either a concentration equal to the natural background concentration of arsenic, or at least to a depth of four feet to prevent future exposure to residents."*

In addition, the Settlement Agreement in Section XIV stipulated that the On-Scene Coordinator (OSC) was authorized to *"... hault, conduct, or direct any work required by the Settlement Agreement, or to direct any other removal action undertaken at the Site."* In certain circumstances described in this report and as deemed appropriate by the OSC, the Scope of Work was modified from what was proposed in the approved Work Plan, including the conditions specified in the Decision Statements above.

Each of these activities is summarized in this document in their appropriate Sections. The first portion of the report describes the activities to determine the concentrations of arsenic in soil and determine the extent of removal. The second portion of the report summarizes the activities relevant to the removal of soil and restoration activities at each property.

## 2.2 Decision Inputs

The information in E&E's report reflected arsenic concentrations to a depth of 0.5 feet bgs that exceeded the established action level (AL) of 23 mg/kg. As stated in the Work Plan, there was no additional input required to determine the need to remove the surficial 0.5 feet of soil at each referenced property. Additional decision input data was necessary from Properties #2, #3, #4, and #7 to delineate the vertical and lateral extent of arsenic above the AL, and the resultant volume of surficial soil below a depth of 0.5 feet bgs that required removal. The collection of additional data at Property #7 was restricted around the single sample location "G" that yielded an arsenic concentration of 520 mg/kg. The data for the decision was collected by delineation soil sampling at specific locations for each property and analyses for arsenic. The proposed sample locations and rationale for their placement to determine the lateral extent of arsenic was presented in the Work Plan. The proposed depths for sample collection were of 0.5, 1, 2, and 3 feet bgs to determine the vertical distribution of arsenic.

### 2.2.1 Expected Range of Arsenic Concentrations

The expected range of arsenic at Properties #2, #3, #4, and #7 ranged from 25 to 180 mg/kg (E&E, 2005). An outlier of 520 mg/kg from Property #7 was not included due to the potential of other sources for arsenic on the property. Further evaluation of the arsenic ranges on Property #7 was not performed after submittal of the Work Plan when access for delineation sampling could not be obtained from the owner. The distribution of detected arsenic ranges from the E&E data at each property were included as Figures 3 through 6 of the Work Plan.

### 2.2.2 Decision Errors

A discussion of the Decision Errors and methods to control them were presented in Section 3.6.2 of the Work Plan. The necessary controls on Decision Errors were incorporated in the sampling activities described in subsequent Sections and allow data to be utilized in the decision process for arsenic removal.

# 3. PROJECT PLANNING AND REPORTING

Multiple documents were developed for the proposed removal action that included guidance for collection of data, community or property owner notifications, and health and safety. Documentation of field activities during the delineation sampling and removal actions was reviewed daily and used to prepare weekly summaries to EPA. This document represents the formal record of the sampling and removal activities for use in determining the appropriateness and effectiveness of the removal action.

## 3.1 Work Plan

A formal project Work Plan was developed by Brown and Caldwell, on behalf of Ironite, pursuant to the requirements of the Settlement Agreement. The Work Plan designated the procedures to delineate soil containing arsenic and conduct removal actions at Properties #2, #3, #4, and #7. The Work Plan was reviewed by EPA and a revised version of the document was approved on June 23, 2006, for use in performing the activities summarized in this report.

A separate Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) for the Ironite Mine site were included as Attachments E and F of the Work Plan, respectively. Modifications to procedures in those documents were described in Sections 1 through 11 of the Work Plan. Deviations to the Work Plan activities that occurred during the delineation soil sampling and removal actions are summarized in specific Sections of this document with justifications for each of the changes.

## 3.2 Community Involvement Documents

The Work Plan described how local community members were to be informed about the certain environmental activities, including field activities, at the Site and how they would be provided with opportunities for involvement. Mr. Stephan Schuchardt, Ironite Plant Manager, served as the designated spokesperson on behalf of Ironite to the property owners and surrounding community representative in providing the appropriate notification.

However, during the implementation of the Work Plan, the OSC assumed the responsibility of providing the public notices.

## 3.3 Access Agreement

Brown and Caldwell, on behalf of Ironite and in accordance with Section IX.23 of the Settlement Agreement, negotiated access agreements from the owners of Properties #2, #3, and #4 to conduct soil delineation sampling and removal actions for arsenic. The owner of Property #7 did not grant access prior to the delineation sampling or removal actions in 2006. No further activities occurred at Property #7 until access was obtained by EPA in 2007 to conduct limited soil removal associated with sample location "G" from the previous Site Assessment (E&E, 2005). Copies of the signed access agreements for each property owner were retained by Ironite and EPA during the performance of the activities described in this report.

## 3.4 Site Safety and Health Plan

The Site Safety and Health Plan (SSHP), included as Appendix B of the Work Plan, was utilized for both the delineation and removal action phases of work. The SSHP incorporated the requirements of Occupational Safety and Health Administration (OSHA) Title 29 Code of Federal Regulations (CFR), Part 1910.120 for hazardous site work. The SSHP described appropriate measures and safe practices for field personnel to follow and prevent exposure to chemical contaminants, and physical and biological hazards. The SSHP also identified appropriate personal protective equipment (PPE), monitoring requirements, site control measures, and emergency procedures to be followed during the field activities.

The designated level of PPE for all personnel involved in the on-site activities was modified Level D protection. Additional precautions to prevent cross-contamination of excavated areas were utilized during the removal actions, including protective footwear covers and restriction to portions of the excavations. The potential upgrade to respirators during soil removal actions was dependant upon the field monitoring for arsenic content in dust. The dust monitoring summarized in Section 8.4 did not indicate significant, prolonged conditions of elevated dust that required use of respirators.

As stipulated in Section 4.3 of the Work Plan, subcontractors were also required to prepare and adhere to their own SSHP. A daily safety meeting was conducted during the delineation and removal action phases of work when safety protocols were reviewed and changes in site conditions discussed. These meetings incorporated both Brown and Caldwell's SSHP requirements and additional issues relating to the subcontractors SSHP. Copies of the Brown and Caldwell SSHP daily meeting forms are provided in Appendix C.

All personnel potentially accessing the Ironite property were required to complete an orientation at the property supervised by an Ironite representative. The orientation was required to ensure all personnel were familiar with procedures for accessing the site and potential hazards for vehicular traffic. Brown and Caldwell field personnel and subcontracted individuals from Philip Services Corporation (PSC) completed the orientation prior to the removal action. Ironite representatives indicated the location designated for soil disposal on the mine tailings during the orientation.

## 3.5 Field Activity Documentation

Documentation of field activities during delineation sampling and removal actions was performed using multiple records that could be compared for verification purposes. A comprehensive record of significant field activities was maintained in a Project Log Book that recorded events on a daily basis. Additional information recorded in the Log Book consisted of field diagrams, notations regarding modifications to planned activities, discussions with project personnel or visitors, and decisions regarding the status of field activities. The Log Book was reviewed and a copy of the log was retained in the Brown and Caldwell Phoenix office for recordkeeping purposes while field activities were ongoing.

A separate set of daily field logs included a summary of the number of personnel and organizations present at the Site, with a record of the number and types of samples collected, if any. These field logs were primarily maintained to verify events recorded in the Log Book and types of samples listed in chain-of-custody documents.

Sample logs provided a description of the number, dates, times, locations, identification, and types of each individual sample collected. The soil sample material was described using the Unified Soil Classification system (USCS) as presented in American Society for Testing and Materials (ASTM) D-2488. Additional features of the sample material, including surrounding surface conditions, were recorded with the description. These descriptions were used to evaluate the physical conditions of each property for determination of removal actions as discussed in Section 7.3.

Chain-of-custody (COC) forms provide a record of sample information and requested analyses to the laboratory. The COCs were completed as sampling progressed in the field and were subsequently reviewed prior to delivery to the laboratory to ensure the information was accurate. The number and types of samples on the COCs were also verified with the daily field and sample logs to identify any discrepancies.

The information on each COC included the following information:

- Brown and Caldwell project name, number, and contact information.
- Sample identification numbers.
- Sample media types.
- Preservatives used.
- Dates and times of collection.
- Laboratory analyses requested.
- Names, signatures, and dates of sampling personnel and all other individuals who retained custody of samples to the laboratory.
- Special instructions regarding analytical methods or procedures (e.g. compositing samples).

Samples were in the possession of Brown and Caldwell personnel from the time of sampling to delivery at the laboratory. Copies of the COC were provided to Brown and Caldwell upon delivery to the laboratory for reference during the analytical process. Copies of COC documents as completed by the laboratories are provided in their reports contained the Appendix D.

The locations of sample points, removal action boundaries, structures, utilities, and other pertinent features were surveyed using global positioning system (GPS) devices. Surveying was performed prior to the delineation sampling and later during removal actions. A field log of the points surveyed and a physical description of the points was maintained to verify the electronic data when it was downloaded. Details of the GPS surveys are presented in separate Sections of this report for the delineation sampling and removal actions.

## 3.6 Periodic Progress Reports

Brown and Caldwell prepared weekly progress reports that summarized the previous week's activities and submitted them to Ironite and EPA on each Monday. The weekly progress reports were initiated on July 3, 2006 for the preceding week of June 26 through 30, 2006, and continued until December 2006 when a request to stop preparation of the weekly progress reports by Ironite was approved by the OSC. The activities summarized in this report, including modifications to the scope of work, were communicated in the weekly reports according to the requirements of the Work Plan. A summary of project field activities in Table 1 was also condensed from the weekly report information and field data review.

## 3.7 Removal Action Completion Report

This RAC Report satisfies the conditions of Section VIII.20 of the Settlement Agreement, and Section 9.2 of the Work Plan. The submittal of the RAC Report was required within 60 days of the completion date cited in the Settlement Agreement at August 1, 2006. An extension to the completion date to September 29, 2006, was granted by EPA in correspondence entitled *Ironite Mine Site Work Completion Deadline Extension*, dated August 30, 2006. The extension was granted to accommodate delays in the completion of the removal action due to field conditions and additional requests for access to Property #7. An additional extension of time was not requested because EPA assumed the responsibility of acquiring access to Property #7. The information supplied in this document satisfies the decision input requirements for evaluating the lateral and vertical extent of arsenic in soil. The determination of removal action boundaries is presented utilizing the data generated for the decision input. A record of the removal actions and supporting documentation to demonstrate compliance with the Settlement Agreement are included.

# 4. ARSENIC DELINEATION

Delineation of arsenic concentrations was conducted in accordance with Section 4.4 of the Work Plan. The collection of delineation samples was necessary to augment the existing data used for decision input and decision rules for arsenic removal. The evaluation of the delineation soil data for determining the remedial action boundaries is presented in Section 7.0.

## 4.1 Study Boundaries

The properties identified in the Settlement Agreement for potential sampling and removal actions are Properties #2, #3, #4, and #7. Negotiations with the owner of Property #7 did not result in immediate access to that property, and it was not included in the study boundaries for delineation sampling as acknowledged in the Work Plan. However, access to Property #7 in 2007 permitted the inclusion of a single location for removal action into the study boundary. The initial proposed locations for delineation samples and removal action were presented in Figures 7 through 10 of the Work Plan. Revisions to the proposed delineation sample locations resulted in a greater frequency of sampling as described in Section 4.3.1. Additional modifications to the delineation sample locations and removal action boundaries were made based upon field conditions (e.g. utilities, easements, slopes, structures), resulting in the elimination or relocation of sample points. The modifications to the sample locations and removal area boundaries were communicated to the OSC in the weekly Periodic Progress Reports. The resultant delineation sample locations and modified removal boundaries for Properties #2, #3, and #4 are depicted in Figures 3 through 5.

The proposed vertical boundary of the characterization and removal action was a depth of 4 feet bgs or less, subject to modification based upon the presence of subsurface utilities. The vertical boundary for the delineation sampling was specified at 3 feet bgs as part of the Decision Input discussed in Section 2.2 of this document and Section 3.3 of the Work Plan.

## 4.2 Utility Clearance

Utility clearance surveys were performed before initiating any subsurface work at the properties. Initial notification was provided to Arizona Bluestake prior to the delineation sampling to identify and mark all underground utilities coming into or out of the three properties.

A qualified underground utility locating contractor, Underground Detection Services (UDS), was also retained to conduct a survey of the proposed sampling/excavation zones and locate and mark underground utilities. This additional utility location was required because Arizona Bluestake and the utility companies notified do not typically access private property. The initial utility location occurred on June 26, 2006 at Properties #2, #3, and #4. The utilities located at each property included those constructed of metal, with additional plastic lines located with a tracer wire. However, the locations of several plastic lines could not be confirmed and their placement was approximated with the assistance of the property owners. The confirmation of a natural gas line was also requested at Property #4 due to a conflict with the utility markings with the location as determined by UDS.

Additional clarification of subgrade utilities occurred on July 24, 2006, at Properties #2 and #3, and August 7, 2006, at Property #4. The clarification was performed to ensure markings were clear and to discuss potential limits to the depths of excavation over selected utilities. Utility location was performed by UDS prior to the removal action at Property #7 on May 15, 2007.

## 4.3 Delineation Sample Collection

Collection of arsenic delineation samples was conducted at Properties #2, #3, and #4 on June 28 through July 11, 2006. The sampling was performed by two Brown and Caldwell personnel, one of which was the Field Manager designated for the project. The sampling was assisted by PSC under subcontract to Brown and Caldwell to operate the equipment used for excavation of sample potholes. The Brown and Caldwell Project Manager was present on multiple dates to review the status of sampling, field conditions, and coordinate with property owners for pending activities. A summary of the dates and activities during delineation sampling is presented in Table 1.

### 4.3.1 Sample Locations

The proposed locations for delineation samples were designed to represent an area not more than 2,800 square feet in area at each of the properties. The sample grid utilized points with a nominal 40-foot spacing at Properties #3 and #4, and a 60-foot spacing at Property #2. These grid spacings were proposed in order to reduce the decision error for both types of errors identified in Section 3.6.2 of the Work Plan. Thus, the frequency of sampling was increased, and locations modified from those depicted in Figures 7, 8, and 9 in the Work Plan. The sample points at each location were identified and staked prior to sampling to evaluate potential changes in the locations. Each of the modifications cited below were documented and the reasons for altering the sampling grids were communicated to the OSC. The resultant sample locations were then surveyed and the preliminary information utilized to generate maps for evaluating potential excavation areas.

The initial survey of Property #2 conducted on June 26 and 27, 2006, identified several sample locations that required modification. These changes were necessary to accommodate dense vegetation (BC-P2-K, BC-P2-L), a stockpile of cobbles (BC-P2-B), and the steep slope of hills to the north of the property (BC-P2-E, BC-P2-M, BC-P2-L). The close proximity of an underground water line also contributed to the modification of sample point BC-P2-L. The resultant sample locations as collected at Property #2 are presented in Figure 3.

The locations of sample points at Property #3 required more extensive modifications due to physical constraints at the Site. Proposed sample points BC-P3-E, BC-P3-F, and BC-P3-G were removed because their locations were on steeply sloped backfill that was a mixture of natural and imported material. The backfilled material had been used in construction of elevated plots north of Property #3 or as support material for the county road and drainage culvert north of sample BC-P3-D. The row of sample points BC-P3-A through D was shifted eastward because the actual easement for the property and the county road was closer to the house than presented in the Work Plan. The placement of points BC-P3-H, BC-P3-J, BC-P3-K, and BC-P3-L were modified due to limitations accessing portions of the property that contained structures or landscaping. The access agreement and negotiations with the property owner stipulated that no sampling would occur in the landscaped area south of the house. The location of point BC-P3-N was shifted southwest because it was at the base of a steep slope with trees that limited access. The resultant sample locations as collected at Property #3 are presented in Figure 4.

Sample locations at Property #4 were modified primarily due to the proximity of subgrade utilities. The locations of sample points BC-P4-A, BC-P4-G, BC-P4-H, BC-P4-I, and BC-P4-J were altered to provide sufficient space to excavate and collect samples near utilities. In addition, a plastic subgrade water line was encountered during the initial excavation of BC-P4-I and the point was relocated northward after the line was repaired. The presence of stockpiled brick and building materials north of BC-P4-D and a wall near BC-P4-J also limited the placement of the sample points. The resultant sample locations as collected at Property #4 are presented in Figure 5.

### 4.3.2 Sample Collection

Delineation soil samples were collected using an alternate method to those described in Section 4.4 and Attachment F of the Work Plan. The proposed method of collection was to recover core using a hydraulic direct-push probe to the target depths. However, inspections of the physical content of the material to be sampled at the three properties indicated the presence of extensive gravel or cobbles at relatively shallow depths. The direct-push or hand auger techniques of sampling would not penetrate effectively below depths of 1 to 2 feet in the coarse-grained material, and an alternate method was proposed and accepted by the OSC.

The sampling method utilized a backhoe to excavate a pothole at each location to successive depths for sample collection. The samples were collected manually at each specified depth of 0.5, 1, 2, and 3 feet bgs from the potholes according to the procedures described below. The potholes were backfilled after sampling was completed and the material was compacted to a relatively level surface. This method allowed the collection of samples in coarse-grained material to the required depths at each location.

Soil delineation samples were collected from the potholes using the following procedures:

- The backhoe removed soil the appropriate depth of sample collection, which was verified by a measuring rod or tape from the land surface to the base of the pothole.
- Loose material was cleared from the area where the sample is to be collected. The samples were collected from undisturbed material and placed into an 8-ounce glass jar with a plastic lid and Teflon liner. The material was recovered directly from the base of the pothole with the jar, or if the material was hard and consolidated, a disposable plastic trowel was used to remove the sample and place it in the jar.
- The sample jar was sealed tightly and any loose material adhering to the jar was brushed off. A label recording the ID and time of collection was affixed to the outside of the jar. The jar was then placed in a plastic bubble-wrap bag, sealed with an adhesive strip, and placed in a cooler with ice.
- The sample was logged on a COC form, and a description of the sample material was recorded on field data sheets. Excess sample material was placed in the pothole during backfilling.
- The backhoe was decontaminated as described in Section 4.6 and any disposable equipment was placed in trash bag for subsequent disposal.

Soil sample locations are depicted on Figures 3 through 5. The locations were re-staked after backfilling was complete to ensure reacquisition if additional sampling was required and for reference during the removal actions.

Delineation soil samples were identified according to the protocols stipulated in the Work Plan with the following nomenclature:

- Project name;
- Sample ID number with a Brown and Caldwell (BC) abbreviation, followed by the property number, followed by sample location letter, and followed by the depth at which the sample is collected. For example, sample BC-P2-C-3 was a delineation soil sample collected by Brown and Caldwell at Property #2, Location C, from a depth of 3 feet; and,
- Date and time of collection.

A summary of all samples collected during the delineation sampling, including dates sampled and the types of samples, is presented in Table 2. The samples collected at the conclusion of each day of sampling were managed according to the procedures in Section 1.7 of the Work Plan. Samples were conveyed from the sites in Humboldt to the Brown and Caldwell office in Phoenix, Arizona for verification of sample information with COC documents prior to delivery to the laboratory for analyses.

## 4.4 Backfill Material Sample Collection

Brown and Caldwell collected five samples from a borrow pit designated by Ironite as potential material for backfill after arsenic removal was complete. The borrow pit was located approximately two miles north of the residential properties on the west side of Highway 69. Samples were collected from representative locations in the borrow pit, either in undisturbed material or from stockpiled soil. The soil samples were collected manually using methods consistent with those of delineation sampling and Section 1.5.1 of the SAP. Backfill samples were identified with the abbreviations BC-B-1-D-1 through BC-B-1-D-5, corresponding to Section 4.9.2 of the Work Plan (Table 3).

## 4.5 Quality Control Samples

Quality control (QC) samples collected during sampling were described in Section 2.0 of the SAP and consisted of field duplicates and sample equipment rinsate blanks. The frequency of collection for field duplicates was 1 per 10 delineation soil samples. The sample equipment rinsate blanks were collected to verify the effectiveness of decontamination procedures used for non-dedicated sampling equipment. As described above in Section 4.3.2, the method of collection utilized a backhoe and dedicated sampling equipment. The equipment rinsate blank samples were therefore collected only from the backhoe on a daily basis as described in the SAP. The collection of the final two equipment blank samples were collected on July 11, 2006, because the backhoe had malfunctioned on July 10 and could not be properly decontaminated for sampling. An equipment blank was collected prior to the start of sampling on July 11, 2006, after the backhoe was decontaminated (BC-P4-GWS-07), and a second blank was collected at the end of the sampling activities on that day (BC-P4-GWS-08).

The method of collection for field duplicates was identical to that for the delineation samples. The equipment rinsate blanks were collected by pouring distilled/deionized water over the backhoe bucket after decontamination was complete. The water was collected as it ran off the backhoe bucket into appropriate containers for laboratory analyses. An additional QC sample was collected from the decontamination water in the storage tank that was used to steam clean the backhoe (BC-P4-GWS-09). The water was collected from the outlet spigot on the storage tank and the sample submitted with the equipment blank for analyses.

The QC samples were labeled in a manner similar to those for the delineation samples, with the following modifications:

- Field duplicates utilized the same designation as delineation samples with a fictitious sample location letter for the location (e.g. BC-P2-S-1).
- Equipment rinsate blanks utilized a BC abbreviation, followed by "GWS" which fictitiously signifies it to be a groundwater sample, followed by property number, followed by a fictitious well location number. For example, the sample BC-GWS-P2-02 was collected during sampling at Property #2, and the "02" was the fictitious well location number. One of the rinsate blanks was mislabeled as BC-GWS-03 and did not include the property designation of P2.

A summary of the QC sample types, collection dates, and identification are presented in Table 2.

## 4.6 Decontamination Procedures

Sampling equipment that required decontamination was the backhoe bucket used to excavate each sample location and a measuring bar to gauge the depth of excavation. However, the measuring bar was not used to collect or assist in sampling of the soil. The remaining sampling equipment were disposable and did not require decontamination.

Decontamination efforts were conducted in accordance with Section 3.0 of the SAP specifically for soil sampling. The decontamination procedures incorporated the initial removal of gross contamination by dry brushing or scraping visible residue clinging to the backhoe equipment. The decontamination of residual contamination was performed using a three-phase method generally comparable to that described in the SAP. The process was modified due to the alteration in sampling equipment (backhoe) used from the proposed method of direct-push coring or hand auger sampling.

The first phase of decontamination involved spraying down the backhoe bucket and portions of the mechanical arm that contacted the soil with a pressurized solution of potable water and Liquinox®. The backhoe was then rinsed with a steam cleaning pressure washer supplied by PSC. This pressure washing also removed any potential gross contamination that was in joints that could not be removed by brushing. The final rinse was performed with a spray of distilled or deionized water and the backhoe was allowed to air dry.

The rinsate solutions generated from the decontamination procedures were allowed to disperse on the ground near the periphery of the removal action boundaries at each property. This procedure was in accordance with Section 10.3 of the Work Plan and was confirmed with the Brown and Caldwell Project Manager at the beginning of sampling activities.

## 4.7 Investigative Derived Waste

Investigative derived waste (IDW) generated during the delineation sampling consisted of the following types:

- Solid waste – containers, cardboard, paper towels, debris that was not used as PPE and did not contact material sampled.
- PPE waste – disposable nitrile gloves, plastic sample trowels, bags, used to collected or prepare samples.
- Liquid waste – decontamination rinsate.

Each of these types of IDW were managed and disposed as described in Section 9.0.

## 4.8 Global Positioning System Readings

The locations of delineation samples, removal action boundaries, houses and other structures, and utilities were surveyed using GPS methods prior to the initiation of sampling at each property. The type of GPS recorder used was a hand-held unit that contained the receiver and antenna. The electronic data collected during each day was downloaded for verification with coordinates recorded in field logs. Additional field measurements were collected using measuring tapes, wheels, and compass bearings to compare with the GPS data.

The GPS data was combined with direct measurements and compass bearings for each property to generate maps in correspondence to EPA on July 13 and 24, 2006. Modified versions of the maps initially provided to EPA are reproduced in Figures 3, 4, and 5. Revisions to the GPS data were made during the removal action when a different type of GPS unit was used to reacquire sample locations and other significant features, as summarized in Section 8.13.

## 4.9 Significant Deviations from Proposed Activities

The details regarding deviations from proposed activities were presented in the preceding Sections, and are restated below with justifications for each of the deviations:

1. Sample locations were modified at each property from the proposed sampling grid for the following reasons:
   A. The modifications were required to accommodate the actual property boundaries compared with the proposed grid.
   B. Subgrade utilities prevented excavation and sampling at the proposed locations.
   C. Proposed sample locations were on steep slopes of material that was of potentially mixed origin.
   D. Excavation of sample locations on slopes would compromise the integrity of the slope (e.g. county road at Property #3).
2. Sample collection was performed using a backhoe to excavate potholes where samples were collected manually. This modification was necessary because the material at each site consisted of a high proportion of coarser gravel at depth, and use of direct-push or hand auger methods would not have penetrated to the required depths for sample collection. In addition, sample retention of the coarser material would have been problematic for a direct-push core.
3. Backfill samples were submitted for discrete analyses instead of a single composite sample. The borrow pit was a supplier for backfill to multiple contractors, prior to and during the removal actions at the properties. The areas in which backfill would be obtained from the borrow pit could not therefore be specifically determined. The collection of discrete samples was necessary to ensure stockpiled or undisturbed soil was acceptable for backfilling regardless of where the material was obtained at the borrow pit.
4. Decontamination procedures were modified to accommodate the use of a backhoe for sample excavation. The modifications were generally comparable to the methods stipulated in the SAP, but a pressure steam cleaner was used to effectively remove any gross or residual material after the initial decontamination solution rinse.
5. Collection of an equipment rinsate blank on a daily basis was modified on July 10 and 11, 2006. The backhoe malfunctioned at the conclusion of sampling on July 10 and could not be effectively decontaminated prior to the collection of an equipment blank sample. An equipment blank sample was collected after the decontamination, and prior to sampling, on July 11 and a second sample was collected at the conclusion of sampling on that day.

The deviations from the proposed activities were communicated to the Brown and Caldwell Project Manager for confirmation. The resultant modifications are not considered indicative of non-compliance with data acquisition requirements, critical data gaps, or compromise the acceptability of the data generated.

# 5. LABORATORY ANALYSIS

Soil and liquid samples collected during arsenic delineation were managed according to the relevant procedures in the SAP and QAPP, and submitted to Transwest Geochem for analyses. Chain-of-custody documentation was reviewed and confirmed with the laboratory to ensure all samples were accounted and the required analyses performed. The following Sections present the results of laboratory analyses for delineation and QC samples.

## 5.1 Delineation Soil Samples

Delineation soil samples were submitted for the following analyses as per Section 5.1 of the Work Plan:

- Arsenic using EPA Test Method 6010B.

The delineation soil samples were analyzed utilizing a seven-day turnaround time to expedite the data review and determine if the arsenic concentration at each property was at or below the remedial action level of 23 mg/kg.

The following total number of delineation soil samples were analyzed from each property:

- Property #2 - 68 samples;
- Property #3 - 44 samples; and
- Property #4 - 56 samples.

Table 2 summarizes the arsenic concentrations at each sample location for all three properties. Concentrations of arsenic that exceeded the proposed remedial action level were identified in a total of 66 samples from the following locations:

- Property #2 - A, B, D, E, F, G, H, I, J, K, M, N, O, P, Q;
- Property #3 - A, B, D, H, I, J, K, L, M, N; and,
- Property #4 - A, B, D,E, F, G, H, I, J, K, M, N.

The depths at which the detected concentrations exceeded the proposed remedial action level were variable, but the majority (36) were concentrated at a depth of 6 inches (Table 2). The number of detected concentrations exceeding the proposed remedial action level decreased to 15 at a depth of 1 foot, 11 at a depth of 2 feet, and 5 at a depth of 3 feet. Copies of the laboratory analytical reports for the delineation soil samples are included in Appendix D.

## 5.2 Backfill Material Samples

A total of five discrete soil samples of backfill material were submitted for the following analyses as per Section 5.2 of the Work Plan:

- Resource Conservation and Recovery Act (RCRA) eight total metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) using EPA Test Method SW6010B/7000 and 7471A.

Samples were not composited for analyses as had been stipulated in the Work Plan. As noted in Section 4.4, they were collected for analyses separately since it was unknown where the backfill would be taken from at the borrow pit. A summary of the analytical results for the backfill material samples is presented in Table 3. The detected metals in the samples constituted arsenic, barium, and chromium at concentrations below their respective Arizona Residential Soil Remediation Levels (SRLs). The results of the laboratory analyses were communicated to OSC with a recommendation for use of the borrow pit for suitable backfill in the remedial action. Copies of the laboratory analytical reports for the backfill soil samples are included in Appendix D.

## 5.3 Field Quality Control Samples

The QC samples consisting of field duplicates of soil and equipment blanks of liquid were analyzed for arsenic using the following analytical methods:

- Soil samples using EPA Test Method 6010B; and
- Liquid samples using EPA Test Method 200.7 or 6010B.

The following number of field duplicate samples were analyzed from each property:

- Property #2 - 7 samples;
- Property #3 - 4 samples; and
- Property #4 – 6 samples.

A summary of the analyses for the field duplicates is presented in Table 2. The results of the field duplicate and equipment blank analyses are included with the laboratory analytical reports in Appendix D. The analytical results of the duplicate sample were compared to the original sample to determine the relative percent difference (RPD) using the following formula:

$$RPD = \frac{(A - B)}{A + B} \times 100$$

Where: A = Arsenic Concentration of Delineation Sample in mg/kg
B = Arsenic Concentration of Field Duplicate Sample in mg/kg

The RPD is used as an indicator to evaluate the analytical laboratory's precision by assessing the reproducibility of the analytical results. The RPD is compared to a precision goal, which is typically 30 percent or less for analyses of metals in soils. The majority of analytical results for field duplicates were within 30 percent of the original delineation sample concentrations. However, the RPDs for field duplicate samples BC-P2-S-1 and BC-P2-W-1 exceeded 30 percent. The original arsenic concentration in delineation sample BC-P2-G-1 was lower than the duplicate (S-1), although the concentration in BC-P2-O-1 was higher than the field duplicate result (W-1). The soil was removed to a depth of 1 foot at each of these locations as summarized in Section 8.

A total of nine equipment blank samples were analyzed distributed as follows:

- Property #2 - 3 samples;
- Property #3 - 2 samples; and
- Property #4 – 3 samples, 1 water tank sample.

A summary of the analyses for the field duplicates is presented in Table 2. Arsenic was not detected in the equipment blank samples with the exception of BC-GWS-P3-04, which contained a concentration of 0.011 micrograms per liter (µg/L) (Appendix D). Although the detection suggested residual arsenic was present during sampling on the date of collection July 5, 2006, the concentration was near the detection limit of 0.010 µg /L. The arsenic detection in the equipment blank is not inferred to indicate a significant non-conformance during the field sampling or decontamination procedures, and would not result in modifications or flags to concentrations detected in soil samples collected on that date.

## 5.4 Laboratory Quality Control

Laboratory QC samples were analyzed to assess the validity of the analytical results and confirm QC procedures at the laboratory. The QC samples consisted of method blanks, surrogate spikes, matrix spikes/matrix spike duplicates (MS/MSD), internal standards, duplicate samples, and check standard analyses. These samples are prepared and analyzed by the laboratory and are consistent with the requirements of the QAPP. Results of the analyses are provided in the laboratory QC documentation and are reviewed in Section 6.2.

# 6. DATA VERIFICATION AND VALIDATION

The verification and validation of delineation laboratory data was performed by an outside firm, Laboratory Data Consultants, Inc. (LDC), specializing in this type of evaluation in accordance with Section 4.0 of the QAPP. A copy of the QAPP was provided to LDC for their use in validating the laboratory data. Additional verification of field data was performed by Brown and Caldwell as appropriate to the types of information collected and described in the Work Plan and SAP.

## 6.1 Field Data Verification

Verification of field data primarily involved evaluation of the completeness, correctness, and conformance of data with respect to the standard operating procedures for collection, tracking, method of analysis, or contractual requirements for this project. These procedures are summarized in the Work Plan and SAP, with additional assessment and response actions for field procedures in Section 3.1 of the QAPP. From a verification standpoint, field data non-conformance is defined as an occurrence or measurement that is either unexpected or does not meet established acceptance criteria and that will affect data quality if corrective action is not implemented. Non-conformance may result from the following:

- Natural conditions (e.g. inappropriate material type or size);
- Incorrect use of field equipment;
- Field instrument failure/malfunction;
- Data record errors (e.g. times, dates, locations);
- Incomplete field documentation, including COC records; and
- Incorrect collection of QC samples.

Two types of corrective action exist: immediate and long-term. Immediate corrective actions include the correction of documentation deficiencies or errors, the repair of inaccurate instrumentation, or the correction of improper procedures. Often, the source of the problem is obvious and can be corrected at the time of observation by either the personnel involved in the data collection or the Project Manager/QC manager. Long-term corrective actions are designed to eliminate the sources of problems. Long-term corrective actions may include correction of systematic errors in sampling or analysis, or correction of procedures producing questionable results. Corrections can be made through additional supervision, instrument and equipment replacement, and/or procedural improvements.

The following types of field data were verified either on a daily basis by the field personnel and Project Manager, or immediately after the sampling and removal activities were concluded:

- Field log books;
- Sample logs;
- Sample COC records;
- GPS records and electronic data;
- Waste identification information;
- Photographs; and
- Site sketches or field maps.

The review of field data collected during the delineation indicated significant non-conformance with the initial placement of the sampling grid. This condition was created due to the alignment and spacing of the sample points relative to features on maps contained in the Work Plan. The actual property or proposed removal action boundaries were documented in the field and the delineation sample grid verified in relation to the boundaries. The verifications of property boundaries resulted in a shift in grid placement at Properties #3 and #4. The orientation of the grid was also slightly modified at Property #2 to align with the bearings of the removal action boundaries. These actions rectified the non-conformance with the placement of the delineation sampling grid.

A non-conformance is not recognized for the reacquisition and relocation of sampling points with a separate GPS unit during the removal actions (Section 4.3 and 8.13). The instrumentation was used correctly and did not malfunction. The data records were also accurate and complete. The alteration of the sample locations occurred due to less precision in the GPS unit used for sampling in comparison with that used during the removal action. In addition, verification of the staked sample locations was obtained by field observations at each property prior to the initiation of the removal action.

## 6.2 Internal Laboratory Data Verification

Internal QC samples were utilized by the laboratory to assess the validity of the analytical results for the samples collected during arsenic delineation activities. The laboratory QC procedures included method blank, surrogate spike, MS/MSD, internal standards, duplicate sample, and check standard analyses. The objectives of the laboratory QC sample analyses are defined in the QAPP.

Specific aspects of laboratory QC measures that varied from nominal operations included the following:

- The MS recovery associated with samples collected at all depths from Locations A through D at Property #2, and at 0.5, 1, and 2 feet bgs at Location E at Property #2 was high. The method control sample recovery was acceptable.
- The MS recovery associated with samples collected at 3 feet bgs at Location E at Property #2, and at all depths from Locations F through I at Property #2 was low. The method control sample recovery was acceptable.
- The accuracy of the spike recovery value associated with samples collected at all depths from Location L at Property #3, at all depths from Locations A through C at Property #4, and at 0.5 feet bgs at Location D at Property #4 is reduced because the analyte concentration in the samples was disproportionate to the spike level. However, the method control sample recovery was acceptable.
- The RPD for the MS/MSD associated with samples collected at all depths from Location L at Property #3, at all depths from Locations A through C at Property #4, and at 0.5 feet bgs at Location D at Property #4 exceeded the laboratory control limit. The laboratory report's case narrative indicated "*the RPD between the MS and MSD is outside the acceptance criteria due to non-homogeneous nature of the sample. LCS/LCSD PRD was within criteria.*"

The instances where these QC measures deviated from the acceptable criteria are detailed in analytical reports (Appendix D) and were reviewed by the data validation subcontractor; however, the qualified data are usable because the laboratory data QC was determined to be acceptable, as flagged.

## 6.3 Laboratory Data Validation

A Level IV data validation was performed on all analytical results associated with arsenic delineation activities in accordance with Section 4.2 of the QAPP. Standard Level IV QA/QC data packages were supplied to Brown and Caldwell as part of the laboratory reports for analysis of the delineation and backfill samples (Appendix D). These data packages included results of daily method blanks, MS/MSD, laboratory control samples, and surrogate recoveries for all samples as discussed in the preceding Section. Brown and Caldwell contracted with LDC to perform a data quality review of the laboratory results and associated QA/QC data. The LDC review and examination of the data focused on validating the degree to which the data quality indicators (DQIs) established in the QAPP had been achieved. The measurement data were validated in general accordance with the EPA's July 1990 *Draft Laboratory Documentation Requirements for Data Validation.*

The data quality criteria evaluated by LDC include:

- Laboratory report/documentation;
- Chain-of-custody;
- Timeliness and errors;
- Blanks and contamination;
- Surrogate recovery;
- Precision and accuracy;
- Quantitation and reported detection limits;
- Field duplicate evaluation; and
- Data use and overall quality assessment.

Review of the analytical data by LDC indicated that, as qualified and modified/flagged below, the data are acceptable for use and the analyses were performed in general accordance with the requirements of the referenced methods. The detailed review and recommendations from LDC are provided in Appendix E.

### 6.3.1 Delineation Samples

The following modifications or flags to the laboratory results were made for the delineation soil samples:

- Arsenic results for samples collected from all depths at Locations A through D and from depths of 0.5 feet to 2 feet bgs from Location E at Property #2 were flagged "J" (value is estimated) because the MS recovery was high, but the method control sample recovery was acceptable.
- Arsenic results for samples collected from 3 feet bgs from Location E and samples from all depths at Locations F through I at Property #2 were flagged "J" (value is estimated) because the MS recovery was low, but the method control sample recovery was acceptable.
- Arsenic results for samples collected from all depths at Locations L at Property #3, from all depths at Locations A through C at Property #4, and from 0.5 feet bgs from Location D at Property #4 were flagged "J" (value is estimated) because the RPD exceeded the laboratory control limit.
- Arsenic concentrations in samples BC-P2-E-0.5, BC-P2-G-1, and BC-P2-O-1 collected at Property #2, and sample BC-P3-H-1 collected at Property #3 were flagged "J" (value is estimated) because the RPD exceeded the method control limit. The associated field duplicate sample concentrations were also flagged.

No additional modifications were recommended for the delineation soil sample data.

### 6.3.2 Backfill Material Samples

The data validation performed by LDC indicated that the analytical results were acceptable without modifications or flagging.

### 6.3.3 Field Quality Control Samples

The following modifications or flags to the laboratory results were made as a result of field QC samples validation:

- Field duplicate samples BC-P2-R-0.5, BC-P2-S-1, and BC-P2-W-1 collected at Property #2 and field duplicate BC-P3-P-1 collected at Property #3 were flagged "J" (value is estimated) because the RPD exceeded the method control limit.
- Field duplicate samples BC-P2-R-0.5, BC-P2-S-1, and BC-P2-T-0.5 collected at Property #2 were flagged "M1 and M2" because matrix spike recovery was high or low. Method control sample recoveries were acceptable.
- Field duplicate samples BC-P4-O-0.5 and BC-P4-P-1 were flagged "R2" because the RPD exceeded the laboratory control limit. LCS/LCSD RPD were within criteria.

No additional modifications were recommended for the field quality control sample data.

# 7. REMOVAL ACTION DETERMINATION

Delineation sample data satisfied the criterion of the Decision Input to determine the depths and resultant volume for potential soil removal. Sample data also fulfilled the first component of the Decision Statement and provided quantifiable information for completion of the second removal action component.

## 7.1 Decision Rule

The AL identified in Section VIII.14.a. of the Settlement Agreement was an arsenic concentration of 23 mg/kg or less at the excavation surface unless an alternative concentration was approved by EPA. The decision to remove soils below 6 inches was to be based on a mean arsenic concentration calculated from the analytical results of delineation sampling compared to the AL of 23 mg/kg. A 95% upper confidence limit (UCL) could be calculated based upon the mean of arsenic concentrations at a depth of 0.5 foot bgs. If the calculated UCL was below the AL, then no further action was to be performed at the property. However, if the calculated UCL was above the AL, arsenic concentrations in samples at each discrete sample location were compared to the AL to determine if further removal was required at each successive depth sampled. Areas requiring additional removal to depths below 0.5 feet were designated as "Hot Spots". Additional considerations to the application of the Decision Rule included a data gap analysis, the physical conditions of each property, and the type of material sampled or proposed for removal. Although the decision rule was applicable to the removal of soil at Property #7, the area for excavation was restricted to target the highest concentration of arsenic at the direction of the OSC.

## 7.2 Data Gap Analysis

A data gap analysis was performed to determine if critical gaps existed that would limit the ability to use data for Decision Input, affect calculations for the Decision Rule, or prevent determination of removal action boundaries. There are two types of data gaps that can be discerned: critical and non-critical. A critical data gap prevents complete delineation of the extent of arsenic, or that limits ability to determine the extent of remedial boundaries. No critical data gaps are inferred to exist for delineation of arsenic at Properties #2, #3, and #4. Further, existing characterization data was considered sufficient to complete the limited removal action at Property #7. Delineation samples were collected at the appropriate locations within the constraints of the physical conditions at each property and at the specified depths. Three potential sample locations at Property #3 were excluded because their placement was not considered appropriate for removal actions. All delineation samples were analyzed according to the appropriate methods and data validation indicates the data is acceptable for use. Field QC analyses do not indicate non-conformance with procedures for sample collection or anomalies in subsequent analyses. The locations of each sample were recorded and reacquired during the removal actions, and are reproducible for any further activities.

Non-critical data gaps are those that will not result in significant limitations to delineate the extent of arsenic, make determinations of removal action boundaries, or verify that removal actions are complete. These types of gaps are uncommon and must be considered in relation to project objectives to determine whether they are critical in nature. Due to the critical nature of data acquisition for the Decision Rule and documentation of compliance with the Settlement Agreement, there are no data gaps that should be considered as non-critical for the project.

## 7.3 Physical Conditions

An evaluation of the surficial and subsurface conditions at the properties is necessary as qualifying information to the analytical data to determine the applicability of the Decision Rule. The EPA asserted that the origin for the arsenic in soil at the properties subject to removal action was from the Iron King mine tailings.

The Iron King Mine began operations in 1904 for the recovery of gold and silver from the subsurface ore bodies with the addition of lead and zinc recovery in the 1930s (Hoque and Associates, 2001). Active mining was discontinued in 1969, but mine tailings from milling and processing operations have been processed by Ironite since 1974 and sold as commercial plant supplements. The evaluation of physical conditions must determine if the material matches the criteria cited by EPA and ADEQ above, and is inferred to have originated during the period when the Iron King Mine has existed. The classification of material encountered during sampling according to ASTM guidelines is useful for geotechnical purposes (Table 4), but lack sufficient detail necessary to determine the origin and age of the material.

The Iron King Mine is located on the eastern flank of Spud Mountain in an area underlain primarily by Precambrian metamorphic rocks that have been extensively mineralized by hydrothermal alteration (Hoque and Associates, 2001). The metamorphic rocks are covered in areas north of the Iron King Mine by basin fill deposits that are Pliocene to Miocene in age (2-16 Ma)(Arizona Bureau of Mines, 1958; Reynolds and others, 2000). These deposits are also widespread to the north towards Prescott and exposed in many hills or ridges. The basin fill deposits contain a high proportion of sand and coarser clasts that are igneous or metamorphic in character, similar to the Precambrian bedrock exposed around the Iron King Mine and to the west in foothills (Brown and Caldwell, 2004). The hills and ridge north of Property #2 and #3 are composed of basin fill deposits and the material is visible in exposures along Highway 69 to the east and on the north side of Main Street in Humboldt. Colluvium from the basin fill deposits covers the hillslopes and overlaps finer-grained alluvium along the northern portions of Properties #2 and #3 (Figure 3 and 4). The colluvium is similar to coarse-grained alluvial deposits but the rock fragments are typically more angular and the material contains a higher proportion of fine sediment. Additional fill material used for architectural support of developed parcels or the county roadway has been mixed with colluvium at Property #3.

Properties #2, #3, #4, and #7 are located within the boundaries of the Chaparral Wash floodplain, with the hillslopes on the northern edges of Properties #2 and #3 defining the floodplain at those locations. Chaparral Wash drains an area north and east of the Iron King Mine where stream deposits in the floodplain are proximal to the sources. Alluvial deposits in Chaparral Wash west of Highway 69 are typically coarse grained, consisting of sand, gravel, and boulders that were deposited in multiple sequences as the wash changed course through time. A private borrow pit along the Chaparral Wash contains exposures of at least two coarse-grained alluvial sequences capped with finer-grained material that can be correlated northeast to the land surface at Property #2. The coarse alluvial deposits can also be traced along the cutbank of the north side of the wash downstream to the boundary of Property #4.

## 7.4 Removal Action Boundaries

The removal action boundaries for each property were determined using the data generated during delineation sampling and application of the Decision Rule. Additional delineation was not performed at Property #7 due to access restrictions prior to 2007. The removal action boundaries proposed for Property #7 in the Work Plan was restricted to a single location at the direction of the OSC, based upon existing data collected by E&E.

### 7.4.1 Aerial Extent

The original maximum aerial extent of the removal action at Properties #2, #3, and #4 were proposed in the Work Plan and are depicted in Figures 3, 4, and 5. The excavation boundary of Property #2 was determined based on E&E's August 2005 sampling locations, while the boundaries of Properties #3 and #4 were the parcel boundaries as registered with the Yavapai County Assessor. These boundaries were refined based upon evaluation of delineation soil data, field verification of the property limits, and additional physical conditions as described above.

The following areas were excluded from the scope of the removal action as negotiated with EPA prior to the initiation of field activities:

- Excavations were limited to areas outside of any septic tank and leachfield determined to be present at any of the properties. A 5-foot perimeter around any identified leachfield was established prior to commencement of the removal action. A 5-foot perimeter was used to compensate for the error associated with utility detection equipment.
- Excavations were generally limited to areas outside of any subsurface utility corridor determined to be present on any of the properties. A 5-foot perimeter on both sides of any identified underground utility corridor was established prior to commencement of the removal action.
- Excavation was limited to areas where no significant structures were present. A 5-foot perimeter around any identified structure was established prior to commencement of the removal action. A 5-foot perimeter is selected in order to avoid any structural damage due to soil removal or contact with the excavation equipment.
- Excavation was generally limited to areas where large trees or shrubs, or dense vegetation were not present. A 5-foot perimeter around trees/shrub/vegetation was established prior to commencement of the removal action. A 5-foot perimeter was established to avoid any root damage associated with the removal action activities.
- Excavation was restricted to areas that did not possess a significant slope that could result in disruption of drainage or structural considerations (e.g. road support).
- Excavation was limited to areas currently not paved with concrete or asphalt.

The conditions for determining the limits of soil removal allowed for modifications based upon the field conditions and subject to EPA approval. The revised excavation boundaries were depicted in site maps for Properties #2, #3, and #4 and provided to EPA for review in weekly correspondence dated July 13 and 24, 2006. The EPA granted general concurrence with the revised excavation boundaries, but additional modifications during the removal action were not excluded if field conditions supported further changes. The application of the Decision Rule was restricted to the single area around sample point "G" at Property #7. This modification to the proposed removal action boundary was reviewed with the OSC prior to the removal action in 2007.

Specific exceptions to the conditions cited above were made for removal of soil to limited depths over some utilities, excluding natural gas lines. Additional limited soil removal was performed in close proximity to houses at Properties #2 and #3. Details of the modifications to the aerial extent boundaries are summarized individually by property in the following Sections. The final boundaries of excavated areas at Properties #2, #3, #4, and #7 and depicted in Figures 6 through 9.

### 7.4.2 Vertical Extent

The minimum vertical extent of soil removal was 0.5 feet bgs as stated in the Decision Rule. The removal of soil below a depth of 0.5 feet at specific "Hot Spots" was determined using the methodology cited in the

Decision Rule and physical conditions at each specific location. The calculation of 95 percent UCLs for each property yielded values that were significantly above the AL of 23 mg/kg. The detected arsenic concentrations in the delineation samples were within the range of expected values except for samples BC-P2-J-3 (210 mg/kg) and BC-P3-L-1 (300 mg/kg), which contributed to the elevation of calculated UCLs at those properties (Table 2). The determination of vertical extent defaulted to a comparison of arsenic concentrations at specific depths below 0.5 feet to the AL. Concentrations of arsenic exceeding the AL were proposed as "Hot Spots" with vertical limits at the appropriate depths from 1 to 3 feet bgs.

Limitations to the proposed vertical extent of soil removal were based on the physical conditions of the material as described in Section 7.3, or the proximity of features cited for aerial extent. Material that was considered naturally occurring, coarse-grained alluvial deposits, or colluvium on hillslopes (Table 4) was not proposed for removal. The vertical limits for "Hot Spot" excavation were subject to modification if the coarse-grained alluvial deposits were encountered prior to the proposed depths of removal. An additional consideration for vertical limits of "Hot Spots" was the presence of arsenic exceeding the AL, but deeper samples that contained arsenic that was less than the AL. This discrimination rationale limited the proposed vertical extent to a depth of 0.5 feet bgs applied to the following selected locations:

- BC-P2-D;
- BC-P2-N;
- BC-P4-D;
- BC-P4-E; and
- BC-P4-K.

The proposed locations of "Hot Spots" and the vertical extent of excavation for each property were communicated to EPA in weekly correspondence dated July 13 and 24, 2006. The locations of the "Hot Spots" on the maps provided to the OSC were modified as depicted in Figures 6, 7, and 8 to account for the GPS resurveying that occurred during the removal action. The excavated area at Property #7 was considered a "Hot Spot" with a nominal depth to 1 foot bgs as directed by the OSC.

Exceptions to the limits of aerial and vertical extent were made in selected locations over subgrade utilities or near trees and landscaping. These exceptions were dependant upon the depth of burial determined during the removal activities. Removal of surficial material was performed to depths of 1 inch in areas where landscaping was present or within 5 feet of the houses at Properties #2 and #4. Soil removal was limited in depth to 3 inches in areas where subgrade electrical, water, or leach lines were at approximate depths of 1.5 feet bgs at Properties #3 and #4. No other significant factors limited the vertical extent of removal as proposed. The approximate depths of the excavations for each property as completed are identified in Figures 6 through 9.

## 7.5 Removal and Disposal Options

Options for the removal and disposal of soil had been discussed and partially determined during preparation of the Work Plan. The proposed methodology for soil removal was reviewed by Brown and Caldwell and PSC during the planning phases for this project. Itemized estimates including the types of equipment, personnel, and schedules were prepared by PSC and reviewed by Brown and Caldwell to determine the most effective method of soil removal. The methods selected for excavation, and described in the following Sections, were approved by the OSC prior to the mobilization. Recommendations regarding the types of equipment in use or their performance in specific tasks were incorporated as field activities progressed.

The selected disposal option for the excavated soil was transport to an approved location at the Ironite property and placement as directed by mine personnel in accordance with Section VIII 14(c) of the Settlement Agreement.

# 8. ARSENIC REMOVAL ACTION

The arsenic removal action was performed by PSC under the supervision of the Brown and Caldwell Field Manager and an assistant. The OSC was present during the majority of the removal actions. United States Coast Guard personnel were utilized by EPA for dust monitoring and to provide oversight of the removal activities. The EPA also retained E&E to assist in oversight and collection of verification samples.

## 8.1 Environmental Permits and Prevention Plans

Brown and Caldwell notified the Town of Dewey-Humboldt Building Department of the planned removal action prior to initiation of field activities to acquire the necessary permits. Discussions with the Town of Dewey-Humboldt Building Department indicated that a Dust Control Permit was not required. However, minimization of dust was considered a critical element for the removal action due to the potential for worker exposure to arsenic. The dust control measures used during the excavation and backfill activities are described in Section 8.4.

A Storm Water Permit to control or limit the potential runoff of surface water at the excavated areas was also not necessary. This determination was based on the size of the construction activity at each property which was less than 1 acre. Storm water control measures were implemented at the excavation areas primarily as a means to minimize potential transport of arsenic in soil beyond the excavation boundaries into areas that were not proposed for excavation. The minimization of surface water runoff was also considered prudent to protect the residential property from flooding during excavation when the normal land surface was disturbed.

Surface water control measures including straw waddles were implemented at Properties #2 and #4 at the beginning of the excavation activities. The surface water control was not utilized at Properties #3 and #7 due to the short period of time when northern portion of the site was excavated prior to backfilling (Table 1). The surface water controls consisted of a silt fence and hay bales placed along the upslope (northern) portions of the excavations where water could enter the working areas (refer to photos in Appendix F). The silt fence and hay bales were removed at the conclusion of backfill activities and taken to the Ironite property for use in storm water control during the placement of excavated material.

## 8.2 Site Clearance

Brown and Caldwell met with each property owner/tenant as part of the relocation process to discuss the proposed areas of excavation and the clearance of significant obstructions to removal action. Property owners/tenants communicated requests for protection of property or possible excavation limit modifications to Brown and Caldwell and EPA prior to the removal actions. Photographs of each property were taken prior to excavation in order to document the types of items and their location (Appendix F). The photographs were also used to determine if any damages had occurred to items or structures as a result of the removal activities. The locations and conditions of items moved by PSC and Brown and Caldwell were discussed with the owners/tenants during the site inspections conducted after the removal and restoration activities were completed. No significant damage or issues relating to the placement of the items were communicated to Brown and Caldwell at the conclusion of the site inspections.

Site clearance at Property #2 consisted primarily of relocation of items to areas not proposed for excavation and near the houses. The items were replaced in their original locations at the completion of restoration activities.

Property #3 contained multiple items that were either relocated by the owner or PSC. In addition, items that did not retain value as determined by the owner were placed in a 20-cubic yard roll-off bin staged on the western side of the county road. Concurrence to place the items in the roll-off for disposal was obtained from the property owner. The remainder of items at Property #3 were relocated away from excavation areas. A stockpile of wood at the northwest portion of the property was moved during excavation and subsequently replaced in the original position at the conclusion of restoration activities. The wood was sprayed with a dilute solution of 10% chlorine bleach and water for suppression of dust and to eliminate exposure to potential airborne biological hazards such as Hanta Virus (Appendix F).

The majority of items at Property #4 that obstructed removal actions were relocated by the property owner (Appendix F). In addition, electrical and water lines at the eastern side of the house were removed and relocated by the owner. Building materials that could be relocated on the northern portions of the excavation were placed near the property boundary and replaced in the original locations during restoration activities.

The limited area for excavation at Property #7 did not require significant site clearance prior to initiation the removal actions.

## 8.3 Property Owner/Tenant Relocation

Brown and Caldwell, as a representative of Ironite, communicated the proposed arsenic removal actions with the owners or tenants of each property prior to mobilization and initiation of field activities. The relocation of property owners or residents was in general accordance with the EPA document titled *"Superfund Response Action: Temporary Relocations Implementation Guidance"* dated April 2002. Brown and Caldwell communicated the schedule and physical aspects of the proposed removal actions with the property owners/tenants in accordance with Section 8.3 of the Work Plan. The potential concerns of property owners/tenants and specific requests were also documented to incorporate necessary actions into the field activities.

An EPA-approved temporary relocation agreement was provided to each property owner/tenant and subsequently to Ironite for signature at least seven days prior to the initiation of field activities. Copies of each signed relocation agreement were furnished to the EPA to verify compliance with EPA policy, and dates for proposed removal action. Brown and Caldwell notified the property owners/tenants of potential changes to the schedule for completion as the removal actions progressed. The extension of removal actions at Property #2 required the tenants to remain off site for an additional period from July 31 through August 4, 2006. No modifications to the relocation arrangements were required for Properties #3 or #4. The owner of Property #7 was not present during the removal action on May 15, 2007, and no formal relocation arrangement was necessary.

The relocation agreements included compensation for each property owner/tenant affected by the removal actions. Ironite provided funding for the relocation including lodging, per diem, and mileage allowance during the completion of removal actions.

## 8.4 Dust Control

The minimization of dust during the removal activities was identified as a critical task due to the potential for exposure of personnel to arsenic which was designated as the chemical hazards for the project in Section 3.2 of the SSHP. Dust control was not specifically required from the town of Dewey/Humboldt, but minimization of visible dust was required to eliminate a potential nuisance as described in Section 3.2 of the SSHP.

Dust control procedures during removal and backfill activities consisted primarily of water application to prevent the propagation of airborne dust. Water was applied directly to the excavation or areas proposed for removal to pre-treat the soil and make it less susceptible to generation of dust. Water was also directed at locations undergoing excavation, stockpiled material, and earthmoving equipment during active removal of soil (Appendix F). The water was applied using spray nozzles from water storage tanks or using a fire hose to direct the water in a specific location. Excavation and movement of soil, except for transport trucks, was discontinued during periods when water storage tanks were refilled at the Ironite property. Water was also applied to access roads to each property to minimize fugitive dust entering the excavation areas and general nuisance reduction.

### 8.4.1 Encapsulation of Homes

Each of the houses at Properties #2, #3, and #4 were encapsulated with plastic sheeting by PSC personnel prior to the initiation of removal actions. This method of protection prevented dust or debris from contacting the sides of the houses or entering the interior of the homes through cracks or joints. The plastic sheeting was attached to roof edges with staples and the seams sealed with duct tape around the entire structures (Appendix F). The lower edges of the sheeting were staked or weighted to the ground to minimize disturbance and maintain a seal with the land surface. The plastic sheeting remained in place through the removal actions and was removed from each house upon conclusion of restoration activities. No significant breaches were noted in the plastic during the removal actions that may have allowed dust or debris to contact the homes. The materials used for the encapsulation were subsequently disposed as solid waste (Section 9). The limited aerial extent and duration of the removal action at Property #7 was not considered sufficient to require encapsulation of the residence, and was confirmed with OSC prior to the initiation of excavation.

### 8.4.2 Dust Monitoring

Monitoring of dust was required to comply with appropriate chemical exposure limits determined in Section 3.2 of the SSHP. However, the United States Coast Guard personnel conducted the monitoring of dust within the excavation areas and perimeter of each property during the removal actions in 2006. The monitoring data was obtained using portable meters that collected continuous readings of airborne dust. The data was downloaded from the meters during multiple periods each day that removal actions occurred. The results of the dust monitoring were communicated verbally to Brown and Caldwell and PSC during each day, with recommendations based upon the results of the monitoring. No significant events that required cessation of field activities or upgrading of PPE occurred during the removal action. Records of all dust monitoring data were retained by the United States Coast Guard personnel and provided to EPA at the conclusion of the removal action.

Dust monitoring was not performed by the United States Coast Guard or EPA during the removal action at Property #7. The limited duration of the activities and volume of material removed was not considered sufficient to deploy the monitoring network or equipment used for the previous actions in 2006. This modification to the conditions of the SSHP was confirmed with EPA prior to initiation of field activities on May 15, 2007.

## 8.5 Excavation Methods

The removal of soil at Properties #2, #3, and #4 was primarily accomplished using a trackhoe equipped with a straight edge on the bucket to produce a smooth floor in excavated areas. The trackhoe was stationed in various locations to progressively remove the soil and either deposit the material directly in haul trucks or stockpile the material for subsequent loading (Appendix F). Access to excavations was limited to personnel with appropriate PPE to reduce the potential for cross contamination from portions of the property that had not been excavated. The support vehicles for personnel were staged at locations outside the defined exclusion zone at each property. The only support equipment allowed in the exclusion zone was the trackhoe, haul trucks, backfilling equipment, and a water wagon used for dust suppression.

The areas to be excavated were identified with a combination of stakes, feathers, or paint on the ground to indicate the limits of soil removal. The borders of "Hot Spots" were marked with paint after the initial 6 inches of soil had been removed. Assistance for excavating areas near utilities or structures was also provided by visual observation of the ground by Brown and Caldwell personnel. The final borders of the excavated areas, including the "Hot Spots", were delineated with stakes or paint to facilitate the mapping of the boundaries with the GPS unit (Section 8.13). The depths of the excavation were periodically measured to verify the soil removal to appropriate vertical limits. The removal of soil was performed manually in limited areas near structures at Properties #2 and #4 as described below. The material removed in this manner was stockpiled or placed near areas where the trackhoe could access and remove the soil.

The excavation at Property #7 was performed using a backhoe that removed soil and placed it directly into a haul truck for transport (Appendix F). An exclusion zone was established for the excavation area to limit access for personnel with the appropriate PPE. The boundaries of the excavated area were established prior to soil removal with stakes and the vertical limit of excavation was measured prior to backfilling.

## 8.6 Property #2 Removal Action

Soil removal actions were conducted at Property #2 from July 24 through August 2, 2006 (Table 1). The soil removal was initiated at the northeastern portion of the property and progressed west and south around the houses to the main access road (Appendix F). The western portion of the property was subsequently excavated with the access road remaining intact until the final stages of removal. An estimated total of 1,030 cubic yards of soil was removed from Property #2.

The excavation boundaries as completed are depicted on Figure 6, which also depicts the depths of removal in selected areas or "Hot Spots". Large trees or shrubs, typically exceeding 6 to 8 feet in height, were not removed by excavation. Dense clusters of shorter trees or shrubs were also left in place in the central area and north of the southern house at Property #2. Smaller vegetation, such as flower beds or grass, also limited excavation dependant upon the tenant's preference for the eastern yard of the southern house. The northern limit of removal in the western area of Property #2 was determined by the significant break in slope and drainage north of sample point BC-P2-D (Figure 6). An isolated portion of the western area was also not excavated beneath a stockpile of cobbles.

Subgrade utilities limited excavation along two corridors extending from the northern house to the southwest and northwest (Figure 6). A domestic water line located outside of the designated excavation was broken when soil was removed for use along the northern part of the excavation to support the storm water controls described in Section 8.1. The line was subsequently repaired and the area backfilled in conjunction with the excavation. Multiple abandoned steel pipes were excavated in areas between the two houses and in the roadway to the west of both houses. The pipes were not connected to either house or an existing utility, but appeared to have been used for water distribution.

The "Hot Spots" were excavated to depths ranging from one to two feet and dependant upon the vertical limitations of removal. The depths of removal at the points BC-P2-J and BC-P2-Q were less than proposed because alluvial cobbles were encountered at approximately 1.5 feet bgs, and limited further excavation.

Limited removal actions were performed in close proximity to the southern house at the request of the EPA to mitigate exposure of the tenant to arsenic in the surficial soil. The depths of removal varied from one to three inches in areas north and west of the house (Figure 6). The aerial extent restrictions for removal were reduced to excavate soil around trees, decorative items, and the walkway to the house (Appendix F). The soil was removed with the trackhoe and manually in areas where the trackhoe bucket could not reach.

## 8.7 Property #3 Removal Action

Soil removal actions were performed at Property 3# on August 1 and 2, 2006 (Table 1). The soil removal was initiated at the eastern portion of the property and progressed westward north of the house to the easement with the county road (Appendix F). The northern portion of the property was subsequently excavated and the final stages of removal progressed along the western side of the house and southern portion of the property. An estimated total of 140 cubic yards of soil was removed from Property #3.

The excavation boundaries as completed are depicted on Figure 7, which also depicts the depths of removal in selected areas or "Hot Spots". Limitations to the removal areas included trees, landscaping, and structures in the northern portion of the property and a landscaped area south of the house. The western and northern edges of the proposed removal areas were reduced due to the verification of the county road easement closer to the house. Subgrade utilities and a leach line limited excavation to depths of 1 to 3 inches along a corridor extending from the northern and northeastern sides of the house (Figure 7). A plastic liner at a depth of approximately 4 inches bgs was removed during excavation of the area extending approximately 20 feet from the northeast portion of the house. The base of the excavation extended several inches below the liner to the minimum target removal depth of 0.5 feet bgs.

The "Hot Spots" were excavated to depths ranging from 1 to 3 feet and dependant upon the vertical limitations of removal. The depth of removal at point BC-P3-A was approximately 1.5 feet bgs and was less than the proposed depth of 2 feet bgs because alluvial cobbles limited further excavation. A domestic water line was encountered and broken during the excavation of the area at BC-P3-L at a depth of approximately 3 feet bgs (Appendix F). The water line was subsequently repaired prior to backfilling, but additional soil was removed from around the water line to a depth of approximately 4 feet bgs to permit the repairs (Figure 7).

## 8.8 Property #4 Removal Action

Soil removal actions were conducted at Property #4 from August 7 through 10, 2006 (Table 1). The soil removal was initiated at the northeastern portion of the property in landscaped areas located east and south of the house (Appendix F). Removal actions continued on the northern portion of the property extending west and subsequently around the western and southern portions of the property. An estimated total of 434 cubic yards of soil was removed from Property #4.

The excavation boundaries as completed are depicted on Figure 8, which also depicts the depths of removal in selected areas or "Hot Spots". Limitations to removal consisted of trees, walls, and landscaped areas in areas south and east of the house. Additional limitations were present along utility corridors for natural gas, electric, and water lines, and a septic leach line located in the northern and western portions of the property (Figure 8). The northern limit of removal in the western area of Property #4 was determined by the presence of stockpiled building materials and a berm that acted as a surface water diversion. Portions of the utility corridors north and west of the house were manually excavated to depths of 1 to 3 inches, but no excavation occurred over subgrade utilities south of point BC-P4-H. Manual removal of soil also occurred around trees and landscaping east of the house to depths of 1 to 3 inches.

The "Hot Spots" were excavated to depths ranging from 1 to 2 feet without vertical limitations due physical limitations. A domestic water line was encountered and broken during the excavation of the area at BC-P4-H at a depth of approximately 1.5 feet bgs. The water line was subsequently repaired prior to backfilling, but additional soil was removed laterally from around the water line at a depth of approximately 2 feet bgs to permit the repairs.

## 8.9 Property #7 Removal Action

Soil removal actions were conducted at Property #7 on May 15, 2007 (Table 1). The soil removal was performed in a single area measuring approximately 15 feet in a square configuration south of the house and concrete pad (Figure 9 and Appendix F). An estimated total of 8 cubic yards of soil was removed from Property #7.

The excavation boundaries and depth of removal as completed are depicted on Figure 9. These boundaries were stipulated by EPA due to the isolated nature of the arsenic in soil at that location (Sections 7.4.1 and 7.4.2). No physical limitations or utilities were present during the excavation of the soil.

## 8.10 Disposal

Excavated soils were transported by PSC to the Ironite property and deposited on mine tailings at a location designated by Ironite representatives. The material was subsequently distributed as tailings cover by Ironite personnel using mine equipment. Each of the loads of material transported to the Ironite property was weighed to record the total amount of soil excavated. Summary of the soils transported out of and into the properties are provided in Table 6. An estimated total of approximately 1,612 cubic yards of soil were removed from the four properties and placed on the tailings at the Ironite property.

## 8.11 Backfilling and Compaction

The backfilling and compaction of excavated areas at Properties #2, #3, and #4 occurred from July 31 to August 11, 2006, in partial conjunction with removal activities at each property (Table 1). Excavated areas were backfilled with imported soil from a borrow pit approximately two miles north of the properties. The backfill material had been previously sampled and the material deemed acceptable for use based upon the physical and chemical conditions of the soil. Backfill material was transported to the properties by personnel and trucks under subcontract to PSC and placed in stockpiles at the edges of the excavations as the backfilling progressed (Appendix F). Backfilling and compaction of Property #7 occurred on May 15, 2007, the date of excavation, utilizing material obtained from the same source as the other properties.

### 8.11.1 Excavation Backfill and Compaction

Backfilling at Properties #2, #3, and #4 was performed using a bulldozer to distribute and compact the majority of the soil across the excavated areas. Portions of the excavations where trucks brought backfill for stockpiling at Properties #2 and #4 were covered with plastic to minimize the contact of truck wheels with the exposed soil (Appendix F). The potholes created during "Hot Spot" excavations were filled and compacted to the approximate level of the main excavation prior to placement of the final lift of backfill. Water was applied to the backfill during the distribution and compaction process to assist in compaction and to reduce dust. Locations where water lines had been repaired were filled with soil and water to settle the material, providing support to the lines prior to the final backfill lift at the surface. The bulldozer was used for the majority of grading the final backfilled surfaces to the approximate level of the pre-excavation surfaces. The backfilling and compaction process was assisted with the use of a Bobcat loader in areas with reduced access, such as near houses or around trees and landscaping.

Backfilling of the excavation at Property #7 was performed by placing material directly into the excavated area from a dump truck. The material was distributed and compacted with a backhoe, with water application to aid compaction and reduce dust. The backfill material was compacted and graded to a level equivalent to the surrounding ground surface and no further restoration was conducted (Appendix F).

### 8.11.2 Surficial Backfill and Restoration

Portions of each property required additional backfill and restoration activities prior to completion of the removal action. Additional backfill consisting of topsoil similar to pre-existing soil was used in the excavated areas near the southern house at Property #2. Coarse gravel was also replaced at the surface on the northern side of the house, where gravel had been removed during the excavation activities. The location of the subgrade leach field in the center of Property #2 was raised topographically above the surrounding areas prior to the removal action. An extension of this raised area was constructed by PSC at the request of the property owner to assist drainage away from the road. However, surface water became trapped behind the berm and flowed toward the southern house during a subsequent thunderstorm. Brown and Caldwell directed PSC to shorten the berm and raise the grade near the leach field to prevent further events and allow surface water to drain to the south and west (Appendix F).

Upon completion of backfilling and compaction at Property #3, the areas north of the house were restored with pea gravel on the surface and landscape boundaries were replaced. Plastic lining was placed underneath the soil and pea gravel in areas northeast of the house to replace the plastic removed during excavation. The pea gravel cover was extended around the western side and southern sides of the house extending to the county road (Appendix F). The stockpile of wood was replaced in its original location and the slope along the county road was restored.

Surficial backfilling was necessary in areas east and north of the house at Property #4. Topsoil was used for backfilling and compaction, overlain by imported gravel to restore the surface to the pre-excavation conditions (Appendix F). The surface drainage along the eastern portion of the excavated area was also re-graded to promote flow away from the landscaped areas and the house. Coarse gravel had been present on the surface in areas southeast of the house prior to the excavation. This material was removed, stockpiled, and then replaced as surface cover at the conclusion of restoration activities.

## 8.12 Confirmation and Verification Sample Collection

Collection of confirmation or verification samples after removal of soil was not proposed by Brown and Caldwell as stated in Section 4.5 of the Work Plan. However, EPA and E&E collected verification samples on a grid layout at each property, except Property #7, after the excavation activities were completed. Backfill activities were not initiated until the verification samples had been collected from a specific excavated area. The details concerning the sample locations, methods of collection, and analytical results of the samples were not provided to Ironite and are not included in this document.

## 8.13 Revegetation

The excavation areas at each of the three properties were inspected prior to the initiation of soil removal. The considerations of removing substantial vegetation were discussed and the boundaries of soil removal were confirmed with the EPA representative prior to initiating excavation at each property. The limitations generally placed on excavation boundaries were dependant upon size or type of vegetation as discussed in Sections 8.6 through 8.8. The extent of final excavation boundaries and subsequent site restoration activities did not necessitate revegetation of portions of Properties #2, #3, #4, or #7. Brown and Caldwell consulted with each property owner at the conclusion of the restoration activities and confirmed that no revegetation was necessary.

## 8.14 GPS Readings

The locations of each delineation sample point, significant features or structure, and utilities were reacquired and surveyed prior to the removal activities with a GPS unit. The type of GPS unit used was a backpack unit and real-time kinematic (RTK) antenna, which typically can locate points with sub-meter precision. The boundaries of the excavated areas were surveyed upon completion of the soil removal to the required depths.

The survey was performed using a combination of fixed reference points and a mapping function in the GPS unit that allowed data acquisition as the boundaries of the excavated areas were traversed. The record of points along the excavation boundaries were then translated into a map of the path and downloaded.

As discussed in Section 4.8, a review of sample locations and other reference points surveyed during the removal action indicated that inaccuracies were present in the initial GPS data collected during delineation sampling. The precision of the GPS locations contained a significant amount of error of up to 10 meters, resulting in their placement that was inconsistent with one another, or to surface features. The use of a different GPS unit for mapping during the removal activities yielded greater precision and the locations of all delineation sample locations were reacquired at that time. The physical locations of the removal action boundaries were not affected by the revisions to the GPS data. A summary of the GPS coordinates for delineation samples and other significant features at each property is presented in Table 5. The locations of delineation samples and removal action boundaries in Figures 3 through 9 are based upon the coordinates in Table 5.

## 8.15 Heavy Equipment Decontamination

The decontamination of heavy equipment occurred as an ongoing process for haul trucks transporting excavated soil, and in discrete events between removal actions at each property. The haul trucks were visually inspected for gross contamination or other items that adhered to or hung off the trucks. Hanging or loose material was placed securely in the bed of the truck to ensure it did not become loose and fall during transport on the roads to the Ironite property. Loose dirt or dust was brushed off the exterior of the trucks to minimize the spread of excavated material outside of the excavation zones.

Decontamination of the trackhoe and backhoe was performed by scraping and brushing loose material from the bucket, followed by steam cleaning with a pressure washer. This process was performed after the excavation activities were completed prior to use at each successive property. The decontamination was performed outside of the removal action boundary, but within the excavation limits of each property. The trackhoe also removed material adhering to tracks by raising each side individually above the ground and rotating the tracks rapidly to dislodge the soil. The wheels of the backhoe were rinsed with a pressure washer after completion of backfilling at Property #7. The decontamination fluids were allowed to disperse on the ground surface at each location in accordance with the practices described for delineation sampling equipment decontamination.

## 8.16 Significant Deviations from Proposed Activities

All deviations from proposed removal and backfilling activities were approved and/or modified by the OSC and were presented in the preceding Sections. The deviations are restated below with justifications for each of the deviations:

1. *Aerial extent of excavation was decreased in western and northwestern portions of Property #2.* The removal boundaries were modified for the following reasons:
   A. Areas proposed for removal included significant slopes or drainages. The northwestern boundary overlapped an elevated area that was part of the drainage and also used for a domestic water line. In addition, the material was of potentially mixed origin from the hill north of the removal action boundary. The excavation did not extend north from the break in topographic slope at the location of Sample BC-P2-D.
   B. A stockpile of cobbles was present at the western edge of the removal area. The relocation of the material was not requested by EPA to allow excavation beneath the stockpile.

2. *Aerial extent of excavation was decreased in western and northern portions of Property #3.* The removal boundaries were modified for the following reasons:
   A. The areas proposed for removal included significant slopes or material that was used to support a county road and drainage culvert. The western property boundary was restricted by the easement with the county road.
   B. Subgrade utilities and structures attached to the house prevented excavation to the proposed boundaries on the northern side of the house.
3. *Aerial extent of excavation was decreased in western and northwestern portions of Property #4.* The removal boundaries were modified for the following reasons:
   A. Multiple subgrade utilities were present within 1.5 feet of surface. Limited excavation was performed to depths of 1 to 3 inches bgs.
   B. Multiple trees along western edge of property and drainage berm at northwestern portion of excavation limited access to remove soil.
4. *Aerial extent of excavation was decreased at Property #7.* The removal boundaries were modified for the following reasons:
   A. Access to the property was not obtained until after the delineation sampling was completed in 2006. The existing data indicated that the area of maximum exposure risk was restricted to an area south of the house. The EPA concurred in limiting the excavation to minimize disruption to the property and owner, to remove the soil and eliminate the exposure risk.
5. *Excavation of specific "Hot Spots" were terminated at depths shallower than proposed.* The removal boundaries were modified for the following reasons:
   A. Alluvial cobbles were encountered at a depth of approximately 1.5 feet bgs at locations P2-J and P2-Q at Property #2.
   B. Alluvial cobbles were encountered at a depth of approximately 1.5 feet bgs at location P3-A at Property #3.

The deviations from the proposed activities were communicated to the OSC for approval prior to implementation.

# 9. WASTE MANAGEMENT

## 9.1 PPE Waste

Personal protective equipment that was used during the delineation sampling and removal action consisted of nitrile gloves and disposable footcovers. No other PPE equipment was utilized that required disposal as a waste product. The PPE was managed and disposed with other non-regulated solid waste as summarized below.

## 9.2 Solid Waste

The primary type of solid waste generated was excavated soil from the removal action. A pre-determination to classify the soil as non-hazardous according to RCRA was made in Section 10.2 of the Work Plan. Accordingly, the non-hazardous excavated soil was transported to the Ironite property as described previously in Section 8.9.

Other types of solid waste consisted of a mixture of wood, plastic, metal, and paper or cardboard materials that were classified as non-hazardous and non-regulated debris in accordance with Section 4.0 of the SAP. The solid waste included materials stockpiled in the roll-off bin at Property #3 and authorized by the owner for disposal as construction debris.

Solid waste generated during delineation sampling was disposed in appropriate off-site receptacles by Brown and Caldwell or PSC. Solid waste generated during the removal action was contained and removed from the individual properties by PSC.

## 9.3 Liquid Waste

Liquid waste was generated during decontamination activities for the delineation sampling and removal actions. The decontamination liquids were allowed to disperse on the ground in accordance with the procedures stipulated in Section 10.3 of the Work Plan. No other liquid wastes were generated during the completion of delineation sampling or the removal actions.

# 10. REMOVAL ACTION SUMMARY

## 10.1 Site Inspection

The inspection of each property was conducted immediately following backfilling and restoration activities by the Brown and Caldwell On-Site representative and the Project Manager. The inspections were intended to identify areas that potentially required additional action to restore the properties to pre-removal conditions. The modification of surface drainage at Property #2 was performed after the inspection indicated retention and flooding in the central portion of the property (Section 8.11.2). No significant surface drainage problems were observed at Properties #3, #4, and #7 at the conclusion of restoration activities.

## 10.2 Decision Errors

The two types of decision errors identified in the Work Plan were:

1. Deciding that the concentrations of arsenic in a sample are less than the AL when, in fact, it is greater than or equal to the AL.
2. Deciding that the concentrations of arsenic in a sample are greater than or equal to the AL when, in fact, they are less than the AL.

The evaluation of sampling and laboratory analytical data did not identify significant non-conformances that resulted in either of the two types of decision error. No significant critical data gaps have been identified that resulted in decision errors.

Removal actions were completed to the designated aerial extent and depths based upon the application of the Decision Rule to the delineation sample data and physical conditions at each property. Limitations in removal depths at multiple "Hot Spots" could be considered a Type 1 decision error; however, the reductions in vertical extent were based on criteria that had been confirmed by EPA. The completed removal actions therefore did not result in a Type 1 decision error. The removal of additional soil for repairs of utilities is not considered a Type 2 decision error because the material was not removed based upon sample data.

The application of the Decision Rule was modified for the removal of soil at Property #7. Access to the property was not obtained until 2007, and the limitation of excavation to a single area was considered acceptable to minimize disruption to the owner. This limited application of the Decision Rule removed the exposure risk to the maximum concentration of arsenic, and eliminated a Type 1 error for that location. The remaining concentrations of arsenic at Property #7 may be subject to additional delineation or removal action by EPA, dependant upon access. Therefore, evaluation of decision errors for Property #7 is considered premature and may be completed pending further actions.

## 10.3 Post-Removal Site Control

An evaluation of potential actions for post-removal site control is required by the Settlement Agreement. The backfilling, compaction, and restoration of the excavation areas at each property have resulted in surface conditions that are equivalent to, or improved from, the original property characteristics. Surface topography was restored to pre-excavation conditions. Access to the surface at each property may be unrestricted without compromising the restored conditions. Therefore, no post-removal controls are considered necessary for the properties.

## 10.4 Effectiveness

The evaluation of the effectiveness of the removal actions can be based upon several criteria:

1. Compliance with the Decision Rule, modified as a result of physical conditions at each property.
2. Comparison with the defined lateral and vertical boundaries of the removal action.
3. Completion of tasks associated with the removal action in a manner that is appropriate and compliant with regulatory and industry practices.
4. Completion of removal actions without significant health and safety incidents.
5. Completion of restoration to the satisfaction of owners or tenants at each property.
6. The elimination of additional actions to maintain the conditions at each property at the conclusion of restoration.

The removal actions complied with the conditions of the Decision Rule and the proposed limits of excavation. No significant Decision Errors were identified to determine the removal boundaries, or in the completion of the removal actions. No health and safety incidents were recorded and removal actions were conducted in accordance with the conditions applicable at each property. The site restoration activities and inspections have not identified significant deficiencies in the condition of the properties and no post-removal controls are necessary.

The removal action for arsenic in soil at Properties #2, #3, #4, and #7 has been completed as required by the Settlement Agreement.

## 10.5 Certification

The following certification of completion for the activities described in this report for the Ironite is in compliance with Section VIII 20 of the Settlement Agreement.

> Under penalty of law, I certify that to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of the report, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature

Pejman Eshraghi, Associate, Brown and Caldwell
Printed Name and Title

# 11. REPORT LIMITATIONS

This report was prepared solely for Ironite Products Company in accordance with the standards of the environmental consulting industry at the time the services were performed. This report is governed by the specific scope of work authorized by Ironite Products Company and is not intended to be relied upon by any other party except regulatory agencies as contemplated by the Scope of Work. We have relied on information or instruction provided by Ironite Products Company and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information. This report makes no representation or warranty that environmental contamination does not exist at this site beyond that described in this report.

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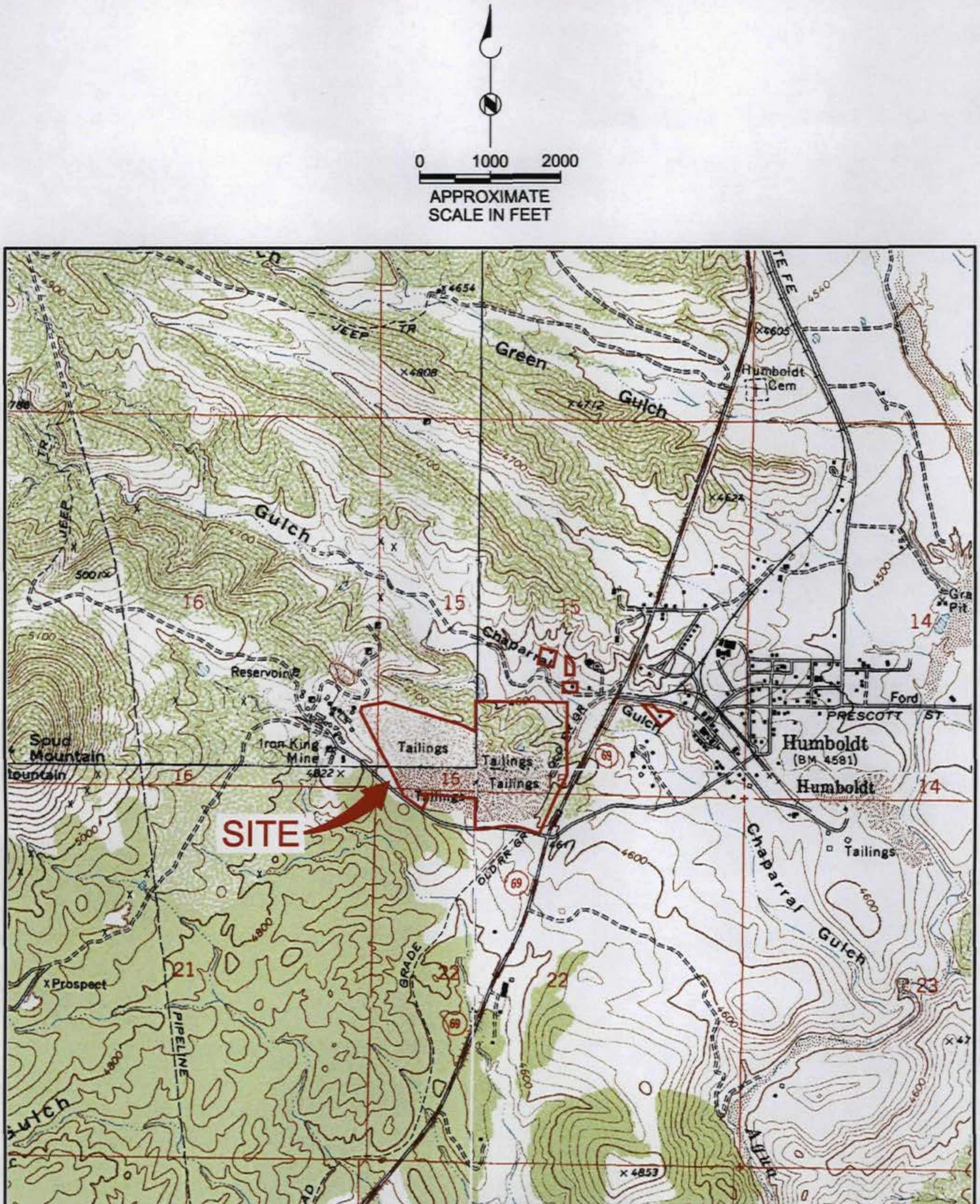
Figures

BROWN AND CALDWELL




SOURCE: USGS 7.5-MINUTE TOPOGRAPHIC QUADRANGLES: HUMBOLDT / MAYER / POLAND JUNCTION / PRESCOTT VALLEY SOUTH, ARIZONA

BROWN AND CALDWELL

Figure 1
VICINITY MAP
IRONITE PRODUCTS COMPANY
HUMBOLDT, ARIZONA

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BROWN AND CALDWELL

Figure 2
GENERAL SITE MAP
AND PROPERTY LOCATIONS
IRONITE PRODUCTS COMPANY
HUMBOLDT, ARIZONA

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BROWN AND CALDWELL

Figure 3

DELINEATION SAMPLE MAP
PROPERTY #2
IRONITE PRODUCTS COMPANY
HUMBOLDT, ARIZONA

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BC-P3-C (legend example)

| depth | As |
|---|---|
| 6" | 19 |
| 6" (dup) | 18 |
| 1' | 15 |
| 2' | 22 |
| 3' | 20 |

BC-P3-D

| depth | As |
|---|---|
| 6" | 130 |
| 1' | 19 |
| 2' | 14 |
| 3' | 12 |

BC-P3-H

| depth | As |
|---|---|
| 6" | 110 |
| 1' | 29 |
| 1' (dup) | 16 |
| 2' | 14 |
| 3' | 15 |

BC-P3-C

| depth | As |
|---|---|
| 6" | 19 |
| 6" (dup) | 18 |
| 1' | 15 |
| 2' | 22 |
| 3' | 20 |

BC-P3-N

| depth | As |
|---|---|
| 6" | 140 |
| 1' | 25 |
| 2' | 12 |
| 3' | 10 |

BC-P3-I

| depth | As |
|---|---|
| 6" | 97 |
| 1' | 22 |
| 2' | 18 |
| 3' | 13 |

BC-P3-J

| depth | As |
|---|---|
| 6" | 51 |
| 1' | 45 |
| 2' | 43 |
| 3' | 16 |

BC-P3-B

| depth | As |
|---|---|
| 6" | 34 |
| 1' | 31 |
| 2' | 20 |
| 3' | 23 |

BC-P3-M

| depth | As |
|---|---|
| 6" | 47 |
| 1' | 150 |
| 1' (dup) | 110 |
| 2' | 16 |
| 3' | 12 |

BC-P3-L

| depth | As |
|---|---|
| 6" | 42 |
| 1' | 300 |
| 2' | 31 |
| 3' | 14 |

BC-P3-A

| depth | As |
|---|---|
| 6" | 26 |
| 1' | 21 |
| 2' | 31 |
| 3' | 22 |

BC-P3-K

| depth | As |
|---|---|
| 6" | 30 |
| 1' | 19 |
| 2' | 17 |
| 2' (dup) | 20 |
| 3' | 10 |

Figure 4
DELINEATION SAMPLE MAP
PROPERTY #3
IRONITE PRODUCTS COMPANY
HUMBOLDT, ARIZONA

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BROWN AND CALDWELL

Figure 5
DELINEATION SAMPLE MAP
PROPERTY #4
IRONITE PRODUCTS COMPANY
HUMBOLDT, ARIZONA

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Figure 6
ARSENIC REMOVAL AREA MAP
PROPERTY #2
IRONITE PRODUCTS COMPANY
HUMBOLDT, ARIZONA

BROWN AND CALDWELL

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BROWN AND CALDWELL

Figure 7
ARSENIC REMOVAL AREA MAP
PROPERTY #3
IRONITE PRODUCTS COMPANY
HUMBOLDT, ARIZONA

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Figure 8
ARSENIC REMOVAL AREA MAP
PROPERTY #4
IRONITE PRODUCTS COMPANY
HUMBOLDT, ARIZONA

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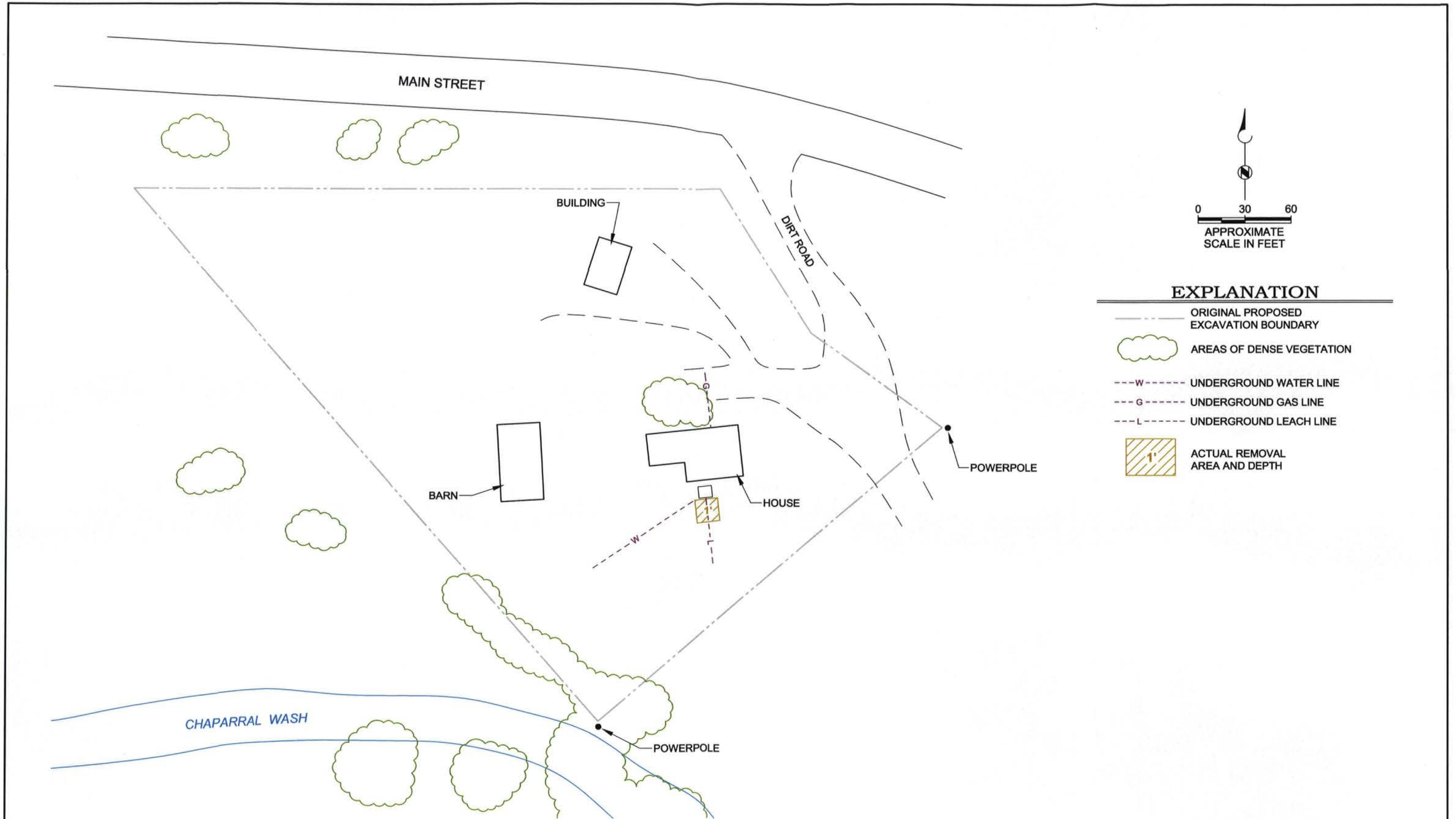


BROWN AND CALDWELL

Figure 9

ARSENIC REMOVAL AREA MAP
PROPERTY #7
IRONITE PRODUCTS COMPANY
HUMBOLDT, ARIZONA

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Tables

**TABLE 1. SUMMARY OF FIELD ACTIVITIES ASSOCIATED WITH THE ARSENIC REMOVAL ACTIONS**

| DATE | SAMPLING ACTIVITIES | OTHER ACTIVITIES | |
|---|---|---|---|
| 6/26/2006 | Performed initial sample point location and defined removal action boundaries at Property #2. | Met with property owners and PSC to discuss scope of work. UDS located underground utilities. | |
| 6/27/2006 | Located and staked sample locations at Property #2 and located initial pattern of sampling grid at Property #4. | None | |
| 6/28/2006 | Initiated sample collection at Property #2; 8 soil samples, 1 equipment blank. | Adjusted sample grid at property #4 to account for reduced potential removal area at north end of property. | |
| 6/29/2006 | Continued sampling at Property #2; 31 soil samples, 1 equipment blank. | None | |
| 6/30/2006 | Completed sampling at Property #2; 36 soil samples, 1 equipment blank. | None | |
| 7/5/2006 | Initiated sample collection at Property #3; 22 soil samples, 1 equipment blank. | Sample grid at Property #3 removed 3 locations, relocated 1 location. Verified gas line location at Property #4. | |
| 7/6/2006 | Continued sampling at Property #3; 22 soil samples, 1 equipment blank. | Rain caused temporary cessation of sampling. | |
| 7/7/2006 | Completed sampling at Property #3, initiated sample collectin at Property #4; 35 soil samples, 1 equipment blank. | Backfilled and graded sample areas at Pproperty #3 that had subsided from rain. | |
| 7/10/2006 | Continued sampling at Property #4; 21 soil samples. | Unmarked water line broken and repaired; backhoe malfunctioned and could not decontaminate for collection of equipment blank. | |
| 7/11/2006 | Completed sampling at Property #4; 6 soil samples, 2 equipment blanks. | Backhoe repaired and decontaminated prior to collection of equipment blank. | |
| | **EXCAVATION ACTIVITIES** | **BACKFILL ACTIVITIES** | **OTHER ACTIVITIES** |
| 7/24/2006 | Prepared Property #2 for excavation including encapsulation of houses with plastic to prevent dust accumulation and delineation of excavation boundaries and depths. Initiated excavation activities at northeast corner of Property #2 (north of northern house) at approximate locations of Samples N and O. | None | Verified underground utility location markings at Property #2 including natural gas lines. |
| 7/25/2006 | Continued excavation northwest of northern house and began excavation between the northern and southern houses at Property #2. | None | Not applicable |
| 7/26/2006 | Began transporting soil from Property #2 to Ironite Mine site. Excavated soil from northeast portion of Property #2 to a location south of the northern house. Performed manual removal of soil from areas on western side of the southern | None | Water line broken while obtaining backfill to reconstruct drainage berm north of excavation. |
| 7/27/2006 | Excavated areas along the road west of the houses at Property #2. Began excavating areas west of vegetation and along boundaries to the northwest. | None | Water line repaired. |
| 7/28/2006 | Continued excavation to the west and south of the southern house at Property #2 to southeast boundary of removal action. Excavated western portion of Property #2, north of the rock pile. | None | Suspended excavation for brief period in afternoon due to lightning. |
| 7/31/2006 | Continued excavation on the western portion of Property #2. | Initiated backfilling on the southern portion of Property #2, progressed to the north to the northern house. | Delivered roll-off bin at Property #3 for disposal of items by owner. |
| 8/1/2006 | Completed excavation on the western and southern portions of Property #2. Initiated soil removal at northeastern area of house at Property #3. | Continued backfilling and site restoration at Property #2. | Encapsulated house at Property #3, cleared items in northern property to allow access to perform removal. |
| 8/2/2006 | Continued excavation in the northern portion of Property #3, progressed along western and southern portions of property and completed excavation activities for Property #3. | Continued backfilling and site restoration at Property #2. Initiated backfilling on the northern portion of Property #3. | Broke unmarked water line along road on southern end of property. Initiated repairs of water line. |
| 8/3/2006 | None | Finalized Property #2 site restoration activities. Continued backfilling and site restoration at Property #3. | Completed repairs of water line. Preparation of Property #4 for excavation by owner. |
| 8/4/2006 | None | Finalized Property #3 site restoration activities. | Preparation of Property #4 for excavation by owner. |
| 8/7/2006 | Initiated excavation on the east portion of Property #4. | None | Confirmation of underground utilities and encapsulated house at Property #4 prior to excavation. |
| 8/8/2006 | Continued excavation at north and northwestern portions of Property #4. | Initiated backfilling on the east portion of Property #4. | Not applicable |
| 8/9/2006 | Continued excavation in western portion of Property #4 extending east to house. | Continued backfilling on eastern and northern portions of Property #4. | Broke unmarked water line and repaired prior to backfilling on 8/10/2006. Suspended excavation for brief period in afternoon due to heavy rain and lightning. |
| 8/10/2006 | Continued excavation in southeastern and southern portions of Property #4 and completed excavation activities. | Backfill and restoration continued along northwestern and southern portions of Property #4. | Berm extending from leach line modified at Property #2 to provide better drainage and prevent accumulation/flooding of portions of the property. |
| 8/11/2006 | None | Finalized Property #4 pea gravel surface backfill and site restoration activites. | Not applicable |
| 5/11/2007 | None | Not applicable | Inspected Property #7 to determine excavation area |
| 5/15/2007 | Excavated 15x15x1 foot area south of concrete pad in yard at Property #7. | Completed backfill and restoration of excavated area at Property #7. | Verified underground utility location markings at Property #7 with UDS. |

## TABLE 2. SUMMARY OF SAMPLE INFORMATION AND ANALYTICAL RESULTS FOR DELINEATION SAMPLING

| LOCATION | SAMPLE ID | SAMPLE TYPE | DATE COLLECTED | TOTAL ARSENIC (mg/kg) | DATA FLAG |
|---|---|---|---|---|---|
| Property #2 | BC-P2-A-0.5 | Soil Delineation | 6/28/2006 | **130** | J, M1 |
| | BC-P2-A-1 | Soil Delineation | 6/28/2006 | 22 | J, M1 |
| | BC-P2-A-2 | Soil Delineation | 6/28/2006 | 18 | J, M1 |
| | BC-P2-A-3 | Soil Delineation | 6/28/2006 | 18 | J, M1 |
| | BC-P2-B-0.5 | Soil Delineation | 6/28/2006 | 23 | J, M1 |
| | BC-P2-B-1 | Soil Delineation | 6/28/2006 | **24** | J, M1 |
| | BC-P2-B-2 | Soil Delineation | 6/28/2006 | 13 | J, M1 |
| | BC-P2-B-3 | Soil Delineation | 6/28/2006 | 15 | J, M1 |
| | BC-P2-C-0.5 | Soil Delineation | 6/29/2006 | 18 | J, M1 |
| | BC-P2-C-1 | Soil Delineation | 6/29/2006 | 18 | J, M1 |
| | BC-P2-C-2 | Soil Delineation | 6/29/2006 | 17 | J, M1 |
| | BC-P2-C-3 | Soil Delineation | 6/29/2006 | 14 | J, M1 |
| | BC-P2-D-0.5 | Soil Delineation | 6/29/2006 | **54** | J, M1 |
| | BC-P2-D-1 | Soil Delineation | 6/29/2006 | 19 | J, M1 |
| | BC-P2-D-2 | Soil Delineation | 6/29/2006 | **24** | J, M1 |
| | BC-P2-D-3 | Soil Delineation | 6/29/2006 | 13 | J, M1 |
| | BC-P2-E-0.5 | Soil Delineation | 6/29/2006 | **90** | J, M1, R8 |
| | BC-P2-E-1 | Soil Delineation | 6/29/2006 | 23 | J, M1 |
| | BC-P2-E-2 | Soil Delineation | 6/29/2006 | **81** | J, M1 |
| | BC-P2-E-3 | Soil Delineation | 6/29/2006 | 18 | J, M2 |
| | BC-P2-F-0.5 | Soil Delineation | 6/29/2006 | **38** | J, M2 |
| | BC-P2-F-1 | Soil Delineation | 6/29/2006 | 18 | J, M2 |
| | BC-P2-F-2 | Soil Delineation | 6/29/2006 | 16 | J, M2 |
| | BC-P2-F-3 | Soil Delineation | 6/29/2006 | 21 | J, M2 |
| | BC-P2-G-0.5 | Soil Delineation | 6/29/2006 | **34** | J, M2 |
| | BC-P2-G-1 | Soil Delineation | 6/29/2006 | 19 | J, M2, R8 |
| | BC-P2-G-2 | Soil Delineation | 6/29/2006 | 15 | J, M2 |
| | BC-P2-G-3 | Soil Delineation | 6/29/2006 | 18 | J, M2 |
| | BC-P2-H-0.5 | Soil Delineation | 6/29/2006 | **24** | J, M2 |
| | BC-P2-H-1 | Soil Delineation | 6/29/2006 | 15 | J, M2 |
| | BC-P2-H-2 | Soil Delineation | 6/29/2006 | 18 | J, M2 |
| | BC-P2-H-3 | Soil Delineation | 6/29/2006 | 15 | J, M2 |
| | BC-P2-I-0.5 | Soil Delineation | 6/29/2006 | **70** | J, M2 |
| | BC-P2-I-1 | Soil Delineation | 6/29/2006 | **69** | J, M2 |
| | BC-P2-I-2 | Soil Delineation | 6/29/2006 | **93** | J, M2 |
| | BC-P2-I-3 | Soil Delineation | 6/29/2006 | **63** | J, M2 |
| | BC-P2-J-0.5 | Soil Delineation | 6/30/2006 | **39** | |
| | BC-P2-J-1 | Soil Delineation | 6/30/2006 | **34** | |
| | BC-P2-J-2 | Soil Delineation | 6/30/2006 | 21 | |
| | BC-P2-J-3 | Soil Delineation | 6/30/2006 | **210** | |
| | BC-P2-K-0.5 | Soil Delineation | 6/30/2006 | **28** | |
| | BC-P2-K-1 | Soil Delineation | 6/30/2006 | **35** | |
| | BC-P2-K-2 | Soil Delineation | 6/30/2006 | 23 | |
| | BC-P2-K-3 | Soil Delineation | 6/30/2006 | 22 | |
| | BC-P2-L-0.5 | Soil Delineation | 6/30/2006 | 21 | |

| LOCATION | SAMPLE ID | SAMPLE TYPE | DATE COLLECTED | TOTAL ARSENIC (mg/kg) | DATA FLAG |
|---|---|---|---|---|---|
| Property #2 (cont.) | BC-P2-L-1 | Soil Delineation | 6/30/2006 | 16 | |
| | BC-P2-L-2 | Soil Delineation | 6/30/2006 | 11 | |
| | BC-P2-L-3 | Soil Delineation | 6/30/2006 | 11 | |
| | BC-P2-M-0.5 | Soil Delineation | 6/30/2006 | **38** | |
| | BC-P2-M-1 | Soil Delineation | 6/30/2006 | 15 | |
| | BC-P2-M-2 | Soil Delineation | 6/30/2006 | 19 | |
| | BC-P2-M-3 | Soil Delineation | 6/30/2006 | 13 | |
| | BC-P2-N-0.5 | Soil Delineation | 6/30/2006 | **26** | |
| | BC-P2-N-1 | Soil Delineation | 6/30/2006 | 19 | |
| | BC-P2-N-2 | Soil Delineation | 6/30/2006 | **36** | |
| | BC-P2-N-3 | Soil Delineation | 6/30/2006 | **25** | |
| | BC-P2-O-0.5 | Soil Delineation | 6/30/2006 | **41** | |
| | BC-P2-O-1 | Soil Delineation | 6/30/2006 | **41** | J, R8 |
| | BC-P2-O-2 | Soil Delineation | 6/30/2006 | 16 | |
| | BC-P2-O-3 | Soil Delineation | 6/30/2006 | 13 | |
| | BC-P2-P-0.5 | Soil Delineation | 6/30/2006 | **37** | |
| | BC-P2-P-1 | Soil Delineation | 6/30/2006 | 19 | |
| | BC-P2-P-2 | Soil Delineation | 6/30/2006 | 12 | |
| | BC-P2-P-3 | Soil Delineation | 6/30/2006 | 16 | |
| | BC-P2-Q-0.5 | Soil Delineation | 6/30/2006 | **120** | |
| | BC-P2-Q-1 | Soil Delineation | 6/30/2006 | **83** | |
| | BC-P2-Q-2 | Soil Delineation | 6/30/2006 | **34** | |
| | BC-P2-Q-3 | Soil Delineation | 6/30/2006 | **29** | |
| Property #3 | BC-P3-A-0.5 | Soil Delineation | 7/5/2006 | **26** | |
| | BC-P3-A-1 | Soil Delineation | 7/5/2006 | 21 | |
| | BC-P3-A-2 | Soil Delineation | 7/5/2006 | **31** | |
| | BC-P3-A-3 | Soil Delineation | 7/5/2006 | 22 | |
| | BC-P3-B-0.5 | Soil Delineation | 7/5/2006 | **34** | |
| | BC-P3-B-1 | Soil Delineation | 7/5/2006 | **31** | |
| | BC-P3-B-2 | Soil Delineation | 7/5/2006 | 20 | |
| | BC-P3-B-3 | Soil Delineation | 7/5/2006 | 23 | |
| | BC-P3-C-0.5 | Soil Delineation | 7/5/2006 | 19 | |
| | BC-P3-C-1 | Soil Delineation | 7/5/2006 | 15 | |
| | BC-P3-C-2 | Soil Delineation | 7/5/2006 | 22 | |
| | BC-P3-C-3 | Soil Delineation | 7/5/2006 | 20 | |
| | BC-P3-D-0.5 | Soil Delineation | 7/5/2006 | **130** | |
| | BC-P3-D-1 | Soil Delineation | 7/5/2006 | 19 | |
| | BC-P3-D-2 | Soil Delineation | 7/5/2006 | 14 | |
| | BC-P3-D-3 | Soil Delineation | 7/5/2006 | 12 | |
| | BC-P3-H-0.5 | Soil Delineation | 7/5/2006 | **110** | |
| | BC-P3-H-1 | Soil Delineation | 7/5/2006 | **29** | J, R8 |
| | BC-P3-H-2 | Soil Delineation | 7/5/2006 | 14 | |
| | BC-P3-H-3 | Soil Delineation | 7/5/2006 | 15 | |
| | BC-P3-I-0.5 | Soil Delineation | 7/6/2006 | **97** | |
| | BC-P3-I-1 | Soil Delineation | 7/6/2006 | 22 | |
| | BC-P3-I-2 | Soil Delineation | 7/6/2006 | 18 | |
| | BC-P3-I-3 | Soil Delineation | 7/6/2006 | 13 | |
| | BC-P3-J-0.5 | Soil Delineation | 7/6/2006 | **51** | |
| | BC-P3-J-1 | Soil Delineation | 7/6/2006 | **45** | |

| LOCATION | SAMPLE ID | SAMPLE TYPE | DATE COLLECTED | TOTAL ARSENIC (mg/kg) | DATA FLAG |
|---|---|---|---|---|---|
| Property #3 (cont.) | BC-P3-J-2 | Soil Delineation | 7/6/2006 | **43** | |
| | BC-P3-J-3 | Soil Delineation | 7/6/2006 | 16 | |
| | BC-P3-K-0.5 | Soil Delineation | 7/6/2006 | **30** | |
| | BC-P3-K-1 | Soil Delineation | 7/6/2006 | 19 | |
| | BC-P3-K-2 | Soil Delineation | 7/6/2006 | 17 | |
| | BC-P3-K-3 | Soil Delineation | 7/6/2006 | 10 | |
| | BC-P3-L-0.5 | Soil Delineation | 7/7/2006 | **42** | J, R2 |
| | BC-P3-L-1 | Soil Delineation | 7/7/2006 | **300** | J, R2 |
| | BC-P3-L-2 | Soil Delineation | 7/7/2006 | **31** | J, R2 |
| | BC-P3-L-3 | Soil Delineation | 7/7/2006 | 14 | J, R2 |
| | BC-P3-M-0.5 | Soil Delineation | 7/6/2006 | **47** | |
| | BC-P3-M-1 | Soil Delineation | 7/6/2006 | **150** | |
| | BC-P3-M-2 | Soil Delineation | 7/6/2006 | 16 | |
| | BC-P3-M-3 | Soil Delineation | 7/6/2006 | 12 | |
| | BC-P3-N-0.5 | Soil Delineation | 7/6/2006 | **140** | |
| | BC-P3-N-1 | Soil Delineation | 7/6/2006 | **25** | |
| | BC-P3-N-2 | Soil Delineation | 7/6/2006 | 12 | |
| | BC-P3-N-3 | Soil Delineation | 7/6/2006 | 10 | |
| Property #4 | BC-P4-A-0.5 | Soil Delineation | 7/7/2006 | **40** | J, R2 |
| | BC-P4-A-1 | Soil Delineation | 7/7/2006 | 21 | J, R2 |
| | BC-P4-A-2 | Soil Delineation | 7/7/2006 | 21 | J, R2 |
| | BC-P4-A-3 | Soil Delineation | 7/7/2006 | 18 | J, R2 |
| | BC-P4-B-0.5 | Soil Delineation | 7/7/2006 | **54** | J, R2 |
| | BC-P4-B-1 | Soil Delineation | 7/7/2006 | 20 | J, R2 |
| | BC-P4-B-2 | Soil Delineation | 7/7/2006 | 21 | J, R2 |
| | BC-P4-B-3 | Soil Delineation | 7/7/2006 | 23 | J, R2 |
| | BC-P4-C-0.5 | Soil Delineation | 7/7/2006 | 22 | J, R2 |
| | BC-P4-C-1 | Soil Delineation | 7/7/2006 | 20 | J, R2 |
| | BC-P4-C-2 | Soil Delineation | 7/7/2006 | 20 | J, R2 |
| | BC-P4-C-3 | Soil Delineation | 7/7/2006 | 22 | J, R2 |
| | BC-P4-D-0.5 | Soil Delineation | 7/7/2006 | **28** | J, R2 |
| | BC-P4-D-1 | Soil Delineation | 7/7/2006 | 18 | |
| | BC-P4-D-2 | Soil Delineation | 7/7/2006 | **24** | |
| | BC-P4-D-3 | Soil Delineation | 7/7/2006 | 17 | |
| | BC-P4-E-0.5 | Soil Delineation | 7/7/2006 | **99** | |
| | BC-P4-E-1 | Soil Delineation | 7/7/2006 | 21 | |
| | BC-P4-E-2 | Soil Delineation | 7/7/2006 | 31 | |
| | BC-P4-E-3 | Soil Delineation | 7/7/2006 | 20 | |
| | BC-P4-F-0.5 | Soil Delineation | 7/7/2006 | **32** | |
| | BC-P4-F-1 | Soil Delineation | 7/7/2006 | **24** | |
| | BC-P4-F-2 | Soil Delineation | 7/7/2006 | 20 | |
| | BC-P4-F-3 | Soil Delineation | 7/7/2006 | 20 | |
| | BC-P4-G-0.5 | Soil Delineation | 7/7/2006 | **41** | |
| | BC-P4-G-1 | Soil Delineation | 7/7/2006 | 17 | |
| | BC-P4-G-2 | Soil Delineation | 7/7/2006 | 21 | |
| | BC-P4-G-3 | Soil Delineation | 7/7/2006 | 18 | |
| | BC-P4-H-0.5 | Soil Delineation | 7/10/2006 | **47** | |
| | BC-P4-H-1 | Soil Delineation | 7/10/2006 | **34** | |
| | BC-P4-H-2 | Soil Delineation | 7/10/2006 | **26** | |

| LOCATION | SAMPLE ID | SAMPLE TYPE | DATE COLLECTED | TOTAL ARSENIC (mg/kg) | DATA FLAG |
|---|---|---|---|---|---|
| Property #4 (cont.) | BC-P4-H-3 | Soil Delineation | 7/10/2006 | 22 | |
| | BC-P4-I-0.5 | Soil Delineation | 7/11/2006 | **32** | |
| | BC-P4-I-1 | Soil Delineation | 7/11/2006 | 19 | |
| | BC-P4-I-2 | Soil Delineation | 7/11/2006 | 18 | |
| | BC-P4-I-3 | Soil Delineation | 7/11/2006 | **24** | |
| | BC-P4-J-0.5 | Soil Delineation | 7/10/2006 | 22 | |
| | BC-P4-J-1 | Soil Delineation | 7/10/2006 | **58** | |
| | BC-P4-J-2 | Soil Delineation | 7/10/2006 | 17 | |
| | BC-P4-J-3 | Soil Delineation | 7/10/2006 | 12 | |
| | BC-P4-K-0.5 | Soil Delineation | 7/10/2006 | **49** | |
| | BC-P4-K-1 | Soil Delineation | 7/10/2006 | 18 | |
| | BC-P4-K-2 | Soil Delineation | 7/10/2006 | **32** | |
| | BC-P4-K-3 | Soil Delineation | 7/10/2006 | 19 | |
| | BC-P4-L-0.5 | Soil Delineation | 7/10/2006 | 19 | |
| | BC-P4-L-1 | Soil Delineation | 7/10/2006 | 21 | |
| | BC-P4-L-2 | Soil Delineation | 7/10/2006 | 17 | |
| | BC-P4-L-3 | Soil Delineation | 7/10/2006 | 19 | |
| | BC-P4-M-0.5 | Soil Delineation | 7/10/2006 | **68** | |
| | BC-P4-M-1 | Soil Delineation | 7/10/2006 | 18 | |
| | BC-P4-M-2 | Soil Delineation | 7/10/2006 | 15 | |
| | BC-P4-M-3 | Soil Delineation | 7/10/2006 | 16 | |
| | BC-P4-N-0.5 | Soil Delineation | 7/11/2006 | **31** | |
| | BC-P4-N-1 | Soil Delineation | 7/11/2006 | 18 | |
| | BC-P4-N-2 | Soil Delineation | 7/11/2006 | 14 | |
| | BC-P4-N-3 | Soil Delineation | 7/11/2006 | 14 | |
| Property #2 | BC-P2-R-0.5 | Field Duplicate of BC-P2-E-0.5 | 6/29/2006 | **130** | J, M1, R8 |
| | BC-P2-S-1 | Field Duplicate of BC-P2-G-1 | 6/29/2006 | **39** | J, M2, R8 |
| | BC-P2-T-0.5 | Field Duplicate of BC-P2-I-0.5 | 6/29/2006 | **61** | J, M2 |
| | BC-P2-U-2 | Field Duplicate of BC-P2-K-2 | 6/30/2006 | 21 | |
| | BC-P2-V-3 | Field Duplicate of BC-P2-M-3 | 6/30/2006 | 13 | |
| | BC-P2-W-1 | Field Duplicate of BC-P2-O-1 | 6/30/2006 | 18 | J, R8 |
| | BC-P2-X-0.5 | Field Duplicate of BC-P2-Q-0.5 | 6/30/2006 | **99** | |
| Property #3 | BC-P3-O-0.5 | Field Duplicate of BC-P3-C-0.5 | 7/5/2006 | 18 | |
| | BC-P3-P-1 | Field Duplicate of BC-P3-H-1 | 7/5/2006 | 16 | J, R8 |
| | BC-P3-Q-1 | Field Duplicate of BC-P3-M-1 | 7/6/2006 | **110** | |
| | BC-P3-R-2 | Field Duplicate of BC-P3-K-2 | 7/6/2006 | 20 | |
| Property #4 | BC-P4-O-0.5 | Field Duplicate of BC-P4-D-0.5 | 7/7/2006 | 22 | J, R2 |
| | BC-P4-P-1 | Field Duplicate of BC-P4-B-1 | 7/7/2006 | 21 | J, R2 |
| | BC-P4-Q-3 | Field Duplicate of BC-P4-F-3 | 7/7/2006 | 19 | |
| | BC-P4-R-0.5 | Field Duplicate of BC-P4-I-0.5 | 7/11/2006 | **24** | |
| | BC-P4-S-3 | Field Duplicate of BC-P4-L-3 | 7/10/2006 | 16 | |
| | BC-P4-T-2 | Field Duplicate of BC-P4-N-2 | 7/11/2006 | 14 | |
| Property #2 | BC-GWS-P2-01 | Equipment Blank | 6/28/2006 | <0.010 | |
| | BC-GWS-P2-02 | Equipment Blank | 6/29/2006 | <0.010 | |
| | BC-GWS-03 | Equipment Blank | 6/30/2006 | <0.010 | |
| Property #3 | BC-GWS-P3-04 | Equipment Blank | 7/5/2006 | 0.011 | |
| | BC-GWS-P3-05 | Equipment Blank | 7/6/2006 | <0.010 | |

| LOCATION | SAMPLE ID | SAMPLE TYPE | DATE COLLECTED | TOTAL ARSENIC (mg/kg) | DATA FLAG |
|---|---|---|---|---|---|
| Property #4 | BC-GWS-P4-06 | Equipment Blank | 7/7/2006 | <0.010 | |
| | BC-GWS-P4-07 | Equipment Blank | 7/11/2006 | <0.010 | |
| | BC-GWS-P4-08 | Equipment Blank | 7/11/2006 | <0.010 | |
| | BC-GWS-P4-09 | Equipment Blank | 7/11/2006 | <0.010 | |

Sample Suffix (0.5, 1, 2, 3) of Delineation Samples indicates depth collected in feet.
**Bold Value** indicates concentrations exceeds Arizona Residential Soil Remediation Level of 23 mg/Kg for arsenic.
J = Value is estimated
M1 = Matrix spike recovery was high, method control sample recovery was acceptable.
M2 = Matrix spike recovery was low, method control sample recovery was acceptable.
R2 = RPD exceeded laboratory control limit, additional explanation in laboratory case narrative.
R8 = Sample RPD exceeded method control limit.

**TABLE 3. SUMMARY OF BACKFILL MATERIAL ANALYTICAL RESULTS**

| Sample ID | Date Collected | Sample Type | Analyte Concentrations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Cadmium | Chromium | Lead | Selenium | Silver | Mercury |
| BC-B-1-D-1 | 7/11/2006 | Backfill Stockpile | 7.6 | 74 | <1.0 | 12 | <5.0 | <5.0 | <5.0 | <0.083 |
| BC-B-1-D-2 | 7/11/2006 | Backfill Stockpile | 7.4 | 85 | <1.1 | 14 | <5.0 | <5.0 | <5.0 | <0.084 |
| BC-B-1-D-3 | 7/11/2006 | Backfill Native | 5.3 | 68 | <1.2 | 14 | <5.0 | <5.0 | <5.0 | <0.085 |
| BC-B-1-D-4 | 7/11/2006 | Backfill Native | 7.8 | 60 | <1.3 | 15 | <5.0 | <5.0 | <5.0 | <0.086 |
| BC-B-1-D-5 | 7/11/2006 | Backfill Native | 9.2 | 120 | <1.4 | 16 | <5.0 | <5.0 | <5.0 | <0.087 |
| **Applicable Regulatory Level** | | | 23* | 5,300 | 38 | 2,100 | 400 | 380 | 380 | 6.7 |

Concentrations reported in mg/Kg.
* = Action Level determined for Ironite sites. Remainder of Regulatory Levels are Arizona Residential Soil Remediation Levels.

**TABLE 4. SUMMARY OF PHYSICAL CONDITIONS FOR DELINEATION SAMPLES.**

| Sample Location | Classification | | | | Interpretation |
|---|---|---|---|---|---|
| | 0.5 ft bgs | 1 ft bgs | 2 ft bgs | 3 ft bgs | |
| | | | *PROPERTY #2* | | |
| P2-A | **SW/SM** road backfill | **SM/ML** dark organic soil | **SM/ML** dark organic soil | **SM/ML** with minor gravel | Road backfill covering fine-grained alluvium, underlain by coarse alluvium. |
| P2-B | **SM/ML** light organic soil | **SM/ML** organic soil | **SM/ML** dark organic soil | **SM/ML** lighter, isolated gravel and cobbles | Fine-grained overbank deposits underlain by upper gravel stream deposits. |
| P2-C | **SM** similar to B | **SM** similar to dark organic material in A/B | **SM** lighter with traces of caliche/CaCO3 | **SM** dark, isolated gravel and cobbles | Fine-grained overbank deposits underlain by upper gravel stream deposits. |
| P2-D | **SM** at base of lower bench/berm | **SM** similar to A-C with more sand | **SM** similar to A-C | **SM** dark, higher sand content with gravel | Fine-grained overbank deposits possibly mixed with hillslope material at near surface, underlain by upper gravel stream deposits. |
| P2-E | **SM** with gravel/colluvium at base of hillslope | **SM** similar to dark organic material in A-C but with coarse sand and gravel | **SM** similar to 1 foot | **SM** similar to dark organic material in A-C, contains caliche/CaCO3 as in C | Mixed hillslope colluvium and imported (?) material covering a finer-grained mixture of SM, gravel, and caliche - base of pit equal to approximate surface of A-D. |
| P2-F | **SM** road backfill with minor gravel | **SM** similar to road backfill but finer grained | **SM** as in A-C | **SW/SM** Lighter brown and higher amount of gravel compared with A-C | Road backfill covering fine-grained overbank deposits, underlain by upper gravel stream deposits. |
| P2-G | **SM** similar to B and C | **SM** similar to dark organic material in A-C but with more coarse sand | **SM** similar to dark organic material in A-C but with coarse sand and gravel | **SM** similar to organic material in A-C, contains some cobbles of schist/metamorphic rock | Fine-grained overbank deposits underlain by upper gravel stream deposits. |
| P2-H | **SM** similar to B/C and G | **SM** similar to A-C | **SM** similar to A-C | **SM** similar to A-C | Fine-grained overbank deposits underlain by upper gravel stream deposits. |
| P2-I | **SM/SW** diversion berm - reworked hillslope or imported material at base of hillslope | **SM** lighter colored but similar to darker fine grained deposits in other holes and coarser grained | **SM** lighter colored but similar to darker fine grained deposits in other holes and coarser grained | **SM** lighter colored but similar to darker fine grained deposits in other holes and coarser grained | Mixed hillslope or imported (?) material covering a finer-grained mixture of sand with lesser amounts of gravel - all material appears to have been moved and base of pit is above pits in lower areas (A-D, F-G). |
| P2-J | **SW/SM** road backfill | **SM** similar to A-C, G/H | **SM** similar to A-C, G/H | **SW/SM** Lighter brown and higher amount of gravel compared shallow material | Road backfill covering fine-grained overbank deposits, underlain by upper gravel stream deposits. |
| P2-K | **SM** similar to B/C and G | **SM** similar to A-C, G/H | **SM** similar to A-C, G/H | **SM** similar to overlying material but with trace of gravel and cobbles | Fine-grained overbank deposits underlain by upper gravel stream deposits. |
| P2-L | **SM** similar to B/C, G/H, and K | **SM** similar to B/C, G/H, and K - nail and charcoal at this depth | **SM** similar to B/C, G/H, and K | **SM** similar to B/C, G/H, and K | Fine-grained overbank deposits, possible disturbed material or backfill mixture (nail, charcoal). |

| Sample Location | Classification 0.5 ft bgs | 1 ft bgs | 2 ft bgs | 3 ft bgs | Interpretation |
|---|---|---|---|---|---|
| **PROPERTY #2 (continued)** | | | | | |
| P2-M | **SW/SM** hillslope colluvium | **SM** hillslope material | **SW/SM** hillslope colluvium | **SW/SM** hillslope colluvium | Hillslope colluvium covering a mixture of fine-grained deposits and colluvium. |
| P2-N | **SW/GW** hillslope colluvium | **SW/GW** hillslope colluvium with CaCO3 | **SW/GW** hillslope colluvium lighter colored | **SW/GW** hillslope colluvium and caliche from 2 to 3 feet | Hillslope colluvium and caliche layer. |
| P2-O | **SM** with minor backfill | **SM/SW** brown with trace of gravel | **SM** similar to A-C, G/H | **SM** similar to A-C, G/H | Backfill covering fine-grained deposits similar to other locations in center of property. |
| P2-P | **SM** brown organic soil | **SM** similar to A-C, G/H | **SM** similar to A-C, G/H | **SM** similar to A-C, G/H with trace of gravel | Fine-grained soil (imported?) and overbank deposits. |
| P2-Q | **SW/SM** road backfill | **SM** with gravel | **GW/SW** drainage gravel deposits | **GW/SW** drainage gravel deposits | Road backfill covering thin layer of fine-grained overbank material, underlain by upper gravel stream deposits. |
| **PROPERTY #3** | | | | | |
| P3-A | **SM** road backfill; high percentage of sand and gravel | **SM** backfill material; less sand and gravel | **SM** hard with gravel/cobbles between 1-2 ft. | **SW/GW** same gravel with cobbles from 2-3 ft; river terrace deposits | Road backfill covering, underlain by upper gravel stream deposits. |
| P3-B | **SM** road backfill; less gravel present than sample point A | **SM** similar to A, boundary of fill just above sample depth | **SM** fewer cobbles at a deeper depth than Sample A | **SM** less cobbles present | Road backfill covering, underlain by upper gravel stream deposits. |
| P3-C | **SM** road backfill, same as A-B | **SM** similar to dark SM in many locations at P2 | **SP-SM** with river cobbles at 2 ft. | **SW/GW** many cobbles below 2 ft, same material as in A-B | Road backfill covering underlain by upper gravel stream deposits. |
| P3-D | **SM** backfill adjacent to shoulder of county road | **SM** similar to material at C | **SC** darker material with a higher clay content | **SM** similar to 2 ft with more sand | Possible backfill material underlain by finer-grained mixture of sand and clay with less gravel content |
| P3-H | **SM** hard packed, cohesive material at base of hill | **SM** similar to 0.5 ft. with less gravel | **SM** similar to previous samples with slightly higher clay content | **SM** similar to 2 ft but harder with more fines | Fine grained soil and overbank deposits |
| P3-I | **SM** high sand content with no gravel | **SM** similar soil to H | **SM** no cobbles like in previous samples | **SM** similar to 2 ft but finer and harder | Fine grained soil and overbank deposits |
| P3-J | **SM** backfill material, compacted sand and pea gravel to at least 1 ft | **GP/SM** Pea gravel with sand/silt mixture of backfill | **SP-SC** coarse grained cobbles starting around 2 ft | **GW/GM** similar to sample point A and river channel | Compacted backfill material underlain by coarse grained river deposits |
| P3-K | **SM** backfill material | **SM** lighter and more sand | **SM** similar to 1 ft | **SW/GW** cobbles from 2.5 ft with more M-C sand | Backfill material underlain by upper gravel stream deposits |
| P3-L | **SM** similar to point I | **ML/SM** lighter/finer material at 10" | **SM** similar to 0.5 ft | **SM** similar, but harder than 1-2 ft. One cobble present at 2.5 ft. | Fine-grained overbank deposits, possible disturbed material at shallower depths |

| Sample Location | Classification 0.5 ft bgs | 1 ft bgs | 2 ft bgs | 3 ft bgs | Interpretation |
|---|---|---|---|---|---|
| **PROPERTY #3 (continued)** | | | | | |
| P3-M | **SM** caliche and gravel from 0.5-1 ft although less gravel present in 0.5 sample | **SM** hard caliche | **SC** thin caliche layer at 1.8 ft on north side; not present on south side of hole | **SM** organic soil | Fine grained deposits and caliche layer |
| P3-N | **SM** at toe of hillslope of exposed sand and gravel | **SM** similar to 0.5 ft. with less gravel | **SC** hard packed material | **SM/ML** hard packed material similar to Sample I- 3 ft. | Hillslope material covering organic rich fine sand and clay |
| **PROPERTY #4** | | | | | |
| P4-A | **SM** near edge of stream channel; gravel and cobbles exposed | **SM** soft, no gravel | **SM** with gravel | **SM/ML** with minor gravel | Backfill material covering fineto coarse-grained alluvium |
| P4-B | **SM** soft, few cobbles present | **SM** similar to A-1 | **SM** gravel/cobbles at 2.5 ft | **SW/GW** fine matrix of gravel deposit | Fill material underlain by river deposits |
| P4-C | **SM** similar to B | **GW** gravel and sand from 1-2 ft | **SM** sandy fill layer, absence of gravel | **GW** sandy layer below gravel layer (present at 2.5 ft) | Interbedded river deposits with backfill material |
| P4-D | **SM/SP** more gravel present, backfill material | **SM** less gravel present at this depth | **SM** increase of gravel and cobbles | **SP** finer material, coarse sand on south side; **SM** on north side | Backfill material underlain by upper gravel stream deposits, tonguing of SP layer from the south |
| P4-E | **SM** fine grained deposits | **SM** similar to material in A B with more coarse sand | **SW/GW** gravel and cobbles above 2 ft; similar sand as in D-3 ft. | **SW/GW** fine matrix between gravel clasts | Fine-grained overbank deposits underlain with coarse river deposits. |
| P4-F | **SM** raised ground (fill?) | **SM** similar to A; trace coarse sand and fine gravel | **SM** similar to 1 ft | **SM** more coarse sand | Backfill, possible levee |
| P4-G | **SM** similar to F-0.5-1 | **SM** similar to F-1 | **SM** similar to F-2 | **SM** similar to F-3 | Backfill, possible levee |
| P4-H | **SC/SM** cobbles along with coarse-grained sand and fine gravel backfill material at surface | **SM** lighter colored with less gravel and more finer-grained sand | **SM** similar to 1 ft | **SM** mostly fine sand with trace gravel | Backfill material |
| P4-I | **SM** fine grained sand | **SW** gravel interval present at about 0.75 ft | **SW** fine to coarse gravel layer | **SW** similar material as 1-2 ft. | Possible interbedding of fine-grained overbank material and coarse river deposits. |
| P4-J | **SM** backfill sand and gravel similar to I | **SM** backfill sand and gravel | **SM** possible backfill or native stream gravels | **SM** loose sand with fine gravel | Possible backfill material to 2 feet underlain by river deposits |
| P4-K | **SM** ditch exposed with fine gravel about 5 ft west | **SM** fine layer between more course sands | **SM** similar to 1 ft with more fine sands | **SM** fine sands; underlain by cobbles and sand; roots present | Fine-grained overbank deposits underlain by upper gravel stream deposits. |
| P4-L | **SM** fine sand overlain by imported gravel from upstream | **SM** coarser sand from 0.75-1.25 ft. | **SM** layer of gravel within fine sand | **SM** similar to 1 ft | Fine-grained overbank deposits, possible disturbed material or backfill mixture |

| Sample Location | Classification | | | | Interpretation |
|---|---|---|---|---|---|
| | 0.5 ft bgs | 1 ft bgs | 2 ft bgs | 3 ft bgs | |
| **PROPERTY #4 (continued)** | | | | | |
| P4-M | **SM** fine sand overlain by imported gravel from upstream; possible gravel mixed into sample | **SM** gravel with coarser sand | **SM/GM** with more gravel present | **SM** fine material below sand gravel interval | Possible backfill covered by imported gravel from upstream, underlain by fine river deposits |
| P4-N | **SM** native material | **SW** coarse sand and gravel layer | **ML/SW** coarse sand and gravel | **SM** hard packed sand and gravel | Fine-grained overbank deposits underlain by coarse gravel alluvium deposits |

**GW** = Well graded gravel/Well graded gravel with sand
**GP** = Poorly graded gravel/Poorly graded gravel with sand
**SW** = Well graded sand/Well graded sand with gravel
**SP** = Poorly graded sand/Poorly graded sand with gravel
**SM** = Silty sand/Silty sand with gravel
**SC** = Clayey sand/Clayey sand with gravel/caliche
**ML** = Silt/Silt with sand or gravel
Classifications based upon USCS/ASTM system for visual-manual determination of soil properties

**TABLE 5. SUMMARY OF GPS LOCATION COORDINATES FOR DELINEATION SAMPLES, SITE FEATURES, AND REMOVAL ACTION BOUNDARIES.**

| GPS Point Description | Location | Date | Elevation (ft) | Horiz. Prec (ft) | Northing | Easting |
|---|---|---|---|---|---|---|
| Sample P2-A | Property #2 | 7/28/2006 | 4561.688 | 0.9 | 1275056.659 | 600186.709 |
| Sample P2-B | Property #2 | 7/28/2006 | 4562.563 | 0.7 | 1275089.901 | 600192.898 |
| P2-B hot spot NE corner | Property #2 | 8/1/2006 | 4561.974 | 0.7 | 1275093.004 | 600201.734 |
| P2-B hot spot SE corner | Property #2 | 8/1/2006 | 4561.230 | 0.7 | 1275084.779 | 600198.820 |
| P2-B hot spot NW corner | Property #2 | 8/1/2006 | 4562.578 | 0.7 | 1275094.831 | 600188.339 |
| P2-B hot spot SW corner | Property #2 | 8/1/2006 | 4562.001 | 0.7 | 1275086.028 | 600187.137 |
| Sample P2-C | Property #2 | 7/28/2006 | 4562.881 | 0.7 | 1275149.792 | 600207.693 |
| Sample P2-D | Property #2 | 7/28/2006 | 4563.977 | 0.7 | 1275204.379 | 600216.166 |
| Sample P2-E | Property #2 | 7/28/2006 | 4570.057 | 0.7 | 1275249.836 | 600228.352 |
| Sample P2-F | Property #2 | 7/28/2006 | 4562.982 | 0.6 | 1275041.436 | 600241.064 |
| Sample P2-G | Property #2 | 8/1/2006 | 4561.223 | 0.6 | 1275094.608 | 600254.300 |
| P2-G hot spot W corner | Property #2 | 8/1/2006 | 4562.735 | 0.5 | 1275095.626 | 600246.462 |
| P2-G hot spot N corner | Property #2 | 8/1/2006 | 4562.808 | 0.6 | 1275102.601 | 600255.021 |
| P2-G hot spot E corner | Property #2 | 8/1/2006 | 4561.785 | 0.6 | 1275093.622 | 600263.241 |
| P2-G hot spot S corner | Property #2 | 8/1/2006 | 4561.910 | 0.6 | 1275085.641 | 600253.503 |
| Sample P2-H | Property #2 | 8/1/2006 | 4563.950 | 0.8 | 1275158.028 | 600268.812 |
| Sample P2-I | Property #2 | 7/28/2006 | 4573.404 | 0.7 | 1275262.785 | 600297.532 |
| Sample P2-J | Property #2 | 7/28/2006 | 4563.091 | 0.6 | 1275026.626 | 600302.340 |
| P2-J hot spot SE corner | Property #2 | 8/1/2006 | 4558.588 | 0.7 | 1275022.950 | 600305.961 |
| P2-J hot spot SW corner | Property #2 | 8/1/2006 | 4561.124 | 0.5 | 1275026.204 | 600292.513 |
| P2-J hot spot NW corner | Property #2 | 8/1/2006 | 4562.659 | 0.5 | 1275038.271 | 600297.411 |
| P2-J hot spot NE corner | Property #2 | 8/1/2006 | 4562.045 | 0.7 | 1275032.158 | 600305.653 |
| Sample P2-K | Property #2 | 7/28/2006 | 4561.646 | 0.6 | 1275070.793 | 600307.719 |
| P2-K hot spot SE corner | Property #2 | 7/28/2006 | 4563.755 | 0.6 | 1275061.501 | 600306.834 |
| P2-K hot spot NE corner | Property #2 | 7/28/2006 | 4562.913 | 0.6 | 1275069.710 | 600314.509 |
| P2-K hot spot NW corner | Property #2 | 7/28/2006 | 4562.095 | 0.6 | 1275079.194 | 600303.742 |
| P2-K hot spot SW corner | Property #2 | 7/28/2006 | 4563.518 | 0.6 | 1275071.142 | 600296.805 |
| Sample P2-L | Property #2 | 6/27/2006 | 4564.948 | 2.7 | 1275205.503 | 600338.687 |
| Sample P2-M | Property #2 | 7/27/2006 | 4569.938 | 0.6 | 1275233.475 | 600344.427 |
| Sample P2-N | Property #2 | 7/27/2006 | 4571.293 | 0.6 | 1275207.000 | 600412.271 |
| Sample P2-O | Property #2 | 7/27/2006 | 4559.434 | 0.8 | 1275183.644 | 600401.841 |
| Sample P2-P | Property #2 | 7/27/2006 | 4563.721 | 0.8 | 1275131.169 | 600387.537 |
| Sample P2-Q | Property #2 | 7/28/2006 | 4559.574 | 0.8 | 1275011.486 | 600359.097 |
| P2-Q hot spot NW corner | Property #2 | 7/28/2006 | 4554.625 | 1.0 | 1275018.734 | 600363.932 |
| P2-Q hot spot NE corner | Property #2 | 7/28/2006 | 4556.486 | 1.0 | 1275008.490 | 600369.582 |
| P2-Q hot spot SE corner | Property #2 | 7/28/2006 | 4555.504 | 1.0 | 1275004.086 | 600362.151 |
| P2-Q hot spot SE corner | Property #2 | 7/28/2006 | 4555.547 | 1.0 | 1275013.949 | 600355.128 |
| Leach line @ North house | Property #2 | 7/27/2006 | 4563.049 | 0.9 | 1275141.433 | 600383.444 |
| Leach line 25 feet SW of North house | Property #2 | 7/27/2006 | 4562.200 | 0.6 | 1275132.137 | 600363.407 |
| Leach line 50 feet SW of North house | Property #2 | 7/27/2006 | 4563.797 | 0.6 | 1275121.358 | 600341.867 |
| Leach field distribution | Property #2 | 6/27/2006 | 4557.928 | 1.8 | 1275098.014 | 600295.018 |
| Electric line @ North house | Property #2 | 7/27/2006 | 4564.836 | 0.7 | 1275140.697 | 600383.876 |
| Electric line 25 feet NW of North house | Property #2 | 7/27/2006 | 4562.765 | 0.7 | 1275159.549 | 600361.096 |
| Electric line 50 feet NW of North house | Property #2 | 7/27/2006 | 4565.413 | 0.6 | 1275178.168 | 600345.347 |
| Gas pipeline SW corner of property | Property #2 | 8/1/2006 | 4563.331 | 0.6 | 1275012.807 | 600284.762 |
| Gas pipeline south of Sample P2-J | Property #2 | 8/1/2006 | 4565.454 | 0.5 | 1274990.828 | 600170.047 |
| North house NE corner | Property #2 | 7/27/2006 | 4566.213 | 0.7 | 1275162.317 | 600426.176 |
| North house SE corner | Property #2 | 7/27/2006 | 4568.567 | 1.0 | 1275128.379 | 600420.999 |
| North house NW corner | Property #2 | 7/27/2006 | 4564.709 | 1.0 | 1275173.007 | 600393.665 |
| North house SW corner | Property #2 | 7/27/2006 | 4561.378 | 1.0 | 1275137.979 | 600383.790 |
| South house NW corner | Property #2 | 7/27/2006 | 4562.803 | 0.7 | 1275062.307 | 600394.288 |
| South house SW corner | Property #2 | 7/27/2006 | 4568.644 | 0.9 | 1275036.300 | 600385.139 |
| N point of removal area | Property #2 | 7/28/2006 | 4565.486 | 0.7 | 1275202.243 | 600183.611 |
| NE point of removal area | Property #2 | 7/27/2006 | 4564.375 | 0.9 | 1275200.352 | 600443.937 |
| NW point of removal area | Property #2 | 7/27/2006 | 4565.100 | 0.9 | 1275251.567 | 600304.132 |
| SW point of removal area | Property #2 | 7/28/2006 | 4563.689 | 0.7 | 1275044.879 | 600148.429 |
| SE point of removal area | Property #2 | 7/28/2006 | 4556.121 | 0.8 | 1274988.008 | 600377.313 |
| P2-O hot spot NW corner | Property #2 | 7/27/2006 | 4563.819 | 0.9 | 1275192.359 | 600394.493 |
| P2-O hot spot SW corner | Property #2 | 7/27/2006 | 4560.606 | 0.9 | 1275181.864 | 600392.607 |
| P2-O hot spot SE corner | Property #2 | 7/27/2006 | 4561.763 | 0.9 | 1275178.509 | 600405.040 |
| P2-O hot spot NE corner | Property #2 | 7/27/2006 | 4559.625 | 0.8 | 1275188.412 | 600406.940 |

| GPS Point Description | Location | Date | Elevation (ft) | Horiz. Prec (ft) | Northing | Easting |
|---|---|---|---|---|---|---|
| East corner of triangle excavation | Property #2 | 7/27/2006 | 4559.152 | 0.8 | 1275142.200 | 600367.085 |
| North corner of triangle excavation | Property #2 | 7/27/2006 | 4561.031 | 0.8 | 1275167.505 | 600350.237 |
| South corner of triangle excavation | Property #2 | 7/27/2006 | 4559.502 | 0.8 | 1275127.842 | 600334.865 |
| Sample P3-A | Property #3 | 8/1/2006 | 4552.047 | 0.7 | 1274821.135 | 600609.108 |
| P3-A hot spot SE corner | Property #3 | 8/3/2006 | 4541.738 | 1.0 | 1274817.919 | 600620.909 |
| P3-A hot spot SW corner | Property #3 | 8/3/2006 | 4548.564 | 0.5 | 1274815.006 | 600609.637 |
| P3-A hot spot NW corner | Property #3 | 8/3/2006 | 4549.274 | 0.5 | 1274824.201 | 600608.901 |
| P3-A hot spot NE corner | Property #3 | 8/3/2006 | 4550.224 | 0.5 | 1274824.404 | 600619.813 |
| Sample P3-B | Property #3 | 8/1/2006 | 4553.084 | 0.6 | 1274861.997 | 600609.430 |
| P3-B hot spot SE corner | Property #3 | 8/3/2006 | 4552.306 | 0.7 | 1274857.580 | 600620.226 |
| P3-B hot spot NE corner | Property #3 | 8/3/2006 | 4551.986 | 0.7 | 1274867.778 | 600619.683 |
| P3-B hot spot NW corner | Property #3 | 8/3/2006 | 4551.511 | 0.7 | 1274867.185 | 600608.786 |
| P3-B hot spot SW corner | Property #3 | 8/3/2006 | 4551.431 | 0.7 | 1274855.199 | 600610.085 |
| Sample P3-C | Property #3 | 8/1/2006 | 4555.970 | 0.7 | 1274900.345 | 600607.293 |
| Sample P3-D | Property #3 | 8/1/2006 | 4556.647 | 0.6 | 1274945.704 | 600610.338 |
| Sample P3-H | Property #3 | 8/1/2006 | 4555.647 | 0.7 | 1274942.485 | 600631.877 |
| P3-H hot spot E corner | Property #3 | 8/3/2006 | 4553.851 | 0.7 | 1274937.056 | 600638.686 |
| P3-H hot spot N corner | Property #3 | 8/3/2006 | 4554.081 | 0.7 | 1274947.533 | 600635.129 |
| P3-H hot spot W corner | Property #3 | 8/3/2006 | 4555.287 | 0.7 | 1274941.005 | 600625.169 |
| P3-H hot spot S corner | Property #3 | 8/3/2006 | 4554.983 | 0.7 | 1274932.512 | 600629.947 |
| Sample P3-I | Property #3 | 8/1/2006 | 4554.598 | 0.7 | 1274901.068 | 600653.161 |
| Sample P3-K | Property #3 | 8/1/2006 | 4557.799 | 0.7 | 1274819.967 | 600631.440 |
| Sample P3-L | Property #3 | 8/1/2006 | 4555.450 | 0.7 | 1274797.433 | 600681.503 |
| P3-L hot spot SW corner | Property #3 | 8/3/2006 | 4551.371 | 0.5 | 1274785.471 | 600674.746 |
| P3-L hot spot SE corner | Property #3 | 8/3/2006 | 4551.272 | 0.5 | 1274787.659 | 600687.559 |
| Sample P3-M | Property #3 | 8/1/2006 | 4559.453 | 0.9 | 1274866.684 | 600681.566 |
| P3-M hot spot E corner | Property #3 | 8/3/2006 | 4552.138 | 0.7 | 1274866.224 | 600685.952 |
| P3-M hot spot N corner | Property #3 | 8/3/2006 | 4551.516 | 0.7 | 1274874.847 | 600677.872 |
| P3-M hot spot SW corner | Property #3 | 8/3/2006 | 4551.583 | 0.7 | 1274864.251 | 600676.295 |
| P3-M hot spot SE corner | Property #3 | 8/3/2006 | 4550.325 | 0.7 | 1274863.936 | 600682.095 |
| Sample P3-N | Property #3 | 8/1/2006 | 4560.243 | 0.8 | 1274888.600 | 600682.727 |
| NW corner of porch | Property #3 | 8/3/2006 | 4554.150 | 0.6 | 1274864.600 | 600653.718 |
| NE corner of porch | Property #3 | 8/3/2006 | 4552.412 | 0.6 | 1274865.301 | 600665.508 |
| NE corner of house | Property #3 | 8/3/2006 | 4552.229 | 0.5 | 1274854.481 | 600692.410 |
| SE corner of house | Property #3 | 8/3/2006 | 4555.404 | 0.7 | 1274828.055 | 600693.786 |
| SW corner of house | Property #3 | 8/3/2006 | 4551.815 | 0.6 | 1274829.884 | 600627.052 |
| NW corner of house | Property #3 | 8/3/2006 | 4552.211 | 0.6 | 1274851.863 | 600627.099 |
| Fence Gate north of house | Property #4 | 8/3/2006 | 4547.566 | 0.8 | 1274678.085 | 600670.024 |
| W corner of fence near garden | Property #4 | 8/3/2006 | 4548.585 | 1.0 | 1274667.537 | 600663.381 |
| SW corner of fence near garden | Property #4 | 8/3/2006 | 4551.899 | 0.9 | 1274652.762 | 600672.098 |
| SE corner of fence near garden | Property #4 | 8/3/2006 | 4549.729 | 0.8 | 1274656.876 | 600679.048 |
| S corner of fence south of house | Property #4 | 8/3/2006 | 4547.529 | 0.8 | 1274620.134 | 600708.334 |
| SE corner of fence south of house | Property #4 | 8/3/2006 | 4547.169 | 0.8 | 1274633.780 | 600728.055 |
| NE corner of house | Property #4 | 8/3/2006 | 4551.738 | 1.0 | 1274656.310 | 600725.002 |
| N corner of house | Property #4 | 8/3/2006 | 4549.012 | 0.8 | 1274687.878 | 600702.815 |
| W corner of house | Property #4 | 8/3/2006 | 4548.397 | 0.9 | 1274681.633 | 600672.473 |
| NW corner of septic tank | Property #4 | 8/3/2006 | 4546.712 | 0.8 | 1274661.009 | 600657.186 |
| W corner of south shed | Property #4 | 8/3/2006 | 4548.150 | 0.8 | 1274608.549 | 600776.991 |
| S corner of south shed | Property #4 | 8/3/2006 | 4547.936 | 0.8 | 1274602.372 | 600782.283 |
| N corner of south shed | Property #4 | 8/3/2006 | 4548.803 | 0.8 | 1274612.607 | 600782.919 |
| S corner of north shed | Property #4 | 8/3/2006 | 4553.978 | 0.7 | 1274716.544 | 600744.637 |
| W corner of north shed | Property #4 | 8/3/2006 | 4557.174 | 1.0 | 1274726.810 | 600738.873 |
| N corner of north shed | Property #4 | 8/3/2006 | 4555.186 | 0.8 | 1274729.551 | 600747.297 |
| NE point of removal area | Property #4 | 8/8/2006 | 4552.046 | 0.5 | 1274715.806 | 600767.970 |
| SE point of removal area | Property #4 | 8/8/2006 | 4546.123 | 0.5 | 1274588.468 | 600772.747 |
| Water line from NW to SE | Property #4 | 8/8/2006 | 4546.886 | 0.5 | 1274599.127 | 600769.699 |
| Sample P4-A | Property #4 | 7/7/2006 | 4550.800 | 1.6 | 1274608.945 | 600602.459 |
| Sample P4-B | Property #4 | 6/28/2006 | 4547.960 | 1.0 | 1274642.786 | 600592.363 |
| Sample P4-C | Property #4 | 6/28/2006 | 4547.137 | 1.0 | 1274683.145 | 600592.165 |
| Sample P4-D | Property #4 | 7/7/2006 | 4553.713 | 20.1 | 1274675.603 | 600633.080 |
| Sample P4-E | Property #4 | 7/7/2006 | 4552.878 | 20.1 | 1274637.799 | 600633.195 |
| Sample P4-F | Property #4 | 8/9/2006 | 4549.534 | 0.5 | 1274606.223 | 600631.760 |
| P4-F hot spot W corner | Property #4 | 8/10/2006 | 4546.578 | 0.6 | 1274615.056 | 600629.507 |
| P4-F hot spot S corner | Property #4 | 8/10/2006 | 4546.316 | 0.6 | 1274605.594 | 600626.401 |

| GPS Point Description | Location | Date | Elevation (ft) | Horiz. Prec (ft) | Northing | Easting |
|---|---|---|---|---|---|---|
| P4-F hot spot E corner | Property #4 | 8/10/2006 | 4544.958 | 0.6 | 1274602.879 | 600637.440 |
| P4-F hot spot N corner | Property #4 | 8/10/2006 | 4545.721 | 0.7 | 1274610.212 | 600641.594 |
| Sampe P4-G | Property #4 | 6/28/2006 | 4551.476 | 1.5 | 1274612.553 | 600677.035 |
| Sample P4-H | Property #4 | 8/10/2006 | 4545.143 | 0.7 | 1274647.232 | 600665.148 |
| P4-H hot spot S corner | Property #4 | 8/10/2006 | 4546.783 | 0.7 | 1274639.207 | 600663.732 |
| P4-H hot spot E corner | Property #4 | 8/10/2006 | 4546.858 | 0.7 | 1274643.794 | 600672.694 |
| P4-H hot spot N corner | Property #4 | 8/10/2006 | 4546.966 | 0.7 | 1274651.984 | 600666.019 |
| P4-H hot spot W corner | Property #4 | 8/10/2006 | 4548.035 | 0.7 | 1274649.891 | 600659.463 |
| Sample P4-I | Property #4 | 8/9/2006 | 4549.403 | 0.6 | 1274702.581 | 600657.878 |
| Sample P4-J | Property #4 | 8/9/2006 | 4552.143 | 0.5 | 1274707.180 | 600707.181 |
| P4-J hot spot NE corner | Property #4 | 8/9/2006 | 4553.222 | 0.6 | 1274713.399 | 600711.088 |
| P4-J hot spot SE corner | Property #4 | 8/9/2006 | 4552.993 | 0.6 | 1274704.149 | 600714.515 |
| P4-J hot spot SW corner | Property #4 | 8/9/2006 | 4551.908 | 0.6 | 1274700.924 | 600706.054 |
| P4-J hot spot NW corner | Property #4 | 8/9/2006 | 4549.811 | 0.7 | 1274711.304 | 600700.812 |
| Sample P4-K | Property #4 | 6/28/2006 | 4555.274 | 1.7 | 1274615.298 | 600717.505 |
| Sample P4-L | Property #4 | 6/28/2006 | 4556.601 | 1.7 | 1274614.781 | 600744.716 |
| Sample P4-M | Property #4 | 7/7/2006 | 4549.405 | 20.9 | 1274652.165 | 600749.696 |
| Sample P4-N | Property #4 | 7/7/2006 | 4553.813 | 20.0 | 1274692.820 | 600749.810 |
| Gas meter @ W side of house | Property #4 | 7/7/2006 | 4551.601 | 1.2 | 1274646.074 | 600685.694 |
| SWGAS/house gas line connection | Property #4 | 7/7/2006 | 4551.005 | 1.0 | 1274559.928 | 600639.445 |
| 25 feet west of SWGAS/house connection | Property #4 | 7/7/2006 | 4551.225 | 1.0 | 1274581.296 | 600620.842 |
| 50 feet west of SWGAS/house connection | Property #4 | 7/7/2006 | 4563.808 | 18.6 | 1274599.529 | 600601.980 |
| 25 feet east of SWGAS/house connection | Property #4 | 7/7/2006 | 4551.329 | 1.0 | 1274544.061 | 600664.137 |
| Water line from south shed SW | Property #4 | 7/7/2006 | 4550.541 | 0.8 | 1274580.798 | 600704.515 |
| NE corner of property #7 boundary | Property #7 | 5/15/2007 | 4543.410 | 5.2 | 1274410.978 | 601976.086 |
| SW corner of house | Property #7 | 5/15/2007 | 4537.824 | 6.9 | 1274256.439 | 601913.569 |
| NW corner of house | Proerty #7 | 5/15/2007 | 4528.817 | 8.5 | 1274279.958 | 601911.516 |
| NE corner of house | Property #7 | 5/15/2007 | 4535.131 | 9.2 | 1274278.595 | 601974.177 |
| SE corner of house | Property #7 | 5/15/2007 | 4536.092 | 5.2 | 1274244.421 | 601970.322 |
| Sample point by EPA | Property #7 | 5/15/2007 | 4530.815 | 4.3 | 1274227.211 | 601953.069 |
| SE corner of septic tank | Property #7 | 5/15/2007 | 4529.775 | 3.9 | 1274232.429 | 601956.478 |
| SW corner of septic tank | Property #7 | 5/15/2007 | 4532.999 | 3.9 | 1274230.853 | 601950.229 |
| NW corner of septic tank | Property #7 | 5/15/2007 | 4530.841 | 5.2 | 1274236.109 | 601951.342 |
| NE corner of septic tank | Property #7 | 5/15/2007 | 4539.064 | 4.6 | 1274238.416 | 601955.260 |
| Overhead electric line | Property #7 | 5/15/2007 | 4534.420 | 4.6 | 1274321.940 | 601997.662 |
| Overhead electric line at house | Property #7 | 5/15/2007 | 4533.855 | 8.5 | 1274291.446 | 601954.597 |
| SW gas line | Property #7 | 5/15/2007 | 4535.571 | 5.2 | 1274287.894 | 601967.760 |
| Second overhead electric line point | Property #7 | 5/15/2007 | 4520.680 | 7.9 | 1274226.820 | 602056.497 |
| NE corner of excavation | Property #7 | 5/15/2007 | 4514.628 | 4.6 | 1274234.030 | 601959.695 |
| NW corner of excavation | Property #7 | 5/15/2007 | 4517.455 | 6.9 | 1274231.422 | 601949.216 |
| SW corner of excavation | Property #7 | 5/15/2007 | 4518.321 | 4.9 | 1274217.529 | 601950.086 |
| SE corner of excavation | Property #7 | 5/15/2007 | 4527.053 | 8.5 | 1274219.314 | 601961.985 |
| SE corner of property #7 boundary | Property #7 | 5/15/2007 | 4543.410 | 7.2 | 1274223.997 | 602050.826 |
| Eastern edge of property | Property #7 | 5/15/2007 | 4530.572 | 5.2 | 1274294.878 | 601992.881 |
| NE corner of barn | Property #7 | 5/15/2007 | 4529.254 | 5.2 | 1274278.348 | 601841.292 |
| NW corner of barn | Property #7 | 5/15/2007 | 4524.534 | 8.5 | 1274281.092 | 601815.000 |
| SW corner of barn | Property #7 | 5/15/2007 | 4505.152 | 5.6 | 1274215.064 | 601814.222 |
| SE corner of barn | Property #7 | 5/15/2007 | 4531.812 | 5.6 | 1274231.946 | 601848.388 |
| Western edge of property | Property #7 | 5/15/2007 | 4528.060 | 5.6 | 1274235.546 | 601750.090 |
| Southern edge of property at electric pole | Property #7 | 5/15/2007 | 4515.727 | 13.1 | 1274131.336 | 601944.573 |
| SW gas line | Property #7 | 5/15/2007 | | | | |
| Leach line | Property #7 | 5/15/2007 | | | | |
| Dead water line to well | Property #7 | 5/15/2007 | | | | |

## TABLE 6. RECORDS OF SOILS AND GRAVEL TRANSPORTED OUT OF AND IN TO PROPERTIES

| PROPERTY | MATERIAL VOLUMES (YARDS$^3$) | | |
|---|---|---|---|
| | TRANSPORTED OUT | TRANSPORTED IN | GRAVEL FOR COVER |
| 2 | 1,030 | 1,150 | 13 |
| 3 | 140 | 160 | 22 |
| 4 | 434 | 500 | 13 |
| 7 | 8 | 11 | 0 |

# Appendices

# APPENDIX A

## EPA Administrative Settlement Agreement and Order on Consent for Removal Action

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION 9

| | |
|---|---|
| IN THE MATTER OF: | ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT FOR REMOVAL ACTION |
| Iron King Mine Site<br>Dewey-Humboldt,<br>Yavapai County, Arizona | U.S. EPA Region 9<br>CERCLA Docket No. 2006-13 |
| Ironite Products Company<br>Respondent | Proceeding Under Sections 104, 106(a), 107 and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. §§ 9604, 9606(a), 9607 and 9622 |

## TABLE OF CONTENTS

## I. JURISDICTION AND GENERAL PROVISIONS

1. This Administrative Settlement Agreement and Order on Consent ("Settlement Agreement") is entered into voluntarily by the United States Environmental Protection Agency ("EPA") and Ironite Products Company ("Respondent"). This Settlement Agreement provides for the performance of a removal action by Respondent at or in connection with 4 residential properties located near the Iron King Mine along the stream corridor known as the Chaparral Gulch in Dewey-Humboldt, Arizona, the " Iron King Mine Site" or the "Site."

2. This settlement Agreement is issued under the authority vested in the President of the United States by Sections 104, 106(a), 107 and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. §§ 9604, 9606(a), 9607 and 9622, as amended ("CERCLA").

3. EPA has notified the State of Arizona (the "State") of this action pursuant to Section 106(a) of CERCLA, 42 U.S.C. § 9606(a).

4. EPA and Respondent recognize that this Settlement Agreement has been negotiated in good faith and that the actions undertaken by Respondent in accordance with this Settlement Agreement do not constitute an admission of any liability. Respondent does not admit, and retains the right to controvert in any subsequent proceedings other than proceedings to implement or enforce this Settlement Agreement, the validity of the findings of facts, conclusions of law, and determinations in Sections IV and V of this Settlement Agreement. Respondent agrees to comply with and be bound by the terms of this Settlement Agreement and further agrees that it will not contest with the United States the basis or validity of this Settlement Agreement or its terms.

## II. PARTIES BOUND

5. This Settlement Agreement applies to and is binding upon EPA and upon Respondent and its successors and assigns. Any change in ownership or corporate status of a Respondent including, but not limited to, any transfer of assets or real or personal property shall not alter such Respondent's responsibilities under this Settlement Agreement.

6. Respondent shall ensure that its contractors, subcontractors, and representatives receive a copy of this Settlement Agreement and comply with this Settlement Agreement. Respondent shall be responsible for any noncompliance with this Settlement Agreement.

## III. DEFINITIONS

7. Unless otherwise expressly provided herein, terms used in this Settlement Agreement which are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or in such regulations. Whenever terms listed below are used in this Settlement Agreement or in the appendices attached hereto and incorporated hereunder, the following definitions shall apply:

a. "Action Memorandum" shall mean the EPA Action Memorandum relating to the Site signed on April 11, 2006, by the Regional Administrator, EPA Region 9, or his delegate, and all attachments thereto. The Action Memorandum is attached as Appendix 1.

b. "CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. §§ 9601, *et seq.*

c. "Day" shall mean a calendar day. In computing any period of time under this Order, where the last day would fall on a Saturday, Sunday, or Federal holiday, the period shall run until the close of business of the next working day.

d. "Effective Date" shall be the effective date of this Order as provided in Section XXXI.

e. "EPA" shall mean the United States Environmental Protection Agency and any successor departments or agencies of the United States.

f. "Arizona Department of Environmental Quality ("ADEQ")" shall mean the State environmental protection agency and any successor departments or agencies of the State.

g. "Future Response Costs" shall mean all costs, including, but not limited to, direct and indirect costs, that the United States incurs in reviewing or developing plans, reports and other items pursuant to this Settlement Agreement, verifying the Work, or otherwise implementing, overseeing, or enforcing this Settlement Agreement, including but not limited to, payroll costs, contractor costs, travel costs, laboratory costs, the costs incurred pursuant to Paragraph 23 (costs and attorneys fees and any monies paid to secure access, including the amount of just compensation), Paragraph 33 (emergency response), and Paragraph 58 (work takeover).

h. "Interest" shall mean interest at the rate specified for interest on investments of the EPA Hazardous Substance Superfund established by 26 U.S.C. § 9507, compounded annually on October 1 of each year, in accordance with 42 U.S.C. § 9607(a). The applicable rate of interest shall be the rate in effect at the time the interest accrues. The rate of interest is subject to change on October 1 of each year.

i. "National Contingency Plan" or "NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, codified at 40 C.F.R. Part 300, and any amendments thereto.

j. "Settlement Agreement" shall mean this Administrative Settlement Agreement and Order on Consent and all appendices attached hereto. In the event of conflict between this Settlement Agreement and any appendix, this Settlement Agreement shall control.

k. "Paragraph" shall mean a portion of this Order identified by an Arabic numeral.

l. "Parties" shall mean EPA and Respondent.

m. "RCRA" shall mean the Solid Waste Disposal Act, as amended, 42 U.S.C. §§ 6901, *et seq.* (also known as the Resource Conservation and Recovery Act).

n. "Respondent" shall mean the Ironite Products Company.

o. "Section" shall mean a portion of this Order identified by a Roman numeral.

p. "Site" shall mean that portion of the Iron King Mine property that includes the Ironite Product Company's property and the Chaparral Gulch Residential area located in the town of Dewey-Humboldt in Yavapai County, Arizona, and depicted generally on the map attached as Appendix 2.

q. "State" shall mean the State of Arizona.

r. "Waste Material" shall mean 1) any "hazardous substance" under Section 101(14) of CERCLA, 42 U.S.C. § 9601(14); 2) any pollutant or contaminant under Section 101(33) of CERCLA, 42 U.S.C. § 9601(33); 3) any "solid waste" under Section 1004(27) of RCRA, 42 U.S.C. § 6903(27); and 4) any "hazardous waste" under Arizona Revised Statutes Title 49 § 49-922.

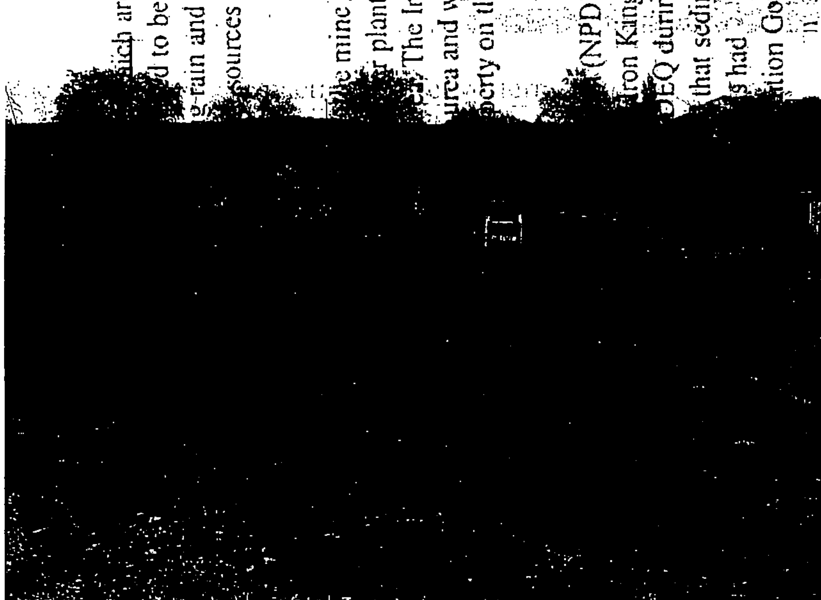
s. "Work" shall mean all activities Respondent is required to perform under this Settlement Agreement.

## IV. FINDINGS OF FACT

8. The Site includes four privately owned, residential parcels located along the stream corridor known as the Chaparral Gulch in Dewey-Humboldt, Yavapai County, Arizona.

a. The properties are located on both sides of State Highway 69, in the town of Dewey-Humboldt, Arizona. These properties are situated east north east and directly downslope

## PROPERTY #4



Backfilling and compaction of the western portion of Property #4. View toward the north from southern edge of removal area.

Completed backfill and surface grade in southern portion of Property #4. View toward the east.

substantial endangerment to the residents that occupy the Site and people engaging in recreational activities on or in close proximity to the Site.

## V. CONCLUSIONS OF LAW AND DETERMINATIONS

9. Based on the Findings of Fact set forth above, and the Administrative Record supporting this removal action, EPA has determined that:

a. The Iron King Mine Site is a "facility" as defined by Section 101(9) of CERCLA, 42 U.S.C. § 9601(9).

b. The contamination found at the Site, as identified in the Findings of Fact above, includes a "hazardous substance" as defined by Section 101(14) of CERCLA, 42 U.S.C. § 9601(14).

c. Respondent is a "person" as defined by Section 101(21) of CERCLA, 42 U.S.C. § 9601(21).

d. Respondent is a responsible party under Section 107(a) of CERCLA, 42 U.S.C. § 9607(a), and is liable for performance of a response action and for response costs incurred and to be incurred at the Site. Respondent is the "owner" and "operator" of the facility, as defined by Section 101(20) of CERCLA, 42 U.S.C. § 9601(20), and within the meaning of Section 107(a)(1) of CERCLA, 42 U.S.C. § 9607(a)(1), from which a hazardous substance was released to the Site.

e. The conditions described in the Findings of Fact above constitute an actual or threatened "release" of a hazardous substance from the facility as defined by Section 101(22) of CERCLA, 42 U.S.C.§ 9601(22).

f. The removal action required by this Settlement Agreement is necessary to protect the public health, welfare, or the environment and, if carried out in compliance with the terms of this Settlement Agreement, will be considered consistent with the NCP, as provided in Section 300.700(c)(3)(ii) of the NCP.

## VI. SETTLEMENT AGREEMENT AND ORDER

Based upon the foregoing Findings of Fact, Conclusions of Law, Determinations, and the Administrative Record for this Site, it is hereby Ordered and Agreed that Respondent shall comply with all provisions of this Settlement Agreement, including, but not limited to, all attachments to this Settlement Agreement and all documents incorporated by reference into this Settlement Agreement.

## VII. DESIGNATION OF CONTRACTOR, PROJECT COORDINATOR, AND ON-SCENE COORDINATOR

10. Respondent shall retain one or more contractors to perform the Work and shall notify EPA of the name(s) and qualifications of such contractor(s) within 3 days of the Effective Date. Respondents shall also notify EPA of the name(s) and qualification(s) of any other contractor(s) or subcontractor(s) retained to perform the Work at least 5 days prior to commencement of such Work. EPA retains the right to disapprove of any or all of the contractors and/or subcontractors retained by Respondent. If EPA disapproves of a selected contractor, Respondent shall retain a different contractor and shall notify EPA of that contractor's name and qualifications within 10 days of EPA's disapproval. The proposed contractor must demonstrate compliance with ANSI/ASQC E-4-1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995), by submitting a copy of the proposed contractor's Quality Management Plan ("QMP"). The QMP should be prepared in accordance with "EPA Requirements for Quality Management Plans (QA/R-2)" (EPA/240/B0-1/002), or equivalent documentation as required by EPA. Any decision not to require submission of the contractor's QMP should be documented in a memorandum from the OSC and Regional QA personnel to the Site file.

11. Within 3 days after the Effective Date, Respondent shall designate a Project Coordinator who shall be responsible for administration of all actions by Respondents required by this Settlement Agreement and shall submit to EPA the designated Project Coordinator's name, address, telephone number, and qualifications. To the greatest extent possible, the Project Coordinator shall be present on Site or readily available during Site work. EPA retains the right to disapprove of the designated Project Coordinator. If EPA disapproves of the designated Project Coordinator, Respondent shall retain a different Project Coordinator and shall notify EPA of that person's name, address, telephone number, and qualifications within 10 days following EPA's disapproval. Receipt by Respondent's Project Coordinator of any notice or communication from EPA relating to this Settlement Agreement shall constitute receipt by all Respondents.

12. EPA has designated Harry Allen of the Emergency Response Section, Response, Planning and Assessment Branch of the Superfund Division, Region 9, as its On-Scene Coordinator ("OSC"). EPA designates Daniel Suter and Hedy Salter as alternate OSCs

in the event Harry Allen is not present at the Site or is otherwise unavailable. During such times, these alternate OSCs are available and have the authority vested in the OSC by the NCP. Except as otherwise provided in this Order, Respondent shall direct all submissions required by this Order to the OSC by over-night mail with a electronic copy by email to the OSC at the following address:

Harry Allen, Federal On-Scene Coordinator
Superfund Division, SFD-9-2
EPA, Region 9
75 Hawthorne Street
San Francisco, CA 94105
allen.harryl@epa.gov

Respondent shall submit two (2) paper copies of each document to EPA.

13. EPA and Respondent shall have the right, subject to Paragraph 11, to change their respective designated OSC or Project Coordinator. Respondent shall notify EPA 3 days before such a change is made. The initial notification may be made orally, but shall be promptly followed by a written notice.

## VIII. WORK TO BE PERFORMED

14. Respondent shall perform, at a minimum, all actions necessary to implement the Action Memorandum. The actions to be implemented generally include, but are not limited to, the following:

a. Removal of surficial contamination by excavating soil within the existing sampling grids to achieve a concentration of 23 ppm arsenic or less at the excavation surface unless an alternative concentration is approved by EPA and documented in an amendment to the Action Memorandum.

b. Confirmation sampling and analysis using laboratory analyses.

c. Transport and disposal of excavated material on-site at an EPA approved location on the Ironite property or at an EPA approved off-site facility. Disposal of contaminated soils shall be at the direction of the OSC, and pursuant to the EPA approved Work Plan. Any off-site disposal shall be consistent with EPA's procedures for planning and implementing off-site response actions at 40 CFR 300.440.

d. Replacement of excavated material with clean fill and restoration of each property to pre-removal conditions replacing patios, fences, trees and shrubs if necessary.

e. Provide community relations support to the affected residents in coordination with EPA's community involvement program.

f. Provide EPA a weekly progress report that summarizes work performed and work planned for the upcoming period, and which includes copies of all documentation related to confirmation sampling, off-site disposal or other disposition of wastes including, but not limited to, manifests, waste profiles and analytical data, and disposal costs.

Under circumstances where special considerations are appropriate for the scope of the residential excavation, such as risk to property or significant duress for the resident, an alternative approach to the excavation extent may be deemed appropriate as determined by EPA.

15. Work Plan and Implementation.

a. Within 10 days after the Effective Date, Respondent shall submit to EPA for approval a draft Work Plan for performing the removal action generally described in Paragraph 14 above. The draft Work Plan shall provide a description of, and an expeditious schedule for, the actions required by this Order. Respondent shall prepare a Quality Assurance Project Plan ("QAPP") as part of the Work Plan. The QAPP should be prepared in accordance with "EPA Requirements for Quality Assurance Project Plans (QA/R-5)" (EPA/240/B-01/003, March 2001), and "EPA Guidance for Quality Assurance Project Plans (QA/G-5)" (EPA/600/R-98/018, February 1998).

b. EPA may approve, disapprove, require revisions to, or modify the draft Work Plan in whole or in part. If EPA requires revisions, Respondent shall submit a revised draft Work Plan within 3 days of receipt of EPA's notification of the required revisions. Respondent shall implement the Work Plan as approved in writing by EPA in accordance with the schedule approved by EPA. Once approved, or approved with modifications, the Work Plan, the schedule, and any subsequent modifications shall be incorporated into and become fully enforceable under this Order.

c. Respondent shall not commence any Work except in conformance with the terms of this Settlement Agreement. Respondent shall not commence implementation of the Work Plan developed hereunder until receiving written EPA approval pursuant to Paragraph 15(b).

16. Health and Safety Plan. Within 10 days after the Effective Date, Respondent shall submit for EPA review and comment a plan that ensures the protection of the public health and safety during performance of on-Site work under this Settlement Agreement. This plan shall be prepared in accordance with EPA's Standard Operating Safety Guide (PUB 9285.1-03, PB 92-963414, June 1992). In addition, the plan shall comply with all currently applicable Occupational Safety and Health Administration ("OSHA") regulations found at 29 C.F.R. Part 1910. If EPA

determines that it is appropriate, the plan shall also include contingency planning. Respondent shall incorporate all changes to the plan recommended by EPA and shall implement the plan during the pendency of the removal action.

17. Quality Assurance and Sampling.

a. All sampling and analyses performed pursuant to this Settlement Agreement shall conform to EPA direction, approval, and guidance regarding sampling, quality assurance/quality control ("QA/QC"), data validation, and chain of custody procedures. Respondents shall ensure that the laboratory used to perform the analyses participates in a QA/QC program that complies with the appropriate EPA guidance. Respondent shall follow, as appropriate, "Quality Assurance/Quality Control Guidance for Removal Activities: Sampling QA/QC Plan and Data Validation Procedures" (OSWER Directive No. 9360.4-01, April 1, 1990), EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5), Preparation of a U.S. EPA Region 9 Field Sample Plan for EPA-Lead Superfund Projects (Document Control No. 9QA-05-93) and Guidance for the Data Quality Objectives Process (EPA QA/G-4). Soil sampling activities shall utilize proper soil assessment techniques as defined in EPA Document SW-846, Chapter 9 (EPA Environmental Response Team Standard Operating Procedures) or appropriate ASTM standards as guidance for QA/QC and sampling. Respondent shall only use laboratories that have a documented Quality System that complies with ANSI/ASQC E-4 1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995), and "EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, March 2001)," or equivalent documentation as determined by EPA. EPA may consider laboratories accredited under the National Environmental Laboratory Accreditation Program ("NELAP") as meeting the Quality System requirements.

b. Upon request by EPA, Respondent shall have such a laboratory analyze samples submitted by EPA for QA monitoring. Respondents shall provide to EPA the QA/QC procedures followed by all sampling teams and laboratories performing data collection and/or analysis.

c. Upon request by EPA, Respondent shall allow EPA or its authorized representatives to take split and/or duplicate samples. Respondents shall notify EPA not less than 5 days in advance of any sample collection activity, unless shorter notice is agreed to by EPA. EPA shall have the right to take any additional samples that EPA deems necessary. Upon request, EPA shall allow Respondent to take split or duplicate samples of any samples it takes as part of its oversight of Respondent's implementation of the Work.

18. Post-Removal Site Control. In accordance with the Work Plan schedule, or as otherwise directed by EPA, Respondent shall submit a proposal for post-removal site control consistent with Section 300.415(l) of the NCP and OSWER Directive No. 9360.2-02. Upon EPA approval, Respondent shall implement such controls and shall provide EPA with documentation of all post-removal site control arrangements.

19. Reporting.

a. Respondent shall submit weekly written progress reports to EPA each Monday concerning actions undertaken pursuant to this Settlement Agreement after the date of receipt of EPA's approval of the Work Plan until termination of this Order, unless otherwise directed in writing by the OSC. These reports shall describe all significant developments during the preceding period, including the actions performed and any problems encountered, analytical data received during the reporting period, and the developments anticipated during the next reporting period, including a schedule of actions to be performed, anticipated problems, and planned resolutions of past or anticipated problems.

b. Respondent shall submit 2 copies of all plans, reports or other submissions required by this Settlement Agreement, or any approved work plan. Respondent shall also submit all documents in electronic form.

c. Any Respondent who owns or controls property at the Site shall, at least 30 days prior to the conveyance of any interest in real property at the Site, give written notice to the transferee that the property is subject to this Settlement Agreement and written notice to EPA and the State of the proposed conveyance, including the name and address of the transferee. Any Respondent who owns or controls property at the Site also agree to require that their successors comply with the immediately proceeding sentence and Sections IX (Site Access) and X (Access to Information).

20. Final Report. Within 60 days after completion of all Work required by this Settlement Agreement, Respondent shall submit for EPA review and approval a final report summarizing the actions taken to comply with this Settlement Agreement. The final report shall conform, at a minimum, with the requirements set forth in Section 300.165 of the NCP entitled "OSC Reports." The final report shall also conform with "Superfund Removal Procedures: Removal Response Reporting – POLREPS and OSC Reports" (OSWER Directive No. 9360.3-03, June 1, 1994). The final report shall include a good faith estimate of total costs or a statement of actual costs incurred in complying with the Settlement Agreement, a listing of quantities and types of materials removed off-Site or handled on-Site, a discussion of removal and disposal options considered for those materials, a listing of the ultimate destination(s) of those materials, a presentation of the analytical results of all sampling and analyses performed, and accompanying appendices containing all relevant documentation generated during the removal action (*e.g.*, manifests, invoices, bills, contracts, and permits). The final report shall also include the following certification signed by a person who supervised or directed the preparation of that report:

> "Under penalty of law, I certify that to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of the report, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

21. Off-Site Shipments.

a. Respondent shall, prior to any off-Site shipment of Waste Material from the Site to an out-of-state waste management facility, provide written notification of such shipment of Waste Material to the appropriate state environmental official in the receiving facility's state and to the On-Scene Coordinator. However, this notification requirement shall not apply to any off-Site shipments when the total volume of all such shipments will not exceed 10 cubic yards.

> I. Respondent shall include in the written notification the following information: 1) the name and location of the facility to which the Waste Material is to be shipped; 2) the type and quantity of the Waste Material to be shipped; 3) the expected schedule for the shipment of the Waste Material: and 4) the method of transportation. Respondent shall notify the state in which the planned receiving facility is located of major changes in the shipment plan, such as a decision to ship the Waste Material to another facility within the same state, or to a facility in another state.
>
> ii. The identity of the receiving facility and state will be determined by Respondent following the award of the contract for the removal action. Respondent shall provide the information required by Paragraph 21(a) and 21(b) as soon as practicable after the award of the contract and before the Waste Material is actually shipped.

b. Before shipping any hazardous substances, pollutants, or contaminants from the Site to an off-site location, Respondent shall obtain EPA's certification that the proposed receiving facility is operating in compliance with the requirements of CERCLA Section 121(d)(3), 42 U.S.C. § 9621(d)(3), and 40 C.F.R. § 300.440. Respondent shall only send hazardous substances, pollutants, or contaminants from the Chaparral Gulch residential area to an EPA approved location on-site or to an off-site facility that complies with the requirements of the statutory provision and regulation cited in the preceding sentence.

## IX. SITE ACCESS

22. If the Site, or any other property where access is needed to implement this Settlement Agreement, is owned or controlled by the Respondent, the Respondent shall, commencing on the Effective Date, provide EPA and its representatives, including contractors, with access at all reasonable times to the Site, or such other property, for the purpose of conducting any activity related to this Settlement Agreement.

23. Where any action under this Settlement Agreement is to be performed in areas owned by or in possession of someone other than Respondent, Respondent shall use its best efforts to obtain all necessary access agreements within 10 days after the Effective Date, or as otherwise specified in writing by the OSC. Respondent shall immediately notify EPA if after using their best efforts they are unable to obtain such agreements. For purposes of this Paragraph, "best efforts"

includes the payment of reasonable sums of money in consideration of access. Respondent shall describe in writing their efforts to obtain access. EPA may then assist Respondent in gaining access, to the extent necessary to effectuate the response actions described herein, using such means as EPA deems appropriate. Respondent shall reimburse EPA for all costs and attorney's fees incurred by the United States in obtaining such access, in accordance with the procedures in Section XV (Payment of Response Costs).

24. Notwithstanding any provision of this Settlement Agreement, EPA and the State retain all of their access authorities and rights, including enforcement authorities related thereto, under CERCLA, RCRA, and any other applicable statutes or regulations.

## X. ACCESS TO INFORMATION

25. Respondent shall provide to EPA and the State, upon request, copies of all documents and information within its possession or control or that of its contractors or agents relating to activities at the Site or to the implementation of this Settlement Agreement, including, but not limited to, sampling, analysis, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing, correspondence, or other documents or information related to the Work. Respondent shall also make available to EPA and the State, for purposes of investigation, information gathering, or testimony, their employees, agents, or representatives with knowledge of relevant facts concerning the performance of the Work.

26. Respondent may assert business confidentiality claims covering part or all of the documents or information submitted to EPA and the State under this Order to the extent permitted by and in accordance with Section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7), and 40 C.F.R. § 2.203(b). Documents or information determined to be confidential by EPA will be afforded the protection specified in 40 C.F.R. Part 2, Subpart B. If no claim of confidentiality accompanies documents or information when they are submitted to EPA and the State, or if EPA has notified Respondent that the documents or information are not confidential under the standards of Section 104(e)(7) of CERCLA or 40 C.F.R. Part 2, Subpart B, the public may be given access to such documents or information without further notice to Respondent.

27. Respondent may assert that certain documents, records and other information are privileged under the attorney-client privilege or any other privilege recognized by federal law. If the Respondent asserts such a privilege in lieu of providing documents, it shall provide EPA and the State with the following: 1) the title of the document, record, or information; 2) the date of the document, record, or information; 3) the name and title of the author of the document, record, or information; 4) the name and title of each addressee and recipient; 5) a description of the contents of the document, record, or information; and 6) the privilege asserted by Respondent. However, no documents, reports or other information created or generated pursuant to the requirements of this Settlement Agreement shall be withheld on the grounds that they are privileged.

28. No claim of confidentiality shall be made with respect to any data, including, but not limited to, all sampling, analytical, monitoring, hydrogeologic, scientific, chemical, or engineering data, or any other documents or information evidencing conditions at or around the Site.

## XI. RECORD RETENTION

29. Until 10 years after Respondent's receipt of EPA's notification pursuant to Section XXIX (Notice of Completion of Work), each Respondent shall preserve and retain all non-identical copies of records and documents (including records or documents in electronic form) now in its possession or control or which come into its possession or control that relate in any manner to the performance of the Work or the liability of any person under CERCLA with respect to the Site, regardless of any corporate retention policy to the contrary. Until 10 years after Respondents's receipt of EPA's notification pursuant to Section XXIX (Notice of Completion of Work), Respondent shall also instruct their contractors and agents to preserve all documents, records, and information of whatever kind, nature or description relating to performance of the Work.

30. At the conclusion of this document retention period, Respondent shall notify EPA and the State at least 90 days prior to the destruction of any such records or documents, and, upon request by EPA or the State, Respondent shall deliver any such records or documents to EPA or the State. Respondent may assert that certain documents, records and other information are privileged under the attorney-client privilege or any other privilege recognized by federal law. If Respondent asserts such a privilege, it shall provide EPA or the State with the following: 1) the title of the document, record, or information; 2) the date of the document, record, or information; 3) the name and title of the author of the document, record, or information; 4) the name and title of each addressee and recipient; 5) a description of the subject of the document, record, or information; and 6) the privilege asserted by Respondent. However, no documents, reports or other information created or generated pursuant to the requirements of this Settlement Agreement shall be withheld on the grounds that they are privileged.

31. Each Respondent hereby certifies individually that to the best of its knowledge and belief, after thorough inquiry, it has not altered, mutilated, discarded, destroyed or otherwise disposed of any records, documents or other information (other than identical copies) relating to its potential liability regarding the Site since notification of potential liability by EPA or the State or the filing of suit against it regarding the Site and that it has fully complied with any and all EPA requests for information pursuant to Sections 104(e) and 122(e) of CERCLA, 42 U.S.C. §§ 9604(e) and 9622(e), and Section 3007 of RCRA, 42 U.S.C. § 6927.

## XII. COMPLIANCE WITH OTHER LAWS

32. Respondent shall perform all actions required pursuant to this Settlement Agreement in accordance with all applicable local, state, and federal laws and regulations except as provided in Section 121(e) of CERCLA, 42 U.S.C. § 6921(e), and 40 C.F.R. §§ 300.400(e) and 300.415(j). In accordance with 40 C.F.R. § 300.415(j), all on-Site actions required pursuant to this

Settlement Agreement shall, to the extent practicable, as determined by EPA, considering the exigencies of the situation, attain applicable or relevant and appropriate requirements ("ARARs") under federal environmental or state environmental or facility siting laws. Respondent shall identify ARARs in the Work Plan subject to EPA approval.

## XIII. EMERGENCY RESPONSE AND NOTIFICATION OF RELEASES

33. In the event of any action or occurrence during performance of the Work which causes or threatens a release of Waste Material from the Site that constitutes an emergency situation or may present an immediate threat to public health or welfare or the environment, Respondent shall immediately take all appropriate action. Respondent shall take these actions in accordance with all applicable provisions of this Settlement Agreement, including, but not limited to, the Health and Safety Plan, in order to prevent, abate or minimize such release or endangerment caused or threatened by the release Respondent shall also immediately notify the OSC or, in the event of his/her unavailability, the Regional Duty Officer at the EPA Regional Emergency 24-hour telephone number (1-800-300-2193) of the incident or Site conditions. In the event that Respondent fail to take appropriate response action as required by this Paragraph, and EPA takes such action instead, Respondent shall reimburse EPA all costs of the response action not inconsistent with the NCP pursuant to Section XV (Payment of Response Costs).

34. In addition, in the event of any release of a hazardous substance from the Site, Respondent shall immediately notify the OSC at (415) 972-3063 and the National Response Center at (800) 424-8802. Respondent shall submit a written report to EPA within 5 days after each release, setting forth the events that occurred and the measures taken or to be taken to mitigate any release or endangerment caused or threatened by the release and to prevent the reoccurrence of such a release. This reporting requirement is in addition to, and not in lieu of, reporting under Section 103 of CERCLA, 42 U.S.C. § 9603, and Section 304 of the Emergency Planning and Community Right-To-Know Act of 1986, 42 U.S.C. § 11004, *et seq.*

## XIV. AUTHORITY OF ON-SCENE COORDINATOR

35. The OSC shall be responsible for overseeing Respondent's implementation of this Settlement Agreement. The OSC shall have the authority vested in an OSC by the NCP, including the authority to halt, conduct, or direct any Work required by this Settlement Agreement, or to direct any other removal action undertaken at the Site. Absence of the OSC from the Site shall not be cause for stoppage of work unless specifically directed by the OSC.

## XV. PAYMENT OF RESPONSE COSTS

36. Payments for Future Response Costs.

a. Respondent shall pay EPA all Future Response Costs not inconsistent with the NCP. On a periodic basis, EPA will send Respondent a bill requiring payment that includes a Regionally-prepared cost summary, which includes direct and indirect costs incurred by EPA and its contractors. Respondent shall make all payments within 30 days of receipt of each bill requiring payment, except as otherwise provided in Paragraph 38 of this Settlement Agreement.

b. Respondents shall make all payments required by this Paragraph by a certified or cashier's check or checks made payable to "EPA Hazardous Substance Superfund," referencing the name and address of the party making payment and EPA Site/Spill ID number 09NU. Respondent shall send the check(s) to the following address:.

U.S. Environmental Protection Agency
Region 9 Superfund
P.O. Box 371099M
Pittsburgh, PA 15251

c. At the time of payment, Respondents shall send a cover letter with any check and the letter shall identify the Iron King Mine Site by name and make reference to this Settlement Agreement, including the EPA docket number stated above (Docket No. 2006-13). Respondent shall send notification of any amount paid, including a photocopy of the check, simultaneously to the EPA OSC.

d. The total amount to be paid by Respondent pursuant to Paragraph 36(a) shall be deposited in the Iron King Mine - Humboldt Smelter Special Account within the EPA Hazardous Substance Superfund to be retained and used to conduct or finance response actions at or in connection with the Site, or to be transferred by EPA to the EPA Hazardous Substance Superfund.

37. In the event that the payments for Future Response Costs are not made within 30 days of Respondent's receipt of a bill, Respondent shall pay Interest on the unpaid balance. The Interest on Future Response Costs shall begin to accrue on the date of the bill and shall continue to accrue until the date of payment. Payments of Interest made under this Paragraph shall be in addition to such other remedies or sanctions available to the United States by virtue of Respondent's failure to make timely payments under this Section, including but not limited to, payment of stipulated penalties pursuant to Section XVIII.

38. Respondent may dispute all or part of a bill for Future Response Costs submitted under this Order, if Respondent alleges that EPA has made an accounting error, or if Respondent alleges that a cost item is inconsistent with the NCP. If any dispute over costs is resolved before payment is due, the amount due will be adjusted as necessary. If the dispute is not resolved before payment is due, Respondent shall pay the full amount of the uncontested costs to EPA as specified in Paragraph 36 on or before the due date. Within the same time period, Respondent shall pay the full amount of the contested costs into an interest-bearing escrow account. Respondent shall simultaneously transmit a copy of both checks to the persons listed in Paragraph 36 above. Respondent shall ensure that the prevailing party or parties in the dispute shall receive the amount upon which they prevailed from the escrow funds plus interest within 10 days after the dispute is resolved.

## XVI. <u>DISPUTE RESOLUTION</u>

39. Unless otherwise expressly provided for in this Settlement Agreement, the dispute resolution procedures of this Section shall be the exclusive mechanism for resolving disputes arising under this Settlement Agreement. The Parties shall attempt to resolve any disagreements concerning this Settlement Agreement expeditiously and informally.

40. If Respondent objects to any EPA action taken pursuant to this Settlement Agreement, including billings for Future Response Costs, they shall notify EPA in writing of their objection(s) within 5 days of such action, unless the objection(s) has/have been resolved informally. EPA and Respondents shall have 10 days from EPA's receipt of Respondent's written objection(s) to resolve the dispute through formal negotiations (the "Negotiation Period"). The Negotiation Period may be extended at the sole discretion of EPA.

41. Any agreement reached by the parties pursuant to this Section shall be in writing and shall, upon signature by both parties, be incorporated into and become an enforceable part of this Settlement Agreement. If the Parties are unable to reach an agreement within the Negotiation Period, an EPA management official at the Section Chief level or higher will issue a written decision on the dispute to Respondent. EPA's decision shall be incorporated into and become an enforceable part of this Settlement Agreement. Respondent's obligations under this Settlement Agreement shall not be tolled by submission of any objection for dispute resolution under this Section. Following resolution of the dispute, as provided by this Section, Respondent shall fulfill the requirement that was the subject of the dispute in accordance with the agreement reached or with EPA's decision, whichever occurs.

## XVII. <u>FORCE MAJEURE</u>

42. Respondent agrees to perform all requirements of this Settlement Agreement within the time limits established under this Settlement Agreement, unless the performance is delayed by a *force majeure*. For purposes of this Settlement Agreement, a *force majeure* is defined as any event arising from causes beyond the control of Respondent, or of any entity controlled by Respondent, including but not limited to its contractors and subcontractors, which delays or prevents performance of any obligation under this Settlement Agreement despite Respondent's best efforts to fulfill the obligation. *Force majeure* does not include financial inability to complete the Work, or increased cost of performance, or a failure to attain action levels set forth in the Action Memorandum.

43. If any event occurs or has occurred that may delay the performance of any obligation under this Settlement Agreement, whether or not caused by a *force majeure* event, Respondent shall notify EPA orally within 24 hours of when Respondent first knew that the event might cause a delay. Within 3 days thereafter, Respondent shall provide to EPA in writing an explanation and description of the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; Respondent's rationale for attributing such delay to a *force majeure* event if it intends to assert such a claim; and a statement as to whether, in the opinion of Respondent, such event may cause or contribute to an endangerment to public health, welfare or the environment. Failure to comply with the above requirements shall preclude Respondent from asserting any claim of *force majeure* for that event for the period of time of such failure to comply and for any additional delay caused by such failure.

44. If EPA agrees that the delay or anticipated delay is attributable to a *force majeure* event, the time for performance of the obligations under this Settlement Agreement that are affected by the *force majeure* event will be extended by EPA for such time as is necessary to complete those obligations. An extension of the time for performance of the obligations affected by the *force majeure* event shall not, of itself, extend the time for performance of any other obligation. If EPA does not agree that the delay or anticipated delay has been or will be caused by a *force majeure* event, EPA will notify Respondent in writing of its decision. If EPA agrees that the delay is attributable to a *force majeure* event, EPA will notify Respondent in writing of the length of the extension, if any, for performance of the obligations affected by the *force majeure* event.

## XVIII. STIPULATED PENALTIES

45. Respondent shall be liable to EPA for stipulated penalties in the amounts set forth in Paragraphs 46 and 47 for failure to comply with the requirements of this Settlement Agreement specified below, unless excused under Section XVII (*Force Majeure*). "Compliance" by Respondent shall include completion of the activities under this Settlement Agreement or any work plan or other plan approved under this Settlement Agreement identified below in accordance with all applicable requirements of law, this Settlement Agreement, and any plans or other documents

approved by EPA pursuant to this Settlement Agreement and within the specified time schedules established by and approved under this Settlement Agreement.

46. Stipulated Penalty Amounts - Work.

a. The following stipulated penalties shall accrue per violation per day for any noncompliance identified in Paragraph 46(b):

| Penalty Per Violation Per Day | Period of Noncompliance |
|---|---|
| $ 1,000.00 | 1st through 14th day |
| $ 5,000.00 | 15th through 30th day |
| $ 10,000.00 | 31st day and beyond |

b. Compliance Milestones:

I. The Respondent shall prepare and submit the Work Plan by 10 days after the Effective Date.

ii. The Respondent shall mobilize to the Site one week after EPA approval of the Work Plan.

iii. All work on the Site shall be completed by August 1, 2006 unless EPA at its sole discretion extends the period in writing.

iv. A final report for the Site shall be completed and submitted by 60 days after the Work is completed.

47. Stipulated Penalty Amounts - Reports.

The following stipulated penalties shall accrue per violation per day for failure to submit timely or adequate reports or other written documents pursuant to Paragraphs 14, 15,16,19, 20, 21, 30, 33 and 34:

| Penalty Per Violation Per Day | Period of Noncompliance |
|---|---|
| $ 1,000.00 | 1st through 14th day |
| $ 5,000.00 | 15th through 30th day |
| $ 10,000.00 | 31st day and beyond |

48. In the event that EPA assumes performance of a portion or all of the Work pursuant to Paragraph 58 of Section XX, Respondents shall be liable for a stipulated penalty in the amount of $500,000.00.

49. All penalties shall begin to accrue on the day after the complete performance is due or the day a violation occurs, and shall continue to accrue through the final day of the correction of the noncompliance or completion of the activity. However, stipulated penalties shall not accrue: 1) with respect to a deficient submission under Section VIII (Work to be Performed), during the period, if any, beginning on the 31st day after EPA's receipt of such submission until the date that EPA notifies Respondent of any deficiency; and 2) with respect to a decision by the EPA Management Official at the Section Chief level or higher, under Paragraph 41 of Section XVI (Dispute Resolution), during the period, if any, beginning on the 21st day after the Negotiation Period begins until the date that the EPA management official issues a final decision regarding such dispute. Nothing herein shall prevent the simultaneous accrual of separate penalties for separate violations of this Settlement Agreement.

50. Following EPA's determination that Respondent has failed to comply with a requirement of this Settlement Agreement, EPA may give Respondent written notification of the failure and describe the noncompliance. EPA may send Respondent a written demand for payment of the penalties. However, penalties shall accrue as provided in the preceding Paragraphs regardless of whether EPA has notified Respondent of a violation.

51. All penalties accruing under this Section shall be due and payable to EPA within 30 days of Respondent's receipt from EPA of a demand for payment of the penalties, unless Respondent invoke the dispute resolution procedures under Section XVI (Dispute Resolution). All payments to EPA under this Section shall be paid by certified or cashier's check(s) made payable to "EPA Hazardous Substances Superfund," shall be mailed to [insert the Regional Lockbox number and address], shall indicate that the payment is for stipulated penalties, and shall reference the EPA Region and Site/Spill ID Number 09NU, the EPA Docket Number 2006-13, and the name and address of the party making payment. Copies of check(s) paid pursuant to this Section, and any accompanying transmittal letter(s), shall be sent to EPA as provided in Paragraph 12, and to the OSC.

52. The payment of penalties shall not alter in any way Respondent's obligation to complete performance of the Work required under this Settlement Agreement.

53 Penalties shall continue to accrue during any dispute resolution period, but need not be paid until 15 days after the dispute is resolved by agreement or by receipt of EPA's decision.

54. If Respondent fail to pay stipulated penalties when due, EPA may institute proceedings to collect the penalties, as well as Interest. Respondent shall pay Interest on the unpaid balance, which shall begin to accrue on the date of demand made pursuant to Paragraph 50. Nothing in this Order shall be construed as prohibiting, altering, or in any way limiting the ability of EPA to seek any other remedies or sanctions available by virtue of Respondent's violation of this Order or of the statutes and regulations upon which it is based, including, but not limited to, penalties pursuant to Sections 106(b) and 122(*l*) of CERCLA, 42 U.S.C. §§ 9606(b) and 9622(*l*), and punitive damages pursuant to Section 107(c)(3) of CERCLA, 42 U.S.C. § 9607(c)(3). Provided, however, that EPA shall not seek civil penalties pursuant to Section 106(b) or 122(*l*) of CERCLA or punitive damages pursuant to Section 107(c)(3) of CERCLA for any violation for which a stipulated penalty is provided herein, except in the case of a willful violation of this Settlement Agreement or in the event that EPA assumes performance of a portion or all of the Work pursuant to Section XX, Paragraph 58. Notwithstanding any other provision of this Section, EPA may, in its unreviewable discretion, waive any portion of stipulated penalties that have accrued pursuant to this Settlement Agreement.

## XIX. COVENANT NOT TO SUE BY EPA

55. In consideration of the actions that will be performed and the payments that will be made by Respondent under the terms of this Settlement Agreement, and except as otherwise specifically provided in this Settlement Agreement, EPA covenants not to sue or to take administrative action against Respondent pursuant to Sections 106 and 107(a) of CERCLA, 42 U.S.C. §§ 9606 and 9607(a), for the Work and for Future Response Costs. This covenant not to sue shall take effect upon the Effective Date and is conditioned upon the complete and satisfactory performance by Respondent of all obligations under this Settlement Agreement, including, but not limited to, payment of Future Response Costs pursuant to Section XV. This covenant not to sue extends only to Respondent and does not extend to any other person.

## XX. RESERVATIONS OF RIGHTS BY EPA

56. Except as specifically provided in this Settlement Agreement, nothing herein shall limit the power and authority of EPA or the United States to take, direct, or order all actions necessary to protect public health, welfare, or the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substances, pollutants or contaminants, or hazardous or solid waste on, at, or from the Site. Further, nothing herein shall prevent EPA from seeking legal or equitable relief to enforce the terms of this Settlement Agreement, from taking other legal or equitable action as it deems appropriate and necessary, or from requiring Respondent in the future to perform additional activities pursuant to CERCLA or any other applicable law.

57. The covenant not to sue set forth in Section XIX above does not pertain to any matters other than those expressly identified therein. EPA reserves, and this Settlement Agreement is without prejudice to, all rights against Respondent with respect to all other matters, including, but not limited to:

a. claims based on a failure by Respondent to meet a requirement of this Settlement Agreement;

b. liability for costs not included within the definition of Future Response Costs;

c. liability for performance of response actions other than the Work;

d. criminal liability;

e. liability for damages for injury to, destruction of, or loss of natural resources, and for the costs of any natural resource damage assessments;

f. liability arising from the past, present, or future disposal, release or threat of release of Waste Materials outside of the Site; and

g. liability for costs incurred or to be incurred by the Agency for Toxic Substances and Disease Registry related to the Site.

58. Work Takeover. In the event EPA determines that Respondent has ceased implementation of any portion of the Work, are seriously or repeatedly deficient or late in their performance of the Work, or are implementing the Work in a manner which may cause an endangerment to human health or the environment, EPA may assume the performance of all or any portion of the Work as EPA determines necessary. Respondent may invoke the procedures set forth in Section XVI (Dispute Resolution) to dispute EPA's determination that takeover of the Work is warranted under this Paragraph. Costs incurred by the United States in performing the Work pursuant to this Paragraph shall be considered Future Response Costs that Respondent shall pay pursuant to Section XV (Payment of Response Costs). Notwithstanding any other provision of this Settlement Agreement, EPA retains all authority and reserves all rights to take any and all response actions authorized by law.

## XXI. COVENANT NOT TO SUE BY RESPONDENTS

59. Respondent covenants not to sue and agrees not to assert any claims or causes of action against the United States, or its contractors or employees, with respect to the Work, Future Response Costs, or this Settlement Agreement, including, but not limited to:

a. any direct or indirect claim for reimbursement from the Hazardous Substance Superfund established by 26 U.S.C. § 9507, based on Sections 106(b)(2), 107, 111, 112, or 113 of CERCLA, 42 U.S.C. §§ 9606(b)(2), 9607, 9611, 9612, or 9613, or any other provision of law;

b. any claim arising out of response actions at or in connection with the Site, including any claim under the United States Constitution, the State Constitution, the Tucker Act, 28 U.S.C. § 1491, the Equal Access to Justice Act, 28 U.S.C. § 2412, as amended, or at common law; or

c. any claim against the United States pursuant to Sections 107 and 113 of CERCLA, 42 U.S.C. §§ 9607 and 9613, relating to the Site.

Except as provided in Paragraph 61 (Waiver of Claims), these covenants not to sue shall not apply in the event the United States brings a cause of action or issues an order pursuant to the reservations set forth in Paragraphs 57 (b),©, and (e) - (g), but only to the extent that Respondent's claims arise from the same response action, response costs, or damages that the United States is seeking pursuant to the applicable reservation.

60. Nothing in this Agreement shall be deemed to constitute approval or preauthorization of a claim within the meaning of Section 111 of CERCLA, 42 U.S.C. § 9611, or 40 C.F.R. § 300.700(d).

61. Respondents agree not to assert any claims and to waive all claims or causes of action that they may have for all matters relating to the Site, including for contribution, against any person where the person's liability to Respondent with respect to the Site is based solely on having arranged for disposal or treatment, or for transport for disposal or treatment, of hazardous substances at the Site, or having accepted for transport for disposal or treatment of hazardous substances at the Site, if

a. the materials contributed by such person to the Site containing hazardous substances did not exceed the greater of I) 0.002% of the total volume of waste at the Site, or ii) 110 gallons of liquid materials or 200 pounds of solid materials,

b. This waiver shall not apply to any claim or cause of action against any person meeting the above criteria if EPA has determined that the materials contributed to the Site by such person contributed or could contribute significantly to the costs of response at the Site.

## XXII. OTHER CLAIMS

62. By issuance of this Settlement Agreement, the United States and EPA assume no liability for injuries or damages to persons or property resulting from any acts or omissions of Respondent. The United States or EPA shall not be deemed a party to any contract entered into by Respondent or their directors, officers, employees, agents, successors, representatives, assigns, contractors, or consultants in carrying out actions pursuant to this Settlement Agreement.

63. Except as expressly provided in Section XXI, and Section XIX (Covenant Not to Sue by EPA), nothing in this Settlement Agreement constitutes a satisfaction of or release from any claim or cause of action against Respondent or any person not a party to this Order, for any liability such person may have under CERCLA, other statutes, or common law, including but not limited to any claims of the United States for costs, damages and interest under Sections 106 and 107 of CERCLA. 42 U.S.C. §§ 9606 and 9607.

64. No action or decision by EPA pursuant to this Settlement Agreement shall give rise to any right to judicial review, except as set forth in Section 113(h) of CERCLA, 42 U.S.C. § 9613(h).

## XXIII. CONTRIBUTION

65.

a. The Parties agree that this Settlement Agreement constitutes an administrative settlement for purposes of Section 113(f)(2) of CERCLA, 42 U.S.C. § 9613 (f)(2), and that Respondent is entitled, as of the Effective Date, to protection from contribution actions or claims as provided by Sections 113(f)(2) and 122(h)(4) of CERCLA, 42 U.S.C. §§ 9613(f)(2) and 9622(h)(4), for "matters addressed" in this Settlement Agreement. The "matters addressed" in this Settlement Agreement are the Work and Future Response Costs.

b. The Parties agree that this Settlement Agreement constitutes an administrative settlement for purposes of Section 113(f)(3)(B)of CERCLA, 42 U.S.C. § 9613 (f)(3)(B), pursuant to which Respondent has, as of the Effective Date, resolved its liability to the United States for the Work and Future Response Costs.

c. Except as provided in Section XXI of this Settlement Agreement, nothing in this Settlement Agreement precludes the United States or Respondent from asserting any claims, causes of action, or demands for indemnification, contribution or cost recovery against any persons not parties to this Settlement Agreement. Nothing herein diminishes the right of the United States, pursuant to Sections 113(f)(2) and (3) of CERCLA, 42 U.S.C. § 9613 (f)(2)-(3), to pursue any such persons to obtain additional response costs or response action and to enter into settlements that give rise to contribution protection pursuant to Section 113(f)(2).

## XXIV. INDEMNIFICATION

66. Respondent shall indemnify, save and hold harmless the United States, its officials, agents, contractors, subcontractors, employees and representatives from any and all claims or causes of action arising from, or on account of, negligent or other wrongful acts or omissions of Respondents, their officers, directors, employees, agents, contractors, or subcontractors, in carrying out actions pursuant to this Settlement Agreement. In addition, Respondent agrees to pay the United States all costs incurred by the United States, including but not limited to attorneys fees and other expenses of litigation and settlement, arising from or on account of claims made against the United States based on negligent or other wrongful acts or omissions of Respondent, its officers, directors, employees, agents, contractors, subcontractors and any persons acting on their behalf or under their control, in carrying out activities pursuant to this Settlement Agreement. The United States shall not be held out as a party to any contract entered into by or on behalf of Respondent in carrying out activities pursuant to this Settlement Agreement. Neither Respondent nor any such contractor shall be considered an agent of the United States.

67. The United States shall give Respondent notice of any claim for which the United States plans to seek indemnification pursuant to this Section and shall consult with Respondent prior to settling such claim.

68. Respondents waive all claims against the United States for damages or reimbursement or for set-off of any payments made or to be made to the United States, arising from or on account of any contract, agreement, or arrangement between any one or more of Respondents and any person for performance of Work on or relating to the Site, including, but not limited to, claims on account of construction delays. In addition, Respondents shall indemnify and hold harmless the United States with respect to any and all claims for damages or reimbursement arising from or on account of any contract, agreement, or arrangement between any one or more of Respondents and any person for performance of Work on or relating

to the Site, including, but not limited to, claims on account of construction delays.

## XXV. INSURANCE

69. At least 7 days prior to commencing any on-Site work under this Order, Respondent shall secure, and shall maintain for the duration of this Order, comprehensive general liability insurance and automobile insurance with limits of one million dollars, combined single limit. Within the same time period, Respondent shall provide EPA with certificates of such insurance and a copy of each insurance policy. In addition, for the duration of the Settlement Agreement, Respondent shall satisfy, or shall ensure that their contractors or subcontractors satisfy, all applicable laws and regulations regarding the provision of worker's compensation insurance for all persons performing the Work on behalf of Respondent in furtherance of this Settlement Agreement. If Respondent demonstrates by evidence satisfactory to EPA that any contractor or subcontractor maintains insurance equivalent to that described above, or insurance covering some or all of the same risks but in an equal or lesser amount, then Respondent need provide only that portion of the insurance described above which is not maintained by such contractor or subcontractor.

## XXVI. FINANCIAL ASSURANCE

70. Within 10 days of the Effective Date, Respondent shall establish and maintain financial security in the amount of $ 250,000.00 in one or more of the following forms:

a. A surety bond guaranteeing performance of the Work;

b. One or more irrevocable letters of credit equaling the total estimated cost of the Work;

c. A trust fund;

d. A guarantee to perform the Work by one or more parent corporations or subsidiaries, or by one or more unrelated corporations that have a substantial business relationship with at least one of Respondents; or

e. A demonstration that Respondent satisfies the requirements of 40 C.F.R. Part 264.143(f)

71. If Respondents seek to demonstrate the ability to complete the Work through a guarantee by a third party pursuant to Paragraph 70(a) of this Section, Respondent shall demonstrate that the guarantor satisfies the requirements of 40 C.F.R. Part 264.143(f). If Respondent seek to demonstrate their ability to complete the Work by means of the financial test or the corporate guarantee pursuant to Paragraph 70(d) or (e) of this Section, they shall resubmit sworn statements conveying the information required by 40 C.F.R. Part 264.143(f) annually, on the anniversary of the Effective Date. In the event that EPA determines at any time that the financial assurances provided pursuant to this Section are inadequate, Respondent shall, within 30 days of receipt of notice of EPA's determination, obtain and present to EPA for approval one of the other forms of financial assurance listed in Paragraph 70 of this Section. Respondent's inability to demonstrate financial ability to complete the Work shall not excuse performance of any activities required under this Order.

72. If, after the Effective Date, Respondent can show that the estimated cost to complete the remaining Work has diminished below the amount set forth in Paragraph 70 of this Section, Respondent may reduce the amount of the financial security provided under this Section to the estimated cost of the remaining Work to be performed. Respondent shall submit a proposal for such reduction to EPA, in accordance with the requirements of this Section, and may reduce the amount of the security upon approval by EPA. In the event of a dispute, Respondent may reduce the amount of the security in accordance with the written decision resolving the dispute.

73. Respondent may change the form of financial assurance provided under this Section at any time, upon notice to and approval by EPA, provided that the new form of assurance meets the requirements of this Section. In the event of a dispute, Respondent may change the form of the financial assurance only in accordance with the written decision resolving the dispute.

## XXVII. MODIFICATIONS

74. The OSC may make modifications to any plan or schedule in writing or by oral direction. Any oral modification will be memorialized in writing by EPA promptly, but shall have as its effective date the date of the OSC's oral direction. Any other requirements of this Settlement may be modified in writing by mutual agreement of the parties.

75. If Respondent seek permission to deviate from any approved work plan or schedule, Respondent's Project Coordinator shall submit a written request to EPA for approval outlining the proposed modification and its basis. Respondent may not proceed with the requested deviation until receiving oral or written approval from the OSC pursuant to Paragraph 74.

76. No informal advice, guidance, suggestion, or comment by the OSC or other EPA representatives regarding reports, plans, specifications, schedules, or any other writing submitted by Respondents shall relieve Respondents of their obligation to obtain any formal approval required by this Settlement Agreement, or to comply with all requirements of this Settlement Agreement, unless it is formally modified.

## XXVIII. ADDITIONAL REMOVAL ACTION

77. If EPA determines that additional removal actions not included in an approved plan are necessary to protect public health, welfare, or the environment, EPA will notify Respondent of that determination. Unless otherwise stated by EPA, within 30 days of receipt of notice from EPA that additional removal actions are necessary to protect public health, welfare, or the environment, Respondents shall submit for approval by EPA a Work Plan for the additional removal actions. The plan shall conform to the applicable requirements of Section VIII (Work to Be Performed) of this Settlement Agreement. Upon EPA's approval of the plan pursuant to Section VIII, Respondent shall implement the plan for additional removal actions in accordance with the provisions and schedule contained therein. This Section does not alter or diminish the OSC's authority to make oral modifications to any plan or schedule pursuant to Section XXVII (Modifications).

## XXIX. NOTICE OF COMPLETION OF WORK

78. When EPA determines, after EPA's review of the Final Report, that all Work has been fully performed in accordance with this Settlement Agreement, with the exception of any continuing obligations required by this Settlement Agreement, including payment of Future Response Costs, or record retention, EPA will provide written notice to Respondent. If EPA determines that any such Work has not been completed in accordance with this Settlement Agreement, EPA will notify Respondent, provide a list of the deficiencies, and require that Respondent modify the Work Plan if appropriate in order to correct such deficiencies. Respondent shall implement the modified and approved Work Plan and shall submit a modified Final Report in accordance with the EPA notice. Failure by Respondents to implement the approved modified Work Plan shall be a violation of this Settlement Agreement.

## XXX. SEVERABILITY/INTEGRATION/APPENDICES

79. If a court issues an order that invalidates any provision of this Settlement Agreement or finds that Respondent has sufficient cause not to comply with one or more provisions of this Settlement Agreement, Respondent shall remain bound to comply with all provisions of this Settlement Agreement not invalidated or determined to be subject to a sufficient cause defense by the court's order.

80. This Settlement Agreement constitutes the final, complete and exclusive agreement and understanding among the Parties with respect to the settlement embodied in this Settlement Agreement. The parties acknowledge that there are no representations, agreements or understandings relating to the settlement other than those expressly contained in this Settlement Agreement. The following appendices are attached to and incorporated into this Order:

Appendix 1: The Action Memorandum entitled "Request for a Time-Critical Removal Action at the Chaparral Gulch Residential Site. Dewey-Humboldt, Yavapai County, Arizona," dated April 11, 2006.

Appendix 2: Site Map

## XXXI. EFFECTIVE DATE

81. This Settlement Agreement shall be effective upon signature by the Regional Administrator or his delegatee.

The undersigned representative of Respondent certifies that it is fully authorized to enter into the terms and conditions of this Settlement Agreement and to bind the party it represents to this document.

Agreed this 1st day of May , 2006.

For Respondent, Ironite Products Company by

President

Title

It is so ORDERED and Agreed this 12th day of May, 2006.

BY: James C Hanson

for Daniel Meer, Chief
Response, Planning and Assessment Branch
Superfund Division
Region 9
U.S. Environmental Protection Agency

# APPENDIX B

## ADEQ Letter dated April 3, 2006

# ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

1110 West Washington Street • Phoenix, Arizona 85007
(602) 771-2300 • www.azdeq.gov

Janet Napolitano
Governor

Stephen A. Owens
Director

April 3, 2006

Mr. Keith Takata, Director
Superfund Division
Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94105

Re: Proposed EPA Removal at Iron King Mine Site in Humboldt, Arizona

Dear Mr. Takata:

The Arizona Department of Environmental Quality (ADEQ) received a letter dated December 13, 2005 from Mr. Peter Guria regarding a removal assessment that the Environmental Protection Agency (EPA) Region IX conducted in August of 2005 at the Iron King Mine site in Humboldt, Arizona. In his letter, Mr. Guria indicated that elevated arsenic concentrations pose an imminent and substantial human health risk to residents occupying four parcels, and recommended that ADEQ request EPA to mitigate the risks through a removal action under CERCLA. This request was reiterated in a January 11, 2006 letter from you.

Based on the analysis you provided, ADEQ agrees that a removal action is warranted at the four parcels with the highest risk to the residents due to the arsenic concentrations in soil. However, since a complete assessment of risk has not been conducted, ADEQ recommends that the remediation remove the contaminated soil to either a concentration equal to the natural background concentration of arsenic, or at least to a depth of four feet to prevent future exposure to residents. This will ensure that additional removal actions will not be necessary in the future, based on new date or conclusions reached in a future risk assessment.

We look forward to working closely with you and your staff prior to the removal action to ensure that all potentially impacted residents and community representatives are notified. Please contact me at (602) 771-4567 if you have any questions or concerns.

Sincerely,

Amanda E. Stone, Director
Waste Programs Division

# APPENDIX C

## Copies of Brown and Caldwell Daily Site Safety Briefings

| BROWN AND CALDWELL | **Attachment 2—Field Work Safety Plan Implementation Checklist** | |
|---|---|---|
| Project Name: Ironite URP Soil Sampling | Project Location (city and state): Humboldt AZ | Date: 6/26/06 - 27 |
| Name of Site Safety Coordinator: M. Natton | Weather Conditions: Sunny, Warm | Project Number: 130568 |

| BC Staff Present | Name | Office |
|---|---|---|
| | M. Natton | Phoenix |
| | M. Smith | Phoenix |
| | P. Fishburgh - initial setup | Phoenix |
| | | |

Indicate the status of each of the following:

| | | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☐ | ☐ | ☒ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☐ | ☐ | ☒ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

HS—11 REV. 06/98

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| M. Natin | [signature] 6/28/06 | |
| **Project Name** | **Project Location** | **Project Number** |
| Irvite URP Soil Sampling | Hunkelt AZ | 130508 |

**Who attended the briefing?**

| **Names of Brown and Caldwell Employees** | **Names of Subcontractor(s) Employees** |
|---|---|
| M. Natin [signature] | Joshua Velten P.S.L. |
| Meredith Smith [signature] | |

What items were discussed?

- [x] Field Work Safety Plan
- [ ] Specific Accident/Incident
- [x] Protective Equipment to be Used
- [x] Emergency Hospital Route
- [ ] Other ______
- [x] Hazardous Site Conditions/Activities
- [ ] Changes/Solutions to Specific Accident(s)
- [x] Location of Emergency Telephone Number
- [x] Work Schedule

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

- [ ] YES
- [x] NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | **Attachment 2—Field Work Safety Plan Implementation Checklist** |
|---|---|

| Project Name | Project Location (city and state) | Date |
|---|---|---|
| Iranite VRP Soil Sampling | Humbolt AZ | 6/20/06 |
| **Name of Site Safety Coordinator** | **Weather Conditions** | **Project Number** |
| M. Nation | Sunny, Warm | 130508 |

BC Staff Present

| Name | Office |
|---|---|
| M. Nation | Phoenix |
| M. Smith | Phoenix |
| | |
| | |

Indicate the status of each of the following:

| | | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☒ | ☐ | ☐ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

| BROWN AND CALDWELL | Attachment B—Site Safety and Health Plan<br>Site Activity and Safety Briefing | |
|---|---|---|
| Name of Site Safety Officer<br>Matthew Natam | Signature of Site Safety Officer | Date<br>6/29/06 |
| Project Name<br>Irmite URP | Project Location<br>Humboldt AZ | Project Number<br>130508 |

**Who attended the briefing?**

| **Names of Brown and Caldwell Employees** | **Names of Subcontractor(s) Employees** |
|---|---|
| M. Natam | Gary Moore |
| M. Smith | |
| | |
| | |
| | |

What items were discussed?

- ☒ Site Safety and Health Plan
- ☒ Specific Accident/Incident
- ☒ Protective Equipment to be Used
- ☒ Emergency Hospital Route
- ☐ Other ______
- ☒ Hazardous Site Conditions/Activities
- ☐ Changes/Solutions to Specific Accident(s)
- ☒ Location of Emergency Telephone Number
- ☒ Work Schedule

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☒ NO

**NOTE: Place a copy of the completed form in the project file.**

| BROWN AND CALDWELL | Attachment C—Site Safety and Health Plan Safety Plan Implementation Checklist |
|---|---|

| Project Name | Project Location (city and state) | Date |
|---|---|---|
| Finite VRP | Humboldt AZ | 8/29/06 |
| **Name of Site Safety Coordinator** | **Weather Conditions** | **Project Number** |
| M. Nation | Sunny | 130508 |

| BC Staff Present | Name | Office |
|---|---|---|
| | M. Nation | Phoenix |
| | M Smith | " |
| | | |
| | | |

Indicate the status of each of the following:

| | Question | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Site Safety and Health Plan (SSHP) on site? | X | | |
| 2. | Is the personal protective equipment required by the SSHP available and being used correctly? | X | | |
| 3. | Have the work zones been delineated? | X | | |
| 4. | Has a decontamination station been set up as required by the SSHP? | X | | |
| 5. | Are the decontamination procedures being followed? | X | | |
| 6. | Is access to the exclusion zone being controlled? | X | | |
| 7. | Has the site activities briefing and tailgate safety meeting been provided? | X | | |
| 8. | Is the list of emergency telephone numbers posted at the support zone? | X | | |
| 9. | Are directions to nearest emergency medical assistance posted at support zone? | X | | |
| 10. | Is emergency equipment available and functional, as required by the SSHP? | X | | |
| 11. | Has the nearest toilet facility been identified or a portable facility been set up? | X | | |
| 12. | Has an adequate supply of drinking water been provided? | X | | |
| 13. | Has water for decontamination been provided? | X | | |
| 14. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the SSHP? | | | X |
| 15. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | | | X |
| 16. | Have the trenches and excavations been clearly marked? | X | | |
| 17. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | | | X |
| 18. | Are dust suppression measures being used? | X | | |
| 19. | Is food and tobacco consumption being restricted to the support zone? | X | | |
| 20. | Has a confined space been identified as part of this project? | | | X |
| 21. | Are the confined space entry procedures being correctly implemented? | | | X |
| 22. | Has the work/rest cycle for the shift been established? TIME ON (minutes): 60 TIME OFF (minutes): 5 | X | | |
| 23. | Has a shaded rest area been set up in the support zone? | X | | |

**NOTE: Place completed form in project file.**

BROWN AND CALDWELL

# Attachment 3—Field Work Safety Plan
# Site Activity and Safety Briefing

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| M. Nattan | [signature] | |
| **Project Name** | **Project Location** | **Project Number** |
| Ironite VRP 6/30/06 | Humboldt AZ | 130508 |

**Who attended the briefing?**

| Names of Brown and Caldwell Employees | Names of Subcontractor(s) Employees |
|---|---|
| Matthew Nattan [signature] | Joshua Velten P.S.C. |
| Meredith Smith [signature] | |

What items were discussed?

- [x] Field Work Safety Plan
- [x] Hazardous Site Conditions/Activities
- [ ] Specific Accident/Incident
- [ ] Changes/Solutions to Specific Accident(s)
- [x] Protective Equipment to be Used
- [ ] Location of Emergency Telephone Number
- [x] Emergency Hospital Route
- [x] Work Schedule
- [ ] Other ______

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

- [ ] YES
- [x] NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

| BROWN AND CALDWELL | # Attachment 2—Field Work Safety Plan Implementation Checklist |
|---|---|

| Project Name | Project Location (city and state) | Date |
|---|---|---|
| Ivanhoe VRP | Humbolt AZ | 6/30/06 |
| **Name of Site Safety Coordinator** | **Weather Conditions** | **Project Number** |
| Matthew Natton | Sunny | 130508 |

| BC Staff Present | Name | Office |
|---|---|---|
| | Matthew Natton | Phoenix |
| | Meredith Smith | " |
| | | |
| | | |

Indicate the status of each of the following:

| | | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** | |
|---|---|---|
| Name of Site Safety Coordinator<br>Matt Nation | Signature of Site Safety Coordinator<br>Matt Nation 7/5/06 | |
| Project Name<br>Ironite Humboldt | Project Location<br>Humboldt, AZ | Project Number<br>130508 |

**Who attended the briefing?**

| **Names of Brown and Caldwell Employees** | **Names of Subcontractor(s) Employees** |
|---|---|
| Meredith Smith | |
| Matthew Nation | |
| Cary Adams | |
| | |
| | |

What items were discussed?

- [x] Field Work Safety Plan
- [x] Hazardous Site Conditions/Activities
- [ ] Specific Accident/Incident
- [ ] Changes/Solutions to Specific Accident(s)
- [x] Protective Equipment to be Used
- [ ] Location of Emergency Telephone Number
- [ ] Emergency Hospital Route
- [x] Work Schedule
- [ ] Other ______

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

- [ ] YES
- [x] NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | **Attachment 2—Field Work Safety Plan Implementation Checklist** | |
|---|---|---|
| Project Name: Ironite Humboldt | Project Location (city and state): Humboldt, AZ | Date: 7/5/06 |
| Name of Site Safety Coordinator: Matt Nation | Weather Conditions: Cloudy rainy | Project Number: 130508 |

| BC Staff Present | Name | Office |
|---|---|---|
| | Matt Nation | Phoenix |
| | Meredith Smith | Phoenix |
| | | |
| | | |

Indicate the status of each of the following:

| | | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☒ | ☐ | ☐ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☒ | ☐ | ☐ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☒ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

HS—11 REV. 06/98

BROWN AND CALDWELL

# Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matt Nation | [signature] 7/6/06 | |
| **Project Name** | **Project Location** | **Project Number** |
| Ironite Humboldt | Humboldt AZ | 130508 |

**Who attended the briefing?**

| Names of Brown and Caldwell Employees | Names of Subcontractor(s) Employees |
|---|---|
| Matthew Nation [signature] | |
| [signature] | |
| Meredith Smith | |
| | |
| | |

What items were discussed?

- ☐ Field Work Safety Plan
- ☐ Specific Accident/Incident
- ☒ Protective Equipment to be Used
- ☒ Emergency Hospital Route
- ☐ Other ______
- ☒ Hazardous Site Conditions/Activities
- ☐ Changes/Solutions to Specific Accident(s)
- ☐ Location of Emergency Telephone Number
- ☒ Work Schedule

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☒ NO

**NOTE: Send completed form to Health and Safety Director. Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | **Attachment 2—Field Work Safety Plan Implementation Checklist** | |
|---|---|---|
| Project Name<br>Ironite Humboldt | Project Location (city and state)<br>Humboldt, AZ | Date<br>7/6/06 |
| Name of Site Safety Coordinator<br>Matt Nation | Weather Conditions<br>Sunny Warm | Project Number<br>130508 |

| BC Staff Present | Name | Office |
|---|---|---|
| | Matt Nation | Phoenix |
| | Meredith Smith | Phoenix |
| | | |

Indicate the status of each of the following:

| | Question | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Nation | [signature] 7/7/06 | |
| Project Name | Project Location | Project Number |
| Frontx VRP | Humboldt AZ | 130508 |

**Who attended the briefing?**

| **Names of Brown and Caldwell Employees** | **Names of Subcontractor(s) Employees** |
|---|---|
| Matthew Nation | |
| Meredith Smith | |
| Barry Adams | |
| | |
| | |

What items were discussed?

- [ ] Field Work Safety Plan
- [ ] Specific Accident/Incident
- [x] Protective Equipment to be Used
- [ ] Emergency Hospital Route
- [ ] Other ______
- [x] Hazardous Site Conditions/Activities
- [ ] Changes/Solutions to Specific Accident(s)
- [ ] Location of Emergency Telephone Number
- [x] Work Schedule

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

- [ ] YES
- [x] NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | **Attachment 2—Field Work Safety Plan Implementation Checklist** | |
|---|---|---|
| Project Name: Irvine URP | Project Location (city and state): Humboldt AZ | Date: 7/7/08 |
| Name of Site Safety Coordinator: Matthew Nation | Weather Conditions: Rain / High Clouds | Project Number: 130508 |

BC Staff Present

| Name | Office |
|---|---|
| Matthew Nation | Phoenix |
| Meredith Smith | Phoenix |
| | |
| | |

Indicate the status of each of the following:

| | | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☐ | ☒ | ☒ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

| BROWN AND CALDWELL | Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Nation | 7/10/06 | |
| Project Name | Project Location | Project Number |
| Ironite VRP Soil Sampling | Humboldt AZ Property # 4 | 130505 |

**Who attended the briefing?**

| **Names of Brown and Caldwell Employees** | **Names of Subcontractor(s) Employees** |
|---|---|
| Matthew Nation | |
| Gary Adams | |
| Meredith Smith | |
| | |
| | |

What items were discussed?

- [ ] Field Work Safety Plan
- [x] Hazardous Site Conditions/Activities
- [ ] Specific Accident/Incident
- [ ] Changes/Solutions to Specific Accident(s)
- [x] Protective Equipment to be Used
- [ ] Location of Emergency Telephone Number
- [ ] Emergency Hospital Route
- [ ] Work Schedule
- [ ] Other ______

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

- [ ] YES
- [x] NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | **Attachment 2—Field Work Safety Plan Implementation Checklist** | |
|---|---|---|
| Project Name: Fruite VRP | Project Location (city and state): Humboldt AZ | Date: 7/10/06 |
| Name of Site Safety Coordinator: Matthew Nafton | Weather Conditions: Sunny | Project Number: 130508 |

BC Staff Present

| Name | Office |
|---|---|
| Matthew Nafton | |
| | |
| | |
| | |

Indicate the status of each of the following:

| | Question | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☐ | ☐ | ☒ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

| BROWN AND CALDWELL | # Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Nation | [signature] 7/11/06 | |
| **Project Name** | **Project Location** | **Project Number** |
| Iron King VRP Soil Sampling | Humboldt AZ | 130568 |

**Who attended the briefing?**

| Names of Brown and Caldwell Employees | Names of Subcontractor(s) Employees |
|---|---|
| Matthew Nation | Marshall Stewart |
| Meredith Smith | |

What items were discussed?

- [x] Field Work Safety Plan
- [ ] Specific Accident/Incident
- [x] Protective Equipment to be Used
- [x] Emergency Hospital Route
- [ ] Other ______
- [x] Hazardous Site Conditions/Activities
- [ ] Changes/Solutions to Specific Accident(s)
- [ ] Location of Emergency Telephone Number
- [x] Work Schedule

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☒ NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | # Attachment 2—Field Work Safety Plan Implementation Checklist |
|---|---|

| Project Name | Project Location (city and state) | Date |
|---|---|---|
| Iroutk VRP Soil Sampling | Humbolt AZ Property #4 | 7/1/08 |
| **Name of Site Safety Coordinator** | **Weather Conditions** | **Project Number** |
| Matthew Nation | | 130508 |

| BC Staff Present | Name | Office |
|---|---|---|
| | Matthew Nation | Phoenix |
| | Meredith Smith | " " |
| | | |
| | | |

Indicate the status of each of the following:

| | | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | [X] | [ ] | [ ] |
| 2. | Has access to the facility been coordinated with on-site contract? | [X] | [ ] | [ ] |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | [X] | [ ] | [ ] |
| 4. | Has the safety briefing been provided? | [X] | [ ] | [ ] |
| 5. | Is the list of emergency telephone numbers posted or readily available? | [X] | [ ] | [ ] |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | [X] | [ ] | [ ] |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | [X] | [ ] | [ ] |
| 8. | Has an adequate supply of drinking water been provided? | [X] | [ ] | [ ] |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | [ ] | [ ] | [X] |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | [ ] | [ ] | [X] |
| 11. | Have the trenches and excavations been clearly marked? | [X] | [ ] | [ ] |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | [ ] | [ ] | [X] |
| 13. | Are dust suppression measures being used? | [ ] | [X] | [ ] |
| 14. | Has a confined space been identified as part of this project? | [ ] | [ ] | [X] |
| 15. | Are the confined space entry procedures being correctly implemented? | [ ] | [ ] | [X] |
| 16. | Has the work/rest cycle for the shift been established? | [X] | [ ] | [ ] |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Natton | [signature] 7/24/08 | |
| **Project Name** | **Project Location** | **Project Number** |
| Frank VRP | Property #2 Humboldt AZ | 130508 |

**Who attended the briefing?**

| Names of Brown and Caldwell Employees | Names of Subcontractor(s) Employees |
|---|---|
| [signature] | [signature] |
| [signature] | [signature] |
| Rogelio Lopez | [signature] |
| | VALENTE BROWN |
| | JOSE H Gonzales |

What items were discussed?

- [x] Field Work Safety Plan
- [ ] Specific Accident/Incident
- [x] Protective Equipment to be Used
- [x] Emergency Hospital Route
- [ ] Other Excavation procedures/Equipment safety
- [x] Hazardous Site Conditions/Activities
- [ ] Changes/Solutions to Specific Accident(s)
- [x] Location of Emergency Telephone Number
- [x] Work Schedule

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

- [ ] YES
- [x] NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

| BROWN AND CALDWELL | **Attachment 2—Field Work Safety Plan Implementation Checklist** |
|---|---|

| Project Name | Project Location (city and state) | Date |
|---|---|---|
| Ironik VRP | Property #2 Humbolt AZ | 7/24/06 |
| **Name of Site Safety Coordinator** | **Weather Conditions** | **Project Number** |
| Matthew Natson | Sunny | 130508 |

BC Staff Present

| Name | Office |
|---|---|
| Matthew Natson | BC Phoenix |
| Meredith Smith | |

Indicate the status of each of the following:

| | Question | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Nation | [signature] 7/25/06 | |
| Project Name | Project Location | Project Number |
| Tonite URP | Property #2 Humboldt AZ | 130508 |

**Who attended the briefing?**

| Names of Brown and Caldwell Employees | Names of Subcontractor(s) Employees |
|---|---|
| Matthew Nation | PSC Richard [signature] |
| Meredith Smith | [signature] |
| | |
| | |
| | |

What items were discussed?

- [ ] Field Work Safety Plan
- [x] Hazardous Site Conditions/Activities
- [ ] Specific Accident/Incident
- [ ] Changes/Solutions to Specific Accident(s)
- [x] Protective Equipment to be Used
- [ ] Location of Emergency Telephone Number
- [ ] Emergency Hospital Route
- [x] Work Schedule
- [ ] Other ______

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

- [ ] YES
- [x] NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Naton | [signature] 7/21/06 | |
| **Project Name** | **Project Location** | **Project Number** |
| Trinite VRP | Property #2 Humboldt AZ | 130568 |

**Who attended the briefing?**

| Names of Brown and Caldwell Employees | Names of Subcontractor(s) Employees |
|---|---|
| Matthew Naton [signature] | Joel NAve |
| Gary Adams | |
| RichArd DAvies Richard Davies | |
| Meredith Smith | |
| [signature] | |

What items were discussed?

- ☐ Field Work Safety Plan
- ☒ Hazardous Site Conditions/Activities
- ☐ Specific Accident/Incident
- ☐ Changes/Solutions to Specific Accident(s)
- ☒ Protective Equipment to be Used
- ☐ Location of Emergency Telephone Number
- ☐ Emergency Hospital Route
- ☒ Work Schedule
- ☐ Other ______

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☒ NO

**NOTE: Send completed form to Health and Safety Director. Also place a copy in the project file.**

| BROWN AND CALDWELL | **Attachment 2—Field Work Safety Plan Implementation Checklist** | |
|---|---|---|
| Project Name: Ironite VRP | Project Location (city and state): Property #2 Humboldt AZ | Date: 7/26/06 |
| Name of Site Safety Coordinator: Matthew Nation | Weather Conditions: Cloudy | Project Number: 130608 |

BC Staff Present

| Name | Office |
|---|---|
| M. Nation, M. Smith | Phoenix |
| | |
| | |
| | |

Indicate the status of each of the following:

| | Question | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Nation | [signature] 7/29/06 | |
| **Project Name** | **Project Location** | **Project Number** |
| Franite URP | Property #2 Humbolt AZ | 130508 |

**Who attended the briefing?**

| **Names of Brown and Caldwell Employees** | **Names of Subcontractor(s) Employees** |
|---|---|
| Matthew Nation [signature] | [signature] |
| Meredith Smith | [signature] |
| | [signature] |
| | Richard [signature] |
| | |

What items were discussed?

- ☐ Field Work Safety Plan
- ☒ Hazardous Site Conditions/Activities
- ☐ Specific Accident/Incident
- ☐ Changes/Solutions to Specific Accident(s)
- ☒ Protective Equipment to be Used
- ☐ Location of Emergency Telephone Number
- ☐ Emergency Hospital Route
- ☐ Work Schedule
- ☐ Other ______

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☒ NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | **Attachment 2—Field Work Safety Plan Implementation Checklist** | | |
|---|---|---|---|
| Project Name<br>Frmite VRP | Project Location (city and state)<br>Property #2 Humboldt AZ | | Date<br>7/27/06 |
| Name of Site Safety Coordinator<br>Matthew Nation | Weather Conditions<br>Cloudy | | Project Number<br>130508 |

BC Staff Present

| Name | Office |
|---|---|
| Matthew Nation | |
| | |
| | |
| | |

Indicate the status of each of the following:

| | | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☒ | ☐ | ☐ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

BROWN AND CALDWELL

# Attachment 2—Field Work Safety Plan Implementation Checklist

| Project Name | Project Location (city and state) | Date |
|---|---|---|
| Track URP | Property #2 | 7/28/06 |
| **Name of Site Safety Coordinator** | **Weather Conditions** | **Project Number** |
| Matthew Nation | Cloudy, humid | 130508 |

| BC Staff Present | Name | Office |
|---|---|---|
| | Matthew Nation | BC Phoenix |
| | Meredith Smith | " " |
| | | |
| | | |

Indicate the status of each of the following:

| # | Question | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | *Are the confined space entry procedures being correctly implemented?* | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Nation | [signature] 7/31/06 | |
| Project Name | Project Location | Project Number |
| Imite URP | Property #2 Humboldt AZ | 130508 |

**Who attended the briefing?**

| Names of Brown and Caldwell Employees | Names of Subcontractor(s) Employees |
|---|---|
| [signature] | Dave Michaud PSC |
| Meredith Smith | Greg Adams PSC |
| [signature] | Valente Brown |
| Pedro [illegible] | Richard [illegible] PSC |
| Mogel [illegible] Lopez | Jose [illegible] Gonzales |
| | [signature] |

What items were discussed?

- ☐ Field Work Safety Plan
- ☒ Hazardous Site Conditions/Activities
- ☐ Specific Accident/Incident
- ☐ Changes/Solutions to Specific Accident(s)
- ☒ Protective Equipment to be Used
- ☐ Location of Emergency Telephone Number
- ☐ Emergency Hospital Route
- ☒ Work Schedule
- ☐ Other __________

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☐ NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

HS—12 REV. 06/98

BROWN AND CALDWELL

# Attachment 2—Field Work Safety Plan Implementation Checklist

| Project Name | Project Location (city and state) | Date |
|---|---|---|
| Irvaste VRP | Property #2 Humboldt AZ | 7/31/06 |
| **Name of Site Safety Coordinator** | **Weather Conditions** | **Project Number** |
| Matthew Natter | Cloudy to Sunny | 110568 |

| BC Staff Present | Name | Office |
|---|---|---|
| | M. Natter | BC Phoenix |
| | M. Smith | " |
| | | |
| | | |

Indicate the status of each of the following:

| | | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Nation | [signature] 8/1/06 | |
| Project Name | Project Location | Project Number |
| Inde VRP | Property # 2 Humboldt AZ | 130508 |

**Who attended the briefing?**

| **Names of Brown and Caldwell Employees** | **Names of Subcontractor(s) Employees** |
|---|---|
| Matthew Nation | Joel Nam |
| Meredith Smith | Dave Mahood |
| | Richard Davis |
| | [signature] |
| | |

What items were discussed?

- [x] Field Work Safety Plan
- [x] Hazardous Site Conditions/Activities
- [ ] Specific Accident/Incident
- [ ] Changes/Solutions to Specific Accident(s)
- [ ] Protective Equipment to be Used
- [x] Location of Emergency Telephone Number
- [ ] Emergency Hospital Route
- [ ] Work Schedule
- [ ] Other ______

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☐ NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

| BROWN AND CALDWELL | Attachment 3—Field Work Safety Plan<br>Site Activity and Safety Briefing |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Nattan | [signature] 8/2/06 | |
| **Project Name** | **Project Location** | **Project Number** |
| Irmark URP | Property #2 and #3 Humboldt, AZ | 130508 |

**Who attended the briefing?**

| Names of Brown and Caldwell Employees | Names of Subcontractor(s) Employees |
|---|---|
| Matthew Nattan | D. Michaud PSC |
| Meredith Smith | R Davies PSC |

What items were discussed?

- [x] Field Work Safety Plan
- [ ] Specific Accident/Incident
- [x] Protective Equipment to be Used
- [x] Emergency Hospital Route
- [ ] Other ______
- [x] Hazardous Site Conditions/Activities
- [ ] Changes/Solutions to Specific Accident(s)
- [ ] Location of Emergency Telephone Number
- [x] Work Schedule

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

- [ ] YES
- [x] NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | **Attachment 2—Field Work Safety Plan Implementation Checklist** |
|---|---|

| Project Name | Project Location (city and state) | Date |
|---|---|---|
| Tronite URP | Humboldt AZ | 5/2/06 |
| **Name of Site Safety Coordinator** | **Weather Conditions** | **Project Number** |
| Matthew Watson | Partly Cloudy | 130568 |

BC Staff Present

| Name | Office |
|---|---|
| Matthew Watson | Phoenix |
| Meredith Smith | " " |
| | |
| | |

Indicate the status of each of the following:

| | Question | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

HS—11 REV. 06/98

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** | |
|---|---|---|
| Name of Site Safety Coordinator: Meredith Smith | Signature of Site Safety Coordinator: 8/3/06 | |
| Project Name: Iranite aep | Project Location: Humboldt, AZ Property #2 + #3 | Project Number: 130508 |

**Who attended the briefing?**

| **Names of Brown and Caldwell Employees** | **Names of Subcontractor(s) Employees** (PSC) |
|---|---|
| M. Smith | Dave Michaud |
| M. Nation | PEDRO GONZALES |
| M. Orcutt | GARY ADAMS |
| | |
| | |

What items were discussed?

- [x] Field Work Safety Plan
- [x] Hazardous Site Conditions/Activities
- [ ] Specific Accident/Incident
- [ ] Changes/Solutions to Specific Accident(s)
- [x] Protective Equipment to be Used
- [ ] Location of Emergency Telephone Number
- [x] Emergency Hospital Route
- [x] Work Schedule
- [ ] Other ______

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

- [ ] YES
- [x] NO

**NOTE: Send completed form to Health and Safety Director. Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Mike Orcutt | 8/4/06 | |
| Project Name | Project Location | Project Number |
| Ironite | prop #2,3 Humboldt, Az | 130508 |

**Who attended the briefing?**

| **Names of Brown and Caldwell Employees** | **Names of Subcontractor(s) Employees** |
|---|---|
| M. Orcutt | PEDRO GONZALES |
| Meredith Smith | GARY ADAMS |
| | D. Michael |
| | |
| | |

What items were discussed?

- ☒ Field Work Safety Plan
- ☐ Specific Accident/Incident
- ☒ Protective Equipment to be Used
- ☒ Emergency Hospital Route
- ☐ Other
- ☒ Hazardous Site Conditions/Activities
- ☐ Changes/Solutions to Specific Accident(s)
- ☐ Location of Emergency Telephone Number
- ☒ Work Schedule

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☒ NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Natan | [signature] 8/7/06 | |
| **Project Name** | **Project Location** | **Project Number** |
| Iron-ite URP | Property #4 Humboldt AZ | 130508 |

**Who attended the briefing?**

| **Names of Brown and Caldwell Employees** | **Names of Subcontractor(s) Employees** |
|---|---|
| [signature] | Joshua W. Elten |
| Meredith Smith | [signature] |
| | [signature] |
| | [signature] |
| | |

What items were discussed?

- ☐ Field Work Safety Plan
- ☐ Specific Accident/Incident
- ☒ Protective Equipment to be Used
- ☐ Emergency Hospital Route
- ☐ Other ____________
- ☒ Hazardous Site Conditions/Activities
- ☐ Changes/Solutions to Specific Accident(s)
- ☐ Location of Emergency Telephone Number
- ☒ Work Schedule

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☒ NO

**NOTE: Send completed form to Health and Safety Director. Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | **Attachment 2—Field Work Safety Plan Implementation Checklist** | |
|---|---|---|
| Project Name<br>Ironite URP | Project Location (city and state)<br>Property #4 Humboldt AZ | Date<br>8/7/06 |
| Name of Site Safety Coordinator<br>Matthew Nation | Weather Conditions<br>Sunny - Partly Cloudy | Project Number<br>130508 |

| BC Staff Present | Name | Office |
|---|---|---|
| | Matthew Nation | Phoenix |
| | Meredith Smith | " " |
| | | |
| | | |

Indicate the status of each of the following:

| | Question | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

HS—11 REV. 06/98

| BROWN AND CALDWELL | Attachment 3—Field Work Safety Plan<br>Site Activity and Safety Briefing |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Natran | [signature] 8/5/06 | |
| Project Name | Project Location | Project Number |
| Iconite VRP | Property #4 Humbolt AZ | 130808 |

**Who attended the briefing?**

| **Names of Brown and Caldwell Employees** | **Names of Subcontractor(s) Employees** |
|---|---|
| [signature] | Richard Davies PSC |
| Meredith Smith | Guy Adams |
| | [signature] |
| | [signature] |
| | Joshua Vetter |

What items were discussed?

- ☐ Field Work Safety Plan
- ☒ Hazardous Site Conditions/Activities
- ☐ Specific Accident/Incident
- ☐ Changes/Solutions to Specific Accident(s)
- ☒ Protective Equipment to be Used
- ☐ Location of Emergency Telephone Number
- ☐ Emergency Hospital Route
- ☒ Work Schedule
- ☒ Other Traffic control / Logistics

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☒ NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | # Attachment 2—Field Work Safety Plan Implementation Checklist |
|---|---|

| Project Name | Project Location (city and state) | Date |
|---|---|---|
| Irmite URP | Property # 4 Humboldt AZ | 8/8/06 |
| **Name of Site Safety Coordinator** | **Weather Conditions** | **Project Number** |
| Matthew Nation | Sunny | 130508 |

| BC Staff Present | Name | Office |
|---|---|---|
| | Matthew Nation | Phoenix |
| | Meredith Smith | " " |
| | | |
| | | |

Indicate the status of each of the following:

| | | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☒ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): 60 **TIME OFF** (minutes): 5

**NOTE: Place completed form in project file.**

HS—11 REV. 06/98

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** | |
|---|---|---|
| Name of Site Safety Coordinator: Matthew Nation | Signature of Site Safety Coordinator: [signature] 8/4/00 | |
| Project Name: Tronita VRP | Project Location: Property #4 Humboldt AZ | Project Number: 130568 |

**Who attended the briefing?**

| **Names of Brown and Caldwell Employees** | **Names of Subcontractor(s) Employees** |
|---|---|
| Matthew Nation [signature] | [signature] |
| Meredith Smith | [signature] |
| | Joshua Velten |
| | Richard [illegible] |
| | [signature] |

What items were discussed?

- [ ] Field Work Safety Plan
- [x] Hazardous Site Conditions/Activities
- [ ] Specific Accident/Incident
- [ ] Changes/Solutions to Specific Accident(s)
- [x] Protective Equipment to be Used
- [ ] Location of Emergency Telephone Number
- [ ] Emergency Hospital Route
- [x] Work Schedule
- [x] Other Traffic control / logistics for hauling

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

- [ ] YES
- [x] NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

| BROWN AND CALDWELL | **Attachment 2—Field Work Safety Plan Implementation Checklist** | |
|---|---|---|
| Project Name<br>Granite URP | Project Location (city and state)<br>Property #4 Humboldt AZ | Date<br>8/4/06 |
| Name of Site Safety Coordinator<br>Matthew Nation | Weather Conditions<br>Cloudy | Project Number<br>130508 |

| BC Staff Present | Name | Office |
|---|---|---|
| | Matthew Nation | |
| | Meredith Smith | |
| | | |
| | | |

Indicate the status of each of the following:

| | Question | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☐ |
| 11. | Have the trenches and excavations been clearly marked? | ☐ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☐ |
| 13. | Are dust suppression measures being used? | ☐ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☐ | ☐ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☐ |
| 16. | Has the work/rest cycle for the shift been established? | ☐ | ☐ | ☐ |

**TIME ON** (minutes): ____________ **TIME OFF** (minutes): ____________

**NOTE: Place completed form in project file.**

| BROWN AND CALDWELL | **Attachment 3—Field Work Safety Plan Site Activity and Safety Briefing** |
|---|---|

| Name of Site Safety Coordinator | Signature of Site Safety Coordinator | |
|---|---|---|
| Matthew Naftan | [signature] 8/10/06 — 8/11/06 — | |
| **Project Name** | **Project Location** | **Project Number** |
| Franik VRP | Property #4 Humboldt AZ | 130508 |

**Who attended the briefing?**

| Names of Brown and Caldwell Employees | Names of Subcontractor(s) Employees |
|---|---|
| [signature] | [signature] |
| Meredith Smith | Richard Davis PSC |
| | [signature] |
| | Joshua Vetter |
| | |

What items were discussed?

- [ ] Field Work Safety Plan
- [x] Hazardous Site Conditions/Activities
- [ ] Specific Accident/Incident
- [ ] Changes/Solutions to Specific Accident(s)
- [x] Protective Equipment to be Used
- [ ] Location of Emergency Telephone Number
- [ ] Emergency Hospital Route
- [x] Work Schedule
- [x] Other Traffic control, heavy equipment safety, cleanup tasks

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

- [ ] YES
- [x] NO

**NOTE: Send completed form to Health and Safety Director.**
**Also place a copy in the project file.**

HS—12 REV. 06/98

| BROWN AND CALDWELL | Attachment B—Site Safety and Health Plan<br>Site Activity and Safety Briefing | |
|---|---|---|
| Name of Site Safety Officer<br>Meredith Smith | Signature of Site Safety Officer | Date<br>5/15/07 |
| Project Name<br>Ironite Removal Action Plan | Project Location<br>Humboldt, AZ | Project Number<br>130508 |

**Who attended the briefing?**

| Names of Brown and Caldwell Employees | Names of Subcontractor(s) Employees |
|---|---|
| Meredith Smith | Gary Adams |
| ~~GARY ADAMS~~ | Joel NAuer |
| | Gary Moore |
| | Richard Davies PSC |
| | |

What items were discussed?

- [x] Site Safety and Health Plan
- [ ] Specific Accident/Incident
- [x] Protective Equipment to be Used
- [x] Emergency Hospital Route
- [ ] Other ____________
- [x] Hazardous Site Conditions/Activities
- [ ] Changes/Solutions to Specific Accident(s)
- [x] Location of Emergency Telephone Number
- [x] Work Schedule

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

- [ ] YES
- [x] NO

**NOTE: Place a copy of the completed form in the project file.**

| BROWN AND CALDWELL | Attachment 2 - Field Work Safety Plan Implementation Checklist |
|---|---|

| Project Name | Project Location (city and state) | Date |
|---|---|---|
| Inonite Removal Action Plan | Humboldt, AZ. | 5/15/07 |
| **Name of Site Safety Coordinator** | **Weather Conditions** | **Project Number** |
| Meredith Smith | Warm, breezy, clear | BOSO8 |

BC Staff Present

| Name | Office |
|---|---|
| Meredith Smith | Phoenix |
| Pejman Eshraghi | Phoenix |

Indicate the status of each of the following:

| | Question | YES | NO | N/A |
|---|---|---|---|---|
| 1. | Is a copy of the Field Work Safety Plan (FWSP) on site? | ☒ | ☐ | ☐ |
| 2. | Has access to the facility been coordinated with on-site contract? | ☒ | ☐ | ☐ |
| 3. | Is the personal protective equipment required by the FWSP available and being used correctly? | ☒ | ☐ | ☐ |
| 4. | Has the safety briefing been provided? | ☒ | ☐ | ☐ |
| 5. | Is the list of emergency telephone numbers posted or readily available? | ☒ | ☐ | ☐ |
| 6. | Are directions to the nearest emergency medical assistance posted or readily available? | ☒ | ☐ | ☐ |
| 7. | Is emergency equipment available and functional, as required by the FWSP? | ☒ | ☐ | ☐ |
| 8. | Has an adequate supply of drinking water been provided? | ☒ | ☐ | ☐ |
| 9. | Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the FWSP? | ☐ | ☐ | ☒ |
| 10. | Are the instruments being used properly and periodically checked during the shift for battery charge status? | ☐ | ☐ | ☒ |
| 11. | Have the trenches and excavations been clearly marked? | ☒ | ☐ | ☐ |
| 12. | Have trenches and excavations been shored or sloped as required by soil type and work activities? | ☐ | ☐ | ☒ |
| 13. | Are dust suppression measures being used? | ☒ | ☐ | ☐ |
| 14. | Has a confined space been identified as part of this project? | ☐ | ☒ | ☐ |
| 15. | Are the confined space entry procedures being correctly implemented? | ☐ | ☐ | ☒ |
| 16. | Has the work/rest cycle for the shift been established? | ☒ | ☐ | ☐ |

**TIME ON** (minutes): ______________ **TIME OFF** (minutes): ______________

**NOTE: Place completed form in project file.**

HS—11 REV. 06/98

# D2. Assessment Report
# (Ecology and Environment, Inc., 2011)

# Iron King Mine – Humboldt Smelter Assessment Report Dewey-Humboldt Yavapai County, Arizona

**Contract Number: EP-S5-08-01**
**TDD No.: T02-09-10-09-0004**
**PAN No.: 002693.2110.01RA**

**September 2011**

**Prepared for:**

**U.S. ENVIRONMENTAL PROTECTION AGENCY**
Emergency Response Section
2445 Palm Drive, Suite 100
Signal Hill, California 90755

**Prepared by:**

**ECOLOGY AND ENVIRONMENT, INC.**
3700 Industry Avenue, Suite 102
Lakewood, California 90712

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# Table of Contents

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# List of Tables

**Table** **Page**

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# List of Figures

| Figure | | Page |
|---|---|---|

# List of Abbreviations and Acronyms

| | |
|---|---|
| bgs | below ground surface |
| E & E | Ecology and Environment, Inc. |
| ERS | Emergency Response Section |
| FOSC | Federal On-Scene Coordinator |
| GPS | Global Positioning System |
| mg/kg | milligrams per kilogram |
| QA/QC | Quality Assurance/Quality Control |
| RA | Removal Assessment |
| RSL | Regional Screening Level |
| RWQCB | California Regional Water Quality Control Board |
| SAP | Sampling and Analysis Plan |
| START | Superfund Technical Assessment and Response Team |
| U.S. EPA | United States Environmental Protection Agency |

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# 1 Introduction

In September 2010, United States Environmental Protection Agency (U.S. EPA), Region 9 Emergency Response Section Federal On-Scene Coordinator (FOSC) Craig Benson tasked the Ecology and Environment, Inc., (E & E) Superfund Technical Assessment and Response Team (START) to provide technical assistance to support a Removal Assessment (RA) of the Iron King Mine – Humboldt Smelter Superfund Site (the site), located in Dewey-Humboldt, Arizona. The RA and a planned time-critical removal action (TCRA) are interim measures to support the U.S. EPA's Remedial Program, which is considering a broader removal at residential properties at the site. The RA and TCRA are focused on properties in the town of Dewey-Humboldt, a southern portion of which is situated between the mine and the smelter. The contaminants of concern are arsenic and lead in surface and near-surface soils. The RA and planned TCRA address the most contaminated in-town properties at the site.

To conduct the RA, the START used analytical data from previous sampling episodes at the site to prepare a list of the in-town properties posing the highest risk to town residents. Additional residential properties that had not previously been sampled but that were in suspect areas were added to the list. Through site visits and two soil sampling events, the START ultimately reduced the number of in-town properties on the list that would be subject to a TCRA from 30 to 13. One of the properties contains a tailings pile that resulted from historical activities at the Iron King Mine. The tailings pile is referred to as the "small tailings pile" (STP). The STP may be transferred onto Iron King Mine property as part of the TCRA.

This report presents the details of the START assessment and sampling activities that were used to compile the list of the 13 in-town properties that will be subject to the TCRA.

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# 2 Site Description

## 2.1 Site Location

The Iron King Mine – Humboldt Smelter site is located in Dewey-Humboldt, Yavapai County, Arizona (Appendix A, Figure 1). The approximate geographical coordinates of the Dewey-Humboldt town hall are latitude 34.503043° north; longitude 112.243559° west. The town of Dewey-Humboldt was incorporated on December 20, 2004 from the existing unincorporated towns of Dewey and Humboldt, located adjacent to one another in the Agua Fria River Valley, 11 miles east of Prescott. Dewey-Humboldt is located between the mine and the smelter (Appendix A, Figure 2). The population of the town was 3,613 in 2005 according to a census estimate. Three waterways (Chaparral Gulch, Galena Gulch, and Agua Fria River) transect the site.

## 2.2 Iron King Mine

The Iron King Mine property is approximately 153 acres in size. It is located west of Highway 69, bordered by the Chaparral Gulch and residences to the north; Highway 69 to the east; Galena Gulch to the south; and undeveloped land to the west. The Iron King Mine was a periodically-active gold, silver, copper, lead, and zinc mine from 1906 until 1969. The present owner of the 85-acre portion of the Iron King Mine area of interest referred to as the Iron King Mine Proper Area is North American Industries (NAI), which produces Hydromax fertilizers and soil supplements. Previous ownership included Ironite Products Company, which marketed Ironite fertilizer produced from mine tailings from 1989 to 2006. The principal feature of the Iron King Mine Proper Area is a large (more than 50 acres) tailings pile, which contains high concentrations of arsenic and lead. The tailings are subject to off-site migration mainly via air particulate migration and surface water transport.

## 2.3 Humboldt Smelter

The Humboldt Smelter property is located less than one mile east of the Iron King Mine property, on the east side of Highway 69. The approximately 189-acre smelter property is bounded by residences to the north and west; the Agua Fria River to the east; and Chaparral Gulch to the south. The majority of the Humboldt Smelter is owned by Greenfields Enterprises, LLC, which purchased the property in 2003. No businesses are currently operating on the property. The Humboldt Smelter area of interest includes tailings and slag deposit areas and an approximately 23-acre ash pile. The ash pile material is subject to off-site migration mainly via air particulate migration and surface water transport.

## 2.4 Small Tailings Pile

The approximately 12,000 to 20,000 cubic yard STP, containing high concentrations of arsenic and lead and detectable concentrations of cyanide, is located immediately to the north of the Iron King Mine Proper Area on a 40-acre private parcel designated as OFS-002[1]. Although located on private residential property, the STP has been associated with historical mining activities at the Iron King Mine. Anecdotal information from NAI President S. Schuchardt suggests that the STP resulted from a short-lived gold and silver extraction processing attempt that was conducted in or around the 1960s. Mining of the same ore also resulted in the main tailings pile on NAI property (primarily for zinc recovery), but a cyanide extraction process was used in an Iron King Mine operations area, and the slurry was either hydraulically conveyed or piped to a tailings pond at the current STP location.

The Chaparral Gulch borders the STP from the northeast to the southeast. Surface water readily flows in, around, and through this area into the Upper Chaparral Gulch. Hay Bale Ravine borders the STP to the south and flows northeast into Chaparral Gulch (Appendix A, Figure 3). There are no storm water controls mitigating surface water migration from this area. In addition, much of this area is devoid of vegetation, so it is subject to particulate migration. The STP is considered source material because it is a source of contamination to other media such as surface water and air.

[1] Previous site studies at the Iron King Mine – Humboldt Smelter used the term “OFS”, which stands for “off-site soil”, to describe in-town soil sample properties. To avoid confusion when comparing new data to old data for particular properties, the convention of using “OFS” is continued in this assessment although the properties are no longer considered “off site.”

# 3 Previous Investigations

At least 185 residential and commercial properties located in the town of Dewey-Humboldt have been sampled to date in an effort to evaluate metals (primarily arsenic and lead) contamination in shallow soils (surface to up to 18-inch-depth profile). Sample locations have been selected from parcels that were suspected of being impacted by historical mining and smelting operations. In general, for those parcels found to exhibit arsenic and lead above background concentrations, the near surface soils (i.e., 0 – 2 inches below ground surface [bgs]) of these parcels are impacted to a higher degree than the deeper surface soils (i.e., 10 – 12 inches bgs). Parcels with elevated arsenic and lead have been found to be located in closer proximity to the Iron King Mine and Humboldt Smelter. Parcels farther away from these source areas are less likely to have been impacted from particulate migration or surface water transport. A map of all in-town parcels that were either sampled or were visually assessed and determined to not require sampling is provided in Appendix A, Figure 4.

## 3.1 Arizona Department of Environmental Quality, 2002

In April 2002, the Arizona Department of Environmental Quality (ADEQ) sampled sediment near residential parcels throughout the Chaparral Gulch as part of a Preliminary Assessment/Site Inspection. The investigation revealed arsenic concentrations of up to 509 milligrams per kilogram (mg/kg) and lead concentrations of up to 513 mg/kg. The current U.S. EPA Regional Screening Levels (RSLs) for arsenic and lead in residential soil are 0.39 and 400 mg/kg, respectively. As discussed below, the current site-specific background concentrations for arsenic and lead in the Dewey-Humboldt area, determined by EA Engineering, Science and Technology, Inc. (EA) on behalf of the U.S. EPA Remedial Program, have been determined to be 38 and 23 mg/kg, respectively (EA, 2011).

## 3.2 U.S. EPA/START 2005

In 2005, ADEQ requested that the U.S. EPA assess surface soils at residential properties in the vicinity of the Chaparral Gulch and Iron King Mine. In response to the request, the U.S. EPA and START conducted a site assessment of 17 properties along the Chaparral Gulch (E & E, 2005). Soil samples were collected to determine arsenic and lead concentrations on these properties. Ten samples were collected from each property, which included nine surface samples (0-6 inches bgs) and one subsurface sample (18 inches bgs). Analytical results from the sampling event identified lead and arsenic concentrations in surface soil samples at four of the properties that were sufficiently high to warrant a removal action. The removal action was conducted by Brown and Caldwell in late 2006 (EA, 2010).

## 3.3 EA Engineering, Science and Technology, Inc., 2008-2010

In 2008, the Iron King Mine – Humboldt Smelter site was listed on the National Priorities List and a Remedial Investigation (RI) was conducted by EA for the U.S. EPA's Remedial Program. From 2008 to 2010, as part of the RI, EA collected soil samples at 168 parcels within the town. The parcels sampled were selected from areas suspected of being impacted by historical mining and smelting operations (based on wind patterns) and where homeowner sampling access agreements could be obtained. The objective of the RI sampling was to identify levels of metals contamination in soil resulting from the site, and specifically to evaluate impacts on the community of Dewey-Humboldt. Nine discrete samples from the 0 to 2-inch depth interval and one discrete sample from the 10 to 12-inch depth interval were collected at each parcel. The deeper-depth interval was selected at random from beneath one of the nine surface sample locations. The nine surface sample locations were selected on a parcel-by-parcel basis (judgmentally) with an attempt to be spatially representative while taking into account site features (e.g., driveways and landscaping) and roof drainage patterns. The RI samples were analyzed for 23 "target analyte list" metals, including arsenic and lead.

Also as part of the RI, EA collected background soil samples from several different soil types and areas about the site. Background Soil Type 1 was identified as the predominant soil type for the study area, and a background concentration of 48 mg/kg for arsenic and 44 mg/kg for lead was established (EA, 2010). A subsequent addendum to the EA RI report revised the average background concentrations of arsenic and lead in Soil Type 1 to 38 and 23 mg/kg, respectively (EA 2011).

EA tabulated analytical data for the 185 in-town parcels sampled (including the 17 parcels sampled by the START in 2005). EA also calculated the 95% upper confidence limit (UCL) on the arithmetic mean from the sample data for each parcel, following U.S. EPA guidance and using U.S. EPA's ProUCL 4.0 software. The 95% UCLs and mean arsenic and lead concentrations are provided in an abbreviated version of the EA table, which is provided in Appendix B.

## 3.4 U.S. EPA Removal Assessment

In the fall of 2010, the U.S. EPA Remedial Program requested that the U.S. EPA Emergency Response Section provide support to conduct an RA at the site. The RA is the subject of this report.

# 4 U.S. EPA and START Removal Assessment Activities

## 4.1 Determination of Properties Posing Highest Risk to Residents

To determine which in-town properties to investigate for the RA, the START prepared an interim "hot list" of residential and city-owned properties that had already been sampled and that could potentially be candidates for a removal action. To compile the list, the START used the EA table presenting data for 185 in-town properties, which included average concentrations and 95% UCLs for arsenic and lead in soil for each property (Appendix B). Each property was then placed on a list of descending order (highest to lowest) based on its calculated 95% UCL concentration of arsenic and/or lead. In order to limit the initial scope of the RA and the potential removal actions to those properties that could be considered time critical, the U. S. EPA determined that only the upper 10 percent of the in-town properties (as ranked by relative arsenic and/or lead contamination) would be placed on the hot list. Properties with 95% UCLs for arsenic that were greater than or equal to 165.2 mg/kg and properties with 95% UCLs for lead that were greater than or equal to 512.7 mg/kg were designated for the interim hot list. Some properties were identified for the interim hot list based on the 95% UCLs for both arsenic and lead.

In January 2011, the START and U.S. EPA inspected all of the properties on the interim hot list and were able to add additional properties or eliminate some of the properties from the list due to factors described below.

Certain additional residential properties were added to the interim hot list because:

- They had not been previously sampled but were located in areas of concern (for example, they were adjacent to parcels already on the hot list). Reasons for previously un-sampled properties included an inability to contact the current property owner or a refusal for sampling access permission from the property owner.
- The properties had been sampled but there were irregularities in the data. Such irregularities included unusual "hot spots" that required confirmation, or inadequate areal coverage during previous sampling.

Certain properties were omitted from the interim hot list due to factors including:

- A single outlier in a property's dataset that raised the 95% UCL to a point where the property became one of the top 10% most contaminated properties in the investigation. Reasons for such outliers may have been sample location selection from an area in proximity to welding operations, scrap metal, automotive work or other processes that potentially could have created a biased sample.
- A property's outlier sample may have been the 10- to 12-inch depth interval sample, while each of the 0- to 2-inch depth interval samples exhibited concentrations at or around background. Normal soil deposition, landscaping, grading, and other activities may have sufficiently segregated any depositional contamination to a deeper horizon, thus minimizing potential human exposure.
- The property was not being used for residential purposes or human exposure was minimal. Properties in this group included, but were not limited to, livestock pastures, well-vegetated properties or unimproved plots of land.

The resultant hot list contained 30 properties. Of the 30 properties, four were considered to have sufficient data to qualify the property for a removal action without further data collection. For 14 of the properties, additional sampling was prescribed in order to confirm previously-determined hot spots or to assess areas of the properties not covered by the previous sampling. The remaining 12 properties on the hot list had not been previously sampled but were located in potentially-contaminated areas. As discussed in following sections of this report, additional properties were added to the hot list based on field observations. The process of hot list compilation was conducted to support the TCRA and is not meant to preclude any properties that are not on the hot list from the possibility of future consideration for remedial action.

## 4.2 START Sampling Activities

The START prepared a *Draft Sampling and Analysis Plan, Iron King Mine – Humboldt Smelter Assessment, Yavapai County, Arizona,* (March 2011) (SAP) to address the sampling of the 30 properties on the hot list. Table 2-1 of the SAP lists the 30 properties, with their parcel numbers and addresses.

The U.S. EPA *Superfund Lead-Contaminated Residential Sites Handbook* (OSWER Directive 9285.7-50 (August, 2003) (Lead handbook) was referenced during development of the sampling design and was used as a guideline where possible. Previous (EA and E & E) sampling methodology was also considered, in order to obtain data in a similar manner to that historically conducted.

During field sampling episodes that occurred March 8 – 10, June 1, and September 1, 2011, the START collected samples from 19 of the hot list sites.

Four properties on the hot list, OFS-111, -118, -132, and -260, were not sampled because sufficient data were already available for these sites to allow them to qualify for a removal action. Once in the field, an additional property, OFS-148, was determined through review of previous data and its location on Sweet Pea Lane to be an area likely to be significantly impacted and therefore to qualify for a removal action. The U.S. EPA was unable to obtain access agreements for the remaining six properties, and these properties were ultimately dropped from the hot list.

While in the field and as directed by the U.S. EPA, the START also collected samples at two additional properties, OFS-101 and OFS-102, which were not on the hot list. Although these two sites had been previously sampled by EA, they were located in a corridor that was becoming an apparent hot zone (adjacent to Sweet Pea Lane), and one of the sites (OFS-102) had new construction.

All samples collected from all properties were analyzed for total arsenic and total lead by U.S. EPA Method 6010B. Some samples collected from OFS-002 (the location of the STP) were additionally analyzed for total cyanide by U.S. EPA Method 9010B/9012A. Three samples collected from OFS-133 were analyzed for the 17 California Assessment Manual (CAM-17) metals by U.S. EPA Method 6010C/7473.

All sampling activities were conducted in accordance with the SAP, with the following exceptions:

1. One composite sample was collected from OFS-260 and analyzed for toxicity characteristic leaching potential (TCLP) arsenic and lead.
2. Three composite samples were collected along the center of Sweet Pea Lane and analyzed for total arsenic and lead.
3. Global positioning system (GPS) equipment was to be used to log all sample locations. GPS sample locations were lost for 10 of the properties sampled due to defective GPS equipment. For the 10 properties (a total of 21 sample locations), the sample locations were approximated using Google Earth.
4. In the SAP, OFS-148 was slated for additional assessment to determine whether the property should be included in the TCRA. However, when the historical data for this property were reviewed, and because this property is adjacent to other properties on Sweet Pea Lane that are slated for removal activities, it was determined that this property would be included in the TCRA without additional assessment sampling.

All shallow soil samples were collected using steel trowels. Samples collected at depth were collected by hand auger in conjunction with a clean, disposable glove and/or steel trowel. Equipment blanks were collected on a daily basis from trowels and hand augers to document the effectiveness of trowel and auger decontamination procedures. No arsenic or lead was found in any of the equipment blanks. Photo documentation of START sampling activities is presented in Appendix D.

Samples collected for metals analysis in March 2011 were analyzed by the U.S. EPA Region 9 Laboratory in Richmond, California. Samples collected for cyanide analysis and all samples collected in June and September 2011 were analyzed by GEL Laboratories, LLC in Charleston, South Carolina.

A START chemist performed a Tier 2 validation of the sample data in accordance with *Quality Assurance/Quality Control Guidance for Removal Activities, Sampling QA/QC Plan and Data Validation Procedures* (1990), *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (2004), and *U.S. EPA Region IX Superfund Data Evaluation/Validation Guidance R9QA/006* (2001). The data were found to be acceptable as definitive category data, and the data were determined to be usable to meet project use objectives. The data validation reports are archived in the project file. Validated laboratory data sheets are presented in Appendix C.

## 4.3 Discussion of Assessment Sampling Results

Individual properties sampled by the START in March, June, and September of 2011 are discussed below. All samples collected were analyzed for total arsenic and total lead concentrations. Samples for some properties were subjected to additional analyses, as discussed below. Appendix A, Table 1 presents the total arsenic and lead results for all the samples collected by the START for the RA. As applicable, additional tables presenting data for individual properties are referenced below. Quality Assurance/quality control sample results, such as blind duplicate sample results and equipment blank results, are not presented in the tables but are addressed in the data validation reports (Appendix C).

### 4.3.1 OFS-002

OFS-002 had been previously sampled both by the START (in 2005) and by EA. OFS-002 is the property where the STP is located, and only the STP area of the property is considered to be a candidate for a TCRA. In March 2011, the START collected 15 surface and subsurface samples on and around the pile, from 0 to 2 inches bgs to a maximum depth of 84 inches bgs. The sample locations were determined by FOSC Benson when at the property, with a goal of obtaining data that would support volume calculations and STP borders, should the STP need to be moved. Appendix A, Figure 3 presents the locations of the samples collected, along with previous EA 2008 sampling locations. Five of the samples were also analyzed for total cyanide. Appendix A, Table 2 presents the arsenic, lead, and cyanide data collected by the START in 2011 and by EA in 2008-2009. All but three of the 15 samples collected by the START were grab samples. Three 10-point composite samples were collected along contours at intervals of approximately 50 to 100 feet extending to the east of the STP, as shown in Appendix A, Figure 3.

The STP is located in an erosion zone that facilitates the migration of contamination through surface water toward the southeast, down Chaparral Gulch and into the town of Dewey-Humboldt. Because of this situation and the confirmed high concentrations of arsenic and lead found, it is anticipated that the STP will be subject to removal under the TCRA.

### 4.3.2 OFS-101 and OFS-102

OFS-101 and OFS-102 were not on the hot list but were sampled at U.S. EPA request once in the field because these properties are located on Sweet Pea Lane in an area where other properties will be subject to removals of contaminated soil. The START collected two samples at OFS-101 and three samples at OFS-102. The analytical results are presented in Appendix A, Table 1. The sample locations are presented on Appendix A, Figure 5. The results confirm previous data presented in the EA table (Appendix B) and support the conclusion that these properties will not be part of the TCRA.

### 4.3.3 OFS-105

OFS-105 was added to the hot list because EA's individual sample data for lead were not available to the START, and because some portions of the property did not appear to have adequate sample coverage. The START collected three composite samples at OFS-105, at locations shown on Appendix A, Figure 6. Historical EA sampling locations are also presented on the figure. Both the START data and historical EA data are presented in Appendix A, Table 3. Two of the START samples were collected from the surface (0 to 2 inches bgs) and one sample (OFS-105-001-006-Comp) was collected from 4 to 6 inches bgs.

The analytical results confirm that OFS-105 is not a candidate for the TCRA.

### 4.3.4 OFS-114

This parcel was placed on the hot list because EA's individual sample data for lead were not available to the START, and because one EA sample location indicated elevated arsenic at a concentration of 151 mg/kg. The START collected one composite sample from the area where the elevated arsenic sample had been collected by EA. Appendix A, Figure 7 shows both the historical EA sampling locations and the START sampling location. Appendix A, Table 4 presents both the EA and START sample data.

The analytical results confirm that OFS-114 is not a candidate for the TCRA.

### 4.3.5 OFS-116

This parcel was placed on the hot list due to an elevated arsenic hot spot in the front of the property, at 667 mg/kg. The U.S. EPA was unable to gain access to this property until September 1, 2011. On that date, three composite samples were collected. One sample was collected near the driveway and walkway into the house; a second sample was collected from two large planters located on each side of the steps leading into the house; and a third sample was collected along the back fence of the property where an EA sample registered 157 mg/kg of arsenic.

The START was unsure of the exact location of the 667 mg/kg hot spot when in the field, and therefore the first two samples were collected to best approximate the hot spot location. Appendix A, Figure 8 shows both the historical EA sampling locations and the START sampling locations. Appendix A, Table 5 presents both the EA and START sample data.

The analytical results did not confirm the hot spot on the front of the property. Elevated arsenic and lead concentrations were confirmed in the sample collected from the back of the property, but the concentrations were not of sufficient magnitude for inclusion of the property on the hot list.

### 4.3.6 OFS-117

This parcel was placed on the hot list because EA's individual sample data for lead were not available to the START, and because two EA sample locations indicated elevated arsenic concentrations of 123 and 168 mg/kg. The START collected two composite samples from the areas where the elevated arsenic samples had been collected by EA. Appendix A, Figure 9 shows both the historical EA sampling locations and the START sampling locations. Appendix A, Table 6 presents both the EA and START sample data.

The analytical results confirm that OFS-117 is not a candidate for the TCRA.

### 4.3.7 OFS-133

This parcel was placed on the hot list because both arsenic and lead 95% UCLs were in the top 10 percent in relation to all in-town property data. Additional sampling by the START was necessary to cover areas previously inadequately sampled on the northwest and southwest sides of the house located on the property. The START collected three composite samples at this property to cover areas previously not sampled and to confirm previous high arsenic and lead results. Because this property was already slated for removal activities under the TCRA, to obtain additional data that might be useful for the disposition of the removed material, the samples from this property were analyzed for CAM-17 metals. Appendix A, Figure 10 shows both the historical EA sampling locations and the START sampling locations. Appendix A, Table 7 presents both the EA and START sample data for arsenic and lead. Appendix A, Table 8 presents the full CAM-17 analytical results.

The analytical results confirm that OFS-133 is a candidate for the TCRA. The contaminated soil from OFS-133 appears to encroach onto the OFS-119 property, as described in Section 4.4.2, below. A portion of OFS-119 will therefore undergo removal along with OFS-133.

### 4.3.8 OFS-157

This parcel was placed on the hot list because EA's historical sample data indicated one arsenic hot spot at 538 mg/kg. Once in the field, it appeared that the landscape had changed and that a gazebo with cement floor stood in the area of the historical hot sample. The START and U.S. EPA therefore decided to collect one composite sample in a children's play area/garden area. Appendix A, Figure 11 shows both the historical EA sampling locations and the START sampling location. Appendix A, Table 9 presents both the EA and START sample data.

The analytical results confirm that OFS-157 is not a candidate for the TCRA.

### 4.3.9 OFS-203

OFS-203 was added to the hot list because some portions of the property around the house did not appear to have adequate historical sample coverage. The START collected three composite samples at OFS-203 at the locations shown on Appendix A, Figure 12. Historical EA sampling locations are also presented on the figure. Both the EA data and START data for OFS-203 are presented in Appendix A, Table 10.

The analytical results confirm that OFS-203 is not a candidate for the TCRA.

### 4.3.10 OFS-208

OFS-208 was added to the hot list because a hot spot for arsenic and lead was indicated in the historical EA data. The START collected a composite sample at the hot spot to confirm the previous elevated arsenic and lead concentrations at that location. The START sample location is shown on Appendix A, Figure 13. Historical EA sampling locations are also presented on the figure. Both the EA data and START data are presented in Appendix A, Table 11.

The analytical results confirm that OFS-208 does have a hot spot, which will be addressed by the TCRA. Because the hot spot borders on the OFS-244 property, the TCRA will extend onto the OFS-244 property as discussed in Section 4.3.12, below.

### 4.3.11 OFS-227

OFS-227 was added to the hot list because hot spots for arsenic and lead were indicated in the historical EA data, and because some historical data were flagged as "estimated." The START collected two composite samples in the areas of the hot spots to confirm the previous results. START sample locations are shown on Appendix A, Figure 14. Historical EA sampling locations are also presented on the figure. Both the EA data and START data are presented in Appendix A, Table 12.

The hot spots were not confirmed through the START sampling, and therefore OFS-227 will not be a candidate for the TCRA.

### 4.3.12 OFS-244

OFS-244 was added to the hot list because a hot spot for arsenic was indicated in the historical EA data, and because some historical data were flagged as "estimated." The START collected one composite sample in the area of the hot spot to confirm the previous results. The START sample location is shown on Appendix A, Figure 15. Historical EA sampling locations are also presented on the figure. Both the EA data and START data are presented in Appendix A, Table 13. The hot spot was not confirmed through the START sampling. However, because an adjacent property, OFS-208, has a confirmed hot spot located near the fenceline with OFS-244, FOSC Benson determined that the OFS-208 hot spot removal would extend onto the OFS-244 property.

### 4.3.13 OFS-260

This property is a municipal corridor under the jurisdiction of the town of Dewey-Humboldt. It is slated for removal activities under the TCRA based on sample results previously obtained by EA (Appendix A, Table 14 and Figure 16). On August 31, 2011, the U.S. EPA was informed by the city of Dewey-Humboldt that the parcel extends beyond a fence that was assumed to be the southeastern border of the property. The START therefore collected three additional samples on the southeast side of the fence. The START sample results are included in Table 13, and indicate that the soil to the southeast of the fence does not require removal under the TCRA.

At FOSC Benson's request, the START collected one composite sample along the corridor (northwest of the southeastern fence) to be analyzed for TCLP arsenic and lead. The analytical results are presented in Appendix A, Table 14. The results do not exceed the regulatory level of 5 milligrams per liter for either analyte. The information will be used for making decisions regarding the disposition of soil removed during the TCRA.

### 4.3.14 OFS-301

OFS-301 is a property that had not been previously sampled. It was sampled by the START because of its location adjacent to known hot-list properties. The START collected five composite samples and four grab samples at the locations shown on Appendix A, Figure 17. Eight of the samples were collected at the surface (0 to 2 inches bgs) and one sample was collected at a depth of 10 to 12 inches bgs. The analytical results are presented in Appendix A, Table 1. The calculated arsenic and lead 95% UCLs for this property are not in the top 10 percent of concentrations (when compared to data from all the in-town property data) for either arsenic or lead. However, an arsenic concentration is elevated in one sample (180 mg/kg), and lead is elevated in three samples (180 to 1200 mg/kg). This property is occupied by a family that includes young children, and it is located in the corridor along Sweet Pea Lane where removals will take place at adjacent properties. The U.S. EPA has therefore determined that this property will be included in the TCRA for a hot spot removal in the back yard.

### 4.3.15 OFS-303

OFS-303 is a property that had not been previously sampled. It was sampled by the START because of its location adjacent to the smelter. The START collected 10 grab samples at the locations shown on Appendix A, Figure 18. Nine of the samples were collected at the surface (0 to 2 inches bgs) and one sample was collected at a depth of 10 to 12 inches bgs. The analytical results are presented in Appendix A, Table 1. All of the sample analyte concentrations were at relatively low levels. Most of the samples contained concentrations of arsenic and lead that were below the site-specific background concentrations for arsenic and lead of 38 and 23 mg/kg, respectively. One sample exceeded the arsenic background value with a concentration of 45 mg/kg, and three samples exceeded the lead background value with a maximum of 34 mg/kg. This property will not be included in the TCRA.

### 4.3.16 OFS-306

OFS-306 is a property that had not been previously sampled. It was sampled by the START because of its location adjacent to known hot-list properties. The START collected 10 grab samples at the locations shown on Appendix A, Figure 19. Nine of the samples were collected at the surface (0 to 2 inches bgs) and one sample was collected at a depth of 10 to 12 inches bgs. The analytical results are presented in Appendix A, Table 1. The calculated arsenic and lead 95% UCLs for this property are not in the top 10 percent of concentrations (when compared to data from all the in-town property data) for either arsenic or lead. However, arsenic concentrations are elevated in two samples (110 to 210 mg/kg), and lead concentrations are elevated in seven of the samples (140 to 360 mg/kg). This property is located in the corridor along Sweet Pea Lane where removals will take place at adjacent properties. The U.S. EPA has therefore determined that this property will be included in the TCRA.

### 4.3.17 OFS-307 through OFS-311

These properties had not been previously sampled. They were sampled by the START only to confirm expected minor concentrations of arsenic and lead. In some cases, these properties are located near the hot corridor along Sweet Pea Lane; in one case (OFS-309), the property is on a hilltop in an area that could be affected by wind-carried tailings pile dust from the Iron King Mine. The START collected 10 grab samples at each of the properties, at the locations shown on Appendix A, Figures 20 through 24. Nine of the samples at each property were collected at the surface (0 to 2 inches bgs) and one sample was collected at a depth of 10 to 12 inches bgs. The analytical results are presented in Appendix A, Table 1. The calculated arsenic and lead 95% UCLs for these properties do not achieve the top 10 percent (when compared to data from all the in-town property data) for either arsenic or lead. With the exception of one elevated arsenic and one elevated lead concentration at OFS-310 (190 and 130 mg/kg, respectively) and elevated lead concentrations at OFS-307 (maximum of 160 mg/kg) and OFS-308 (maximum of 420 mg/kg), all arsenic and lead results were in the general range of background concentrations. The U.S. EPA has therefore determined that these properties do not warrant inclusion in the TCRA.

### 4.3.18 Sweet Pea Lane

FOSC Benson requested that the START collect composite samples along Sweet Pea Lane. The START collected three composite samples on the surface of the road at the locations shown on Appendix A, Figure 25. The analytical results are presented in Appendix A, Table 1. Arsenic results ranged from 18.9 to 40.7

mg/kg, and lead results ranged from 46.0 to 125 mg/kg. The results indicate that Sweet Pea Lane does not warrant inclusion in the TCRA.

## 4.4 Additional Properties added to TCRA List

### 4.4.1 OFS-103

OFS-103 has not been sampled by the START, but a review of EA data for the property and adjacent properties has found that there is an area of elevated arsenic and lead on the property. Because this property is located adjacent to Sweet Pea Lane near other properties slated for removal activities, the hot spot at OFS-103 will likely undergo a removal during the TCRA. Several EA samples for neighboring properties are actually located on this parcel, and therefore data for those samples are also presented on Appendix A, Table 16, and the sample locations are shown on Appendix A, Figure 26. The hot spot is located at EA sample location 142-1.

### 4.4.2 OFS-119

OFS-119 is located adjacent to OFS-133, a property which is slated for a full removal. OFS-119 has not been sampled by the START, but a review of EA data for the property has found that there is an area of elevated arsenic and lead on the northern corner of the property. Because this property is located adjacent to Sweet Pea Lane near other properties slated for removal activities, the hot spot at OFS-119 will undergo a removal during the TCRA. EA analytical results for OFS-119 are presented in Table on Appendix A, Table 17, and the sample locations are shown on Appendix A, Figure 27. The hot spot is located at EA sample location 5.

### 4.4.3 OFS-148

In the SAP, OFS-148 was slated for additional assessment prior to determining whether the property should be included in the TCRA. However, when the historical data for this property were reviewed, and because this property is adjacent to other properties slated for removal activities, FOSC Benson determined that this property will be included in the TCRA without additional assessment sampling. Appendix A, Table 18 presents the EA analytical results for OFS-148. The sample locations are presented on Appendix A, Figure 28.

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# 5 Summary

Using historical data tabulated by EA, the START compiled a list of the top 10 percent of in-town properties of concern based on the highest 95% UCLs for arsenic and/or lead concentrations in soil. Additional properties were added to the list because:

- Hot spots were indicated in historical data that required confirmation;
- Areas of some properties were not adequately covered by previous sampling;
- Some properties in potentially high-risk zones had not been previously sampled.

After a U.S. EPA/START site visit to review properties on the list, some properties were dropped from the list due to adequate landscaping or because no residence was located on the property. Of the resultant list of 30 properties, the START collected soil samples from 19.  Five properties were slated for TCRA activities without additional START sampling. The U.S. EPA was unable to obtain access agreements for six of the properties, and these properties were dropped from the list. Two properties (OFS-103 and OFS-119) were added to the list due to the appearance of hot spots in their data and their location adjacent to Sweet Pea Lane.

A review of analytical results for the samples collected by the START resulted in 13 properties being dropped from the list. Thirteen properties remain on the list, and these properties will be subjected to a U.S. EPA TCRA. The 13 properties are presented in Appendix A, Table 19.

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# 6 References


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2. EA, 2010. *Remedial Investigation Report Addendum, Iron King Mine – Humboldt Smelter Superfund Site, Dewey-Humboldt, Yavapai County, Arizona*. March.

3. Ecology and Environment, Inc. (E & E), 2005. *Iron King Mine Site, Humboldt, Arizona, Draft Final Report.* October.

4 U.S. Environmental Protection Agency (EPA), 1990. *Quality Assurance/Quality Control Guidance for Removal Activities, Sampling QA/QC Plan and Data Validation Procedures.*

5. EPA, 2001. *U.S. EPA Region IX Superfund Data Evaluation/Validation Guidance R9QA/006*

6. EPA, 2004. *"USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review,* USEPA-540-R-04-004. October.

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# A Figures and Tables

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**Figure 1**
**Site Location Map**

Iron King Mine - Humboldt Smelter **Assessment Site**
Dewey-Humboldt, Yavapai County, Arizona

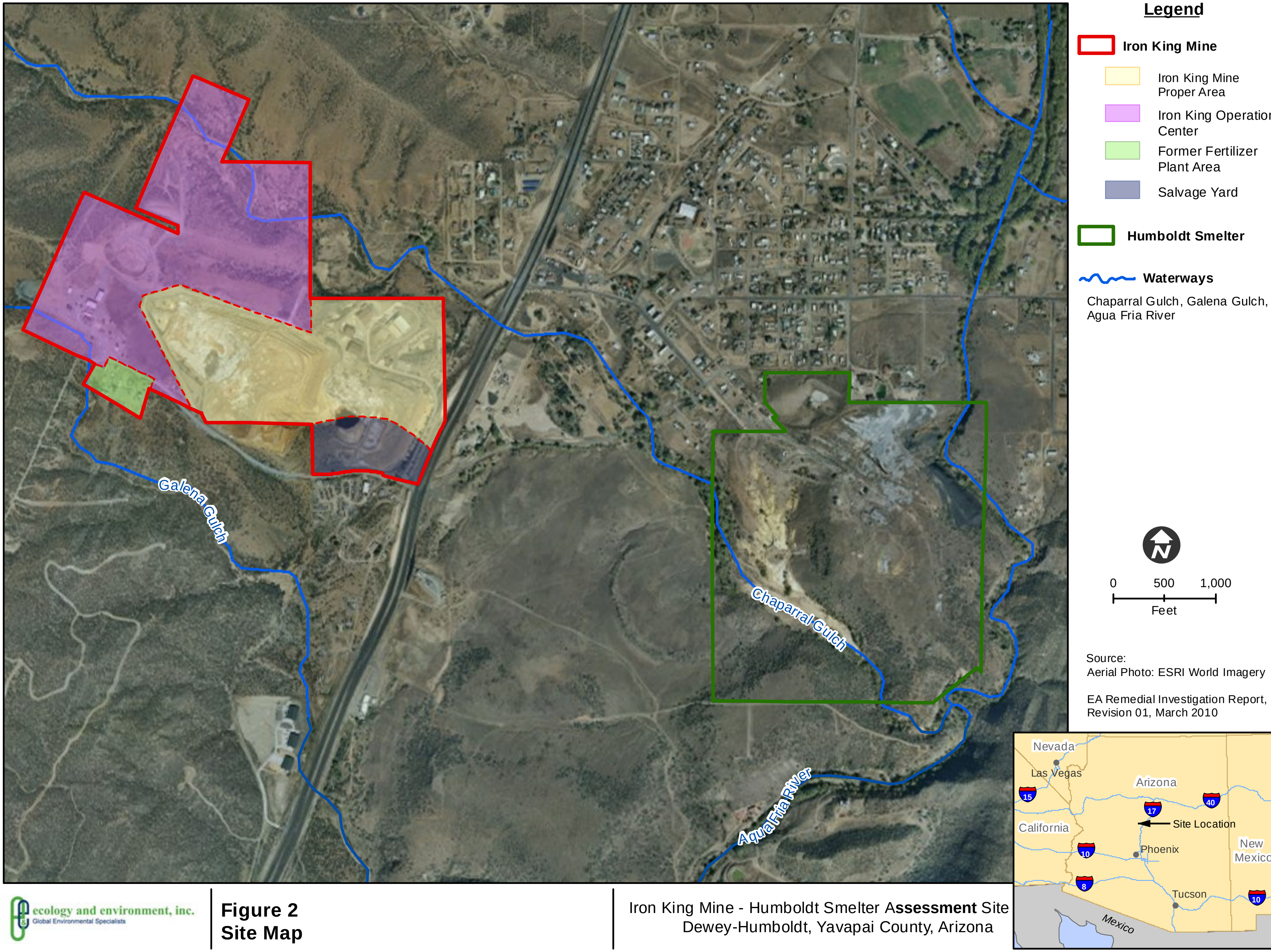


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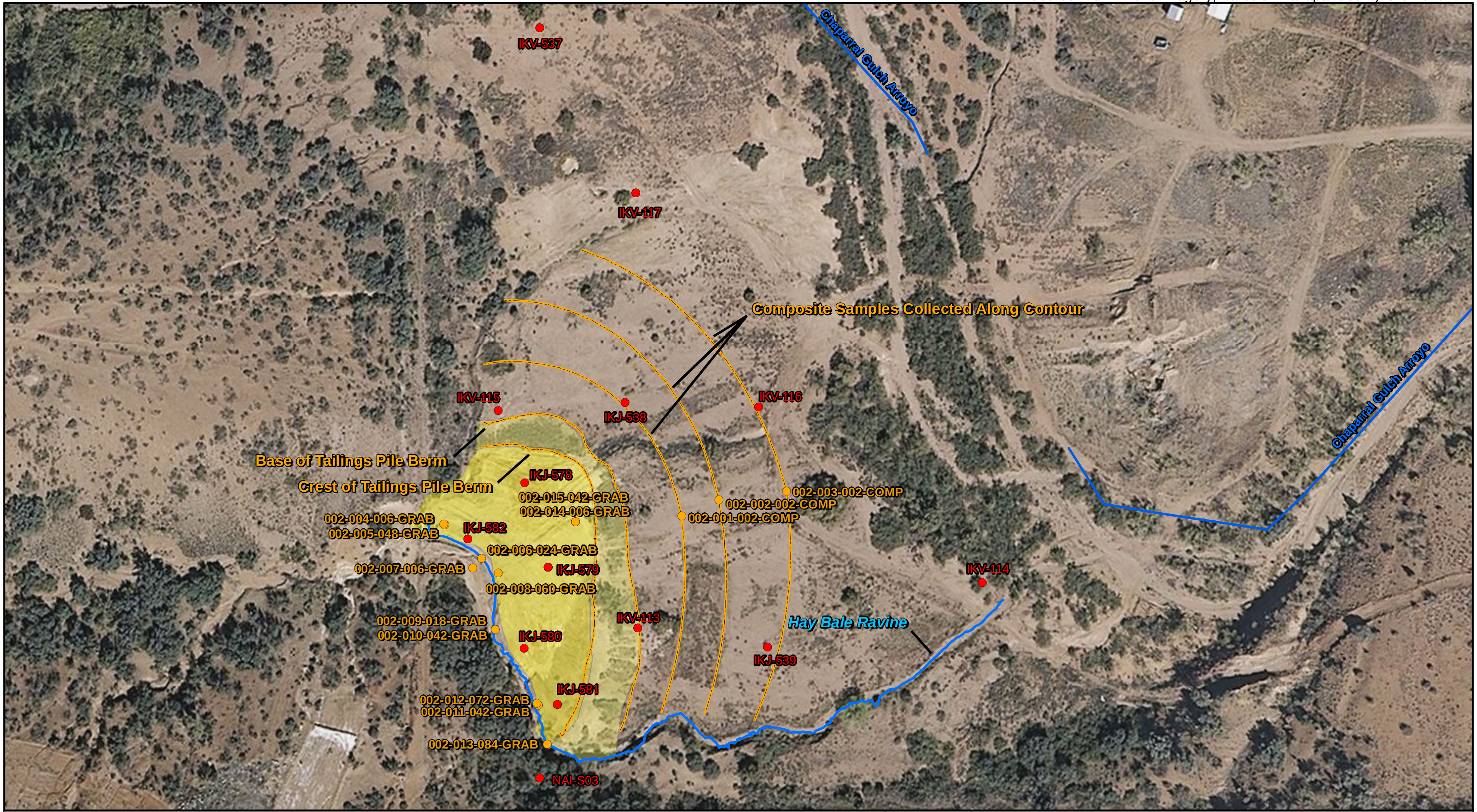
**Figure 2**
**Site Map**

Iron King Mine - Humboldt Smelter **Assessment** Site
Dewey-Humboldt, Yavapai County, Arizona

Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: ESRI Wolrd Imagery, Parcels - Yavapai County GIS 2010




**LEGEND**

E&E Sample Location

EA Sample Location

N

0 100 200 Feet

Figure 3
Small Tailings Pile Sample Locations
Iron King Mine - Humboldt Smelter Assessment
Dewey-Humboldt, Yavapai County, AZ

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Project # 002693.2110.01RA
Path: R:\START 3 R9 Projects\IRON_KING\GIS\Projects\Fig 04_In-Town Parcel Assessment_24x36.mxd

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010.


| | |
|---|---|
| Visually Assessed; No Current Removal Program Action Recommended | Additional Removal Assessment Sampling Recommended; Unable to Obtain Access |
| Previously Assessed and Data Reviewed; No Current Removal Program Action Recommended | Yellow: Potential Candidate for Removal Assessment; Unable to Obtain Access |
| No Further Removal Action Recommended; Removal Action Performed in 2006 | Iron King Mine |
| Potential Candidate for Removal | Humboldt Smelter |

Parcels

N

0 200 400 800 Feet

**Note: Recommendations based on START's understanding of criteria for time critical removal actions and do not necessarily indicate that soil concentrations for lead and arsenic are less than USEPA Region 9 Regional Screening Levels (RSLs) and/or ADEQ's Soil Screening Levels (SSLs)**

**Figure 4**
**In-Town Parcel Assessment**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

START Soil Sample Location

EA Soil Sample Location

Humboldt Smelter Boundary

Parcel boundary

N

0 75 150 Feet

**Figure 5**
**OFS-101 and OFS-102**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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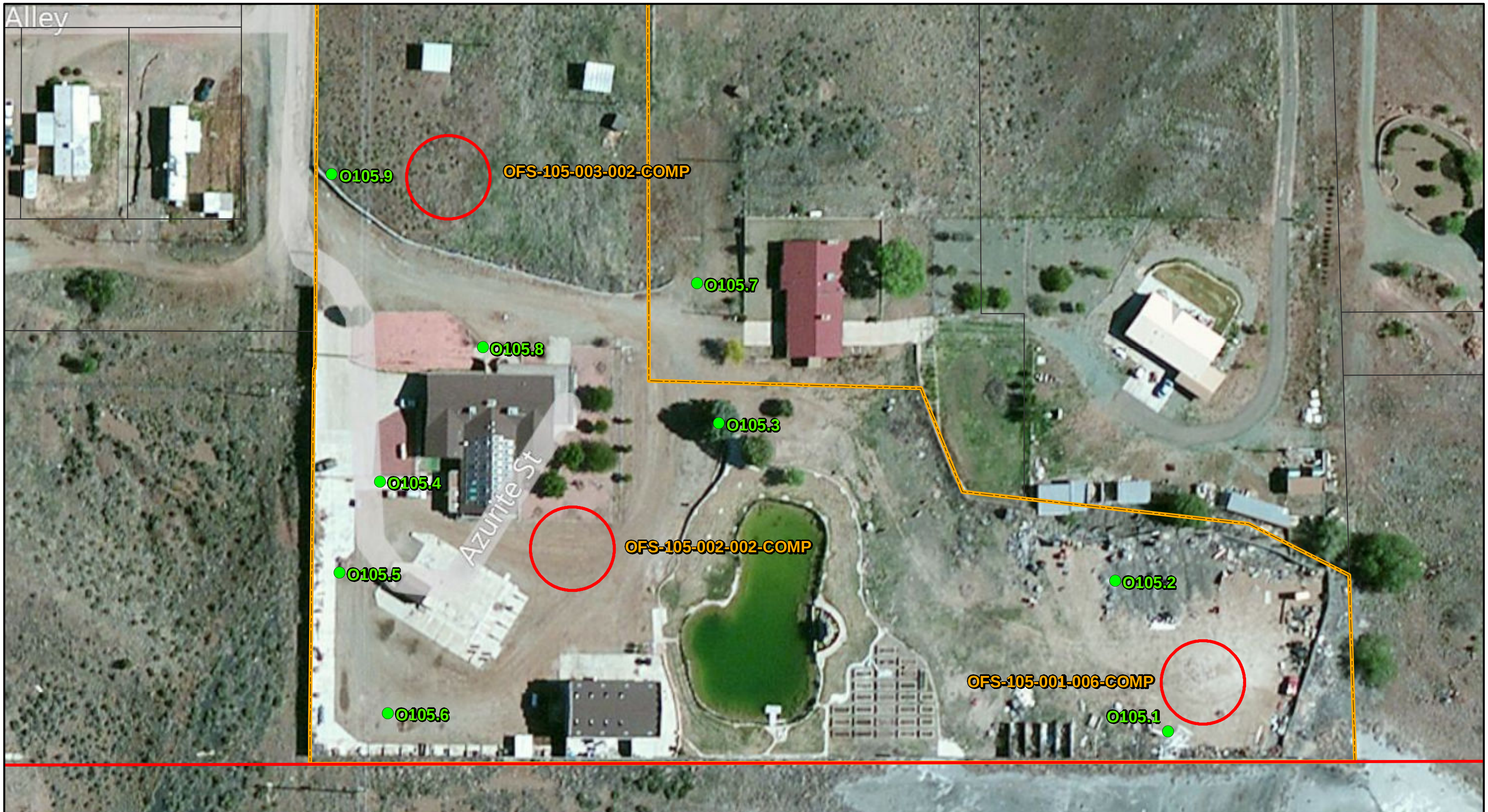
TDD# T02-09-10-09-0004

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10




**LEGEND**

START **C**omposite **S**oil **S**ample Location

EA Soil Sample Location

Parcel Boundary

N

0 100 200 Feet

**Figure 6**
**OFS-105**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

START **Composite Soil** Sample Location

EA Soil Sample Location

Parcel Boundary

N

0 75 150 Feet

**Figure 7**
**OFS-114**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

START **C**omposite **S**oil Sample Location

EA Soil Sample Location

Parcel Boundary

N

0 75 150 Feet

**Figure 8**
**OFS-116**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

START **C**omposite **S**ample Location

EA Soil Sample Location

Parcel Boundary

N

0 75 150 Feet

**Figure 9**
**OFS-117**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

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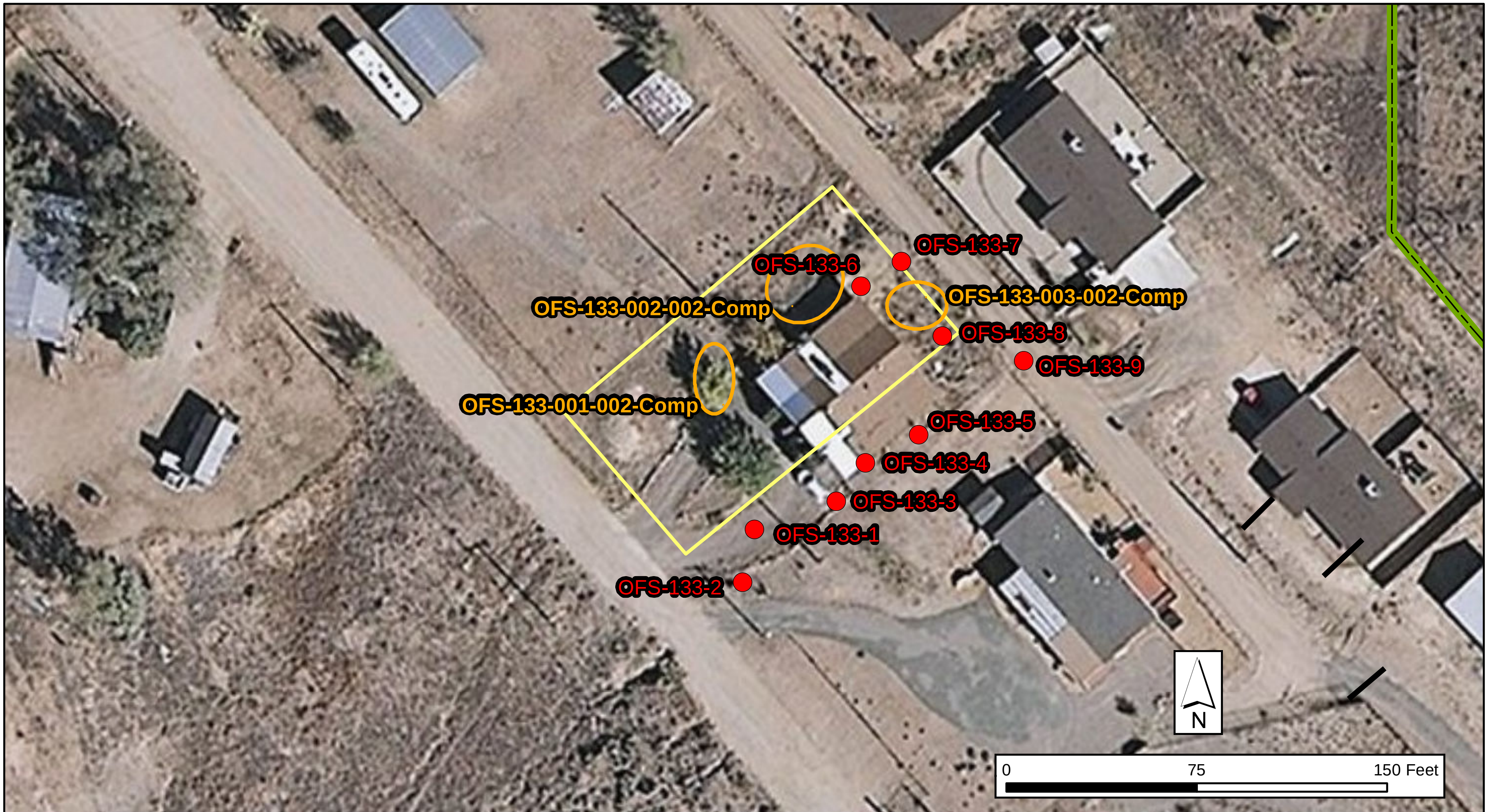


**LEGEND**

START Composite Soil Sample Location

EA Soil Sample Location

Parcel Boundary

Humboldt Smelter

**Figure 10**
**OFS-133**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, AZ**

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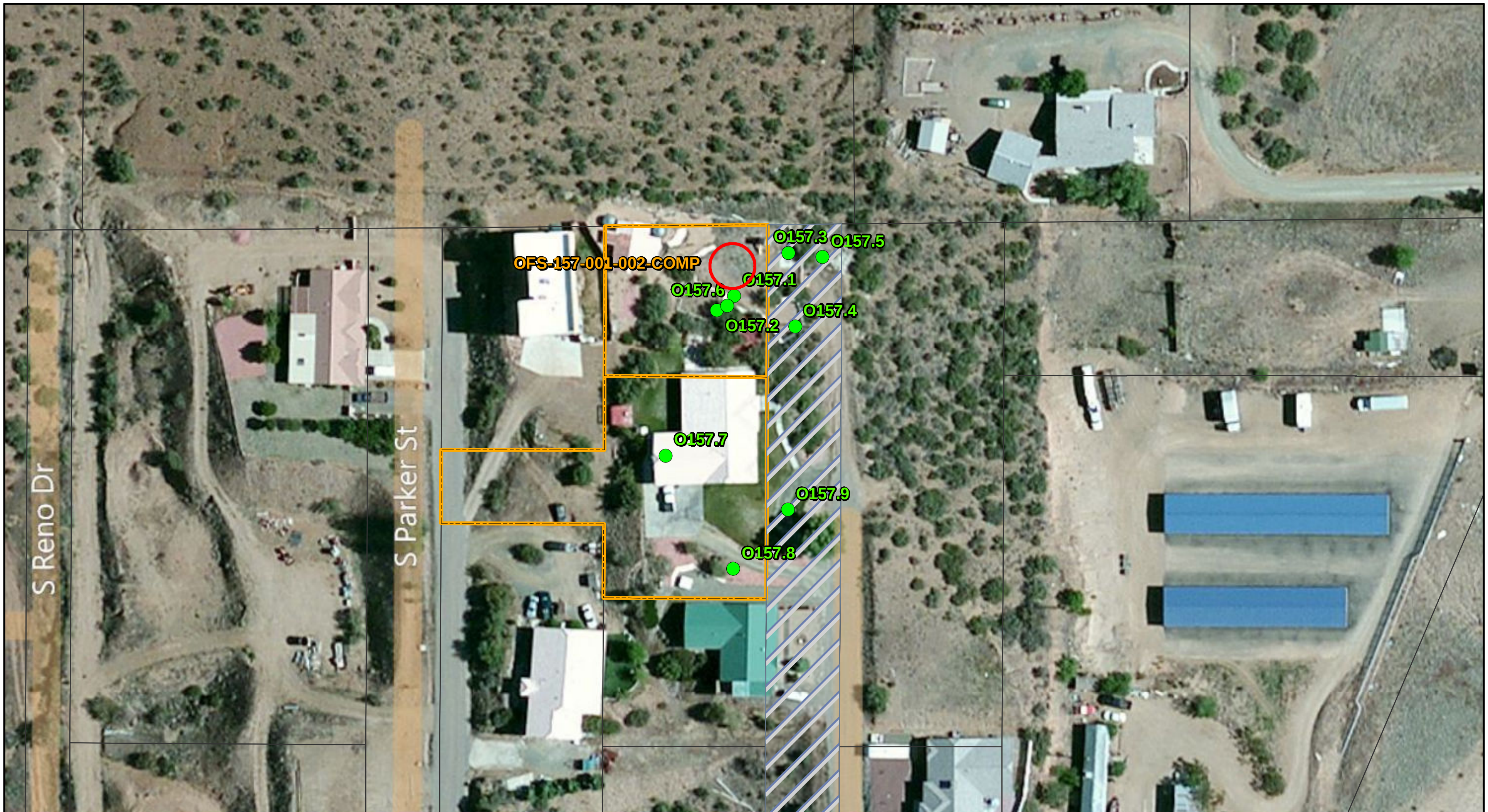
Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10




**LEGEND**

START Composite Soil Sample Location

EA Soil Sample Location

Parcel Boundary

Parcel Ownership Other Than Subject Parcel

N

0 100 200 Feet

**Figure 11**
**OFS-157**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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Project # 002693.2110.01RA
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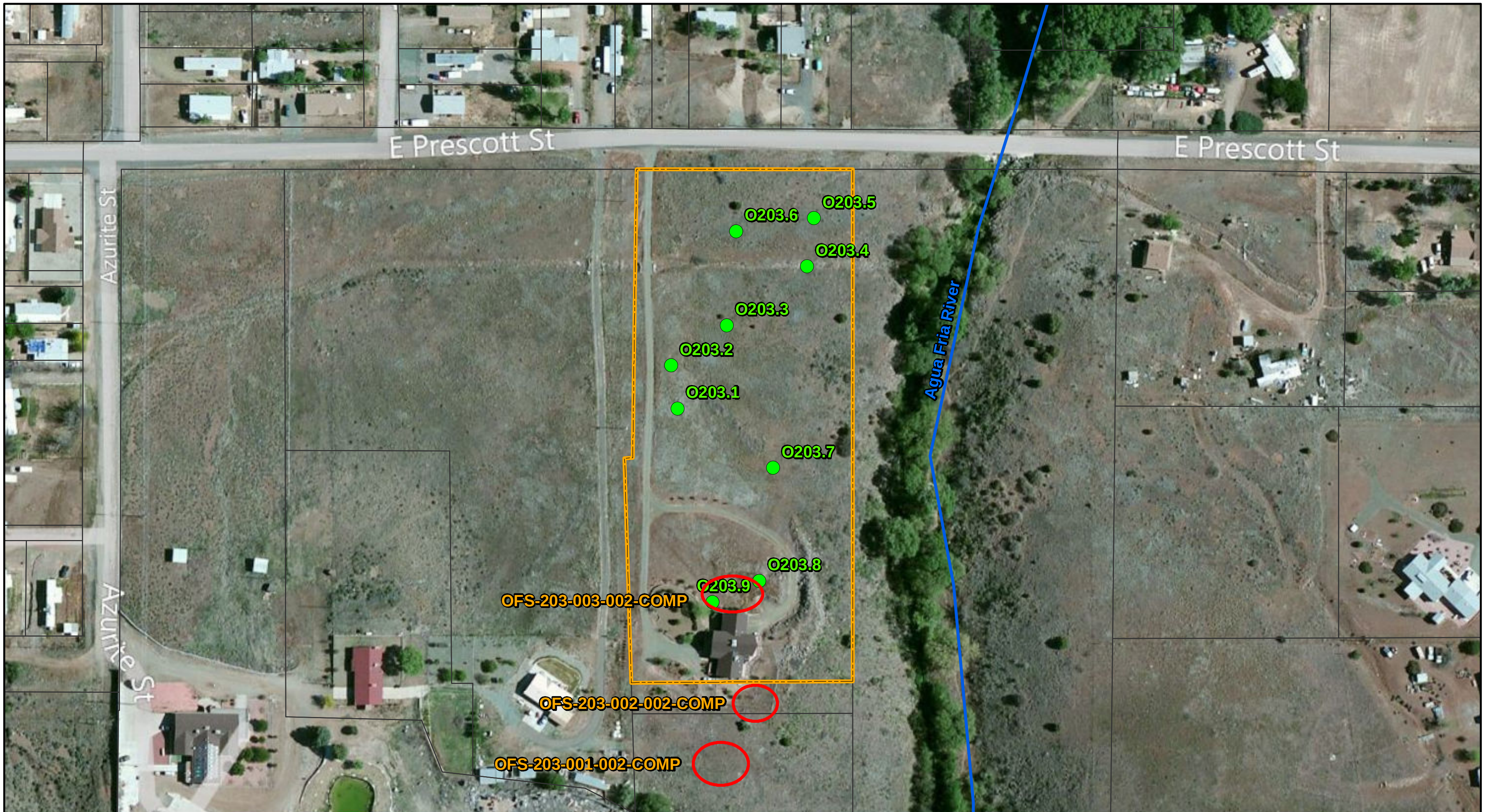
Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10




**LEGEND**

START Composite Soil Sample Location

EA Soil Sample Location

Parcel Boundary

N

0 200 400 Feet

**Figure 12**
**OFS-203**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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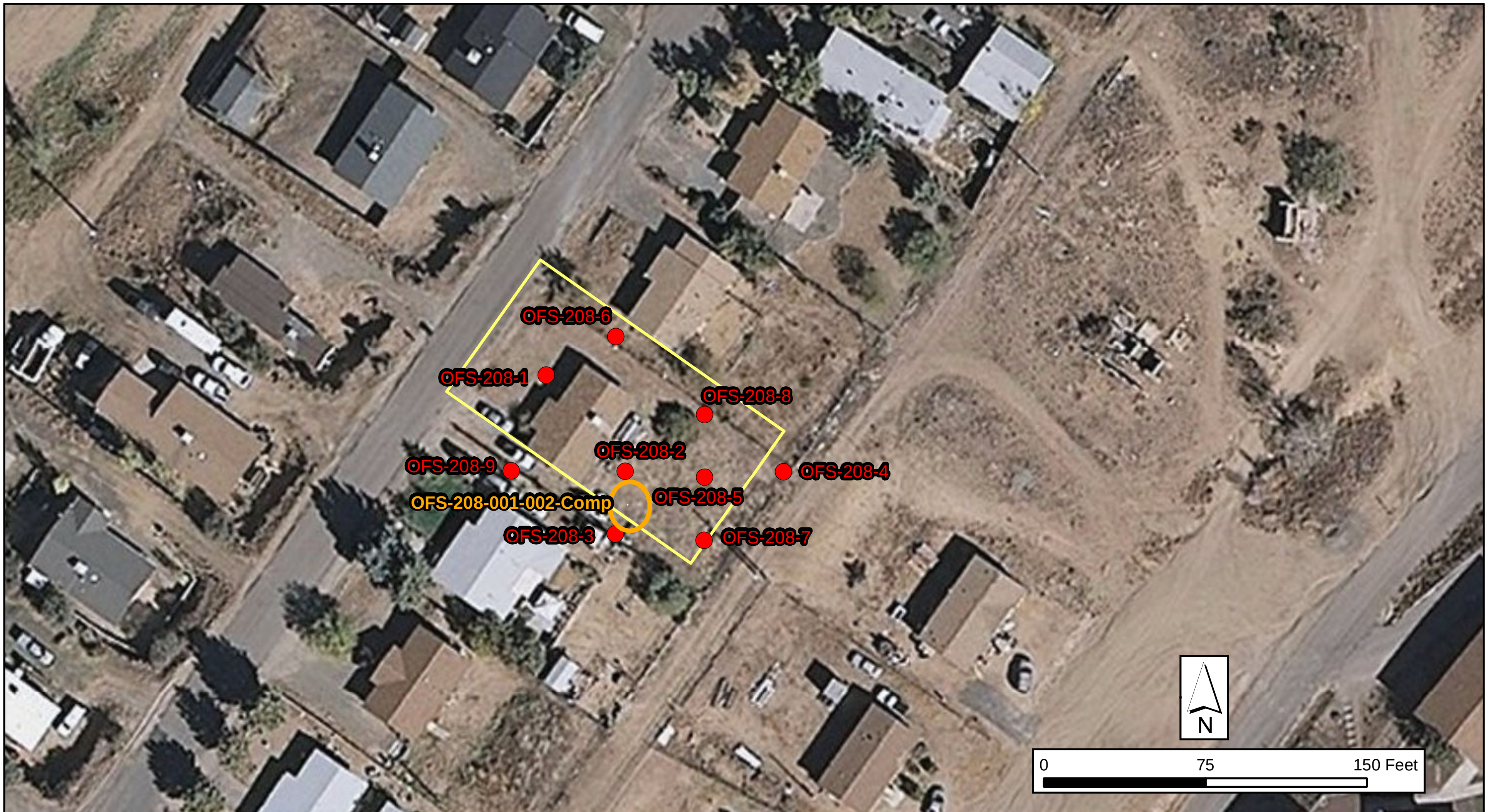
Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: ESRI World Imagery, Parcels - Yavapai County GIS 2010,




**LEGEND**

START Composite Soil Sample Location

EA Sample Location

Parcel Boundary

**Figure 13**
**OFS-208**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

START Composite Soil Sample Location

EA Soil Sample Location

Parcel Boundary

N

0 50 100 Feet

**Figure 14**
**OFS-227**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

START Composite Soil Sample Location

EA Soil Sample Location

Parcel Boundary

N

0 75 150 Feet

**Figure 15**
**OFS-244**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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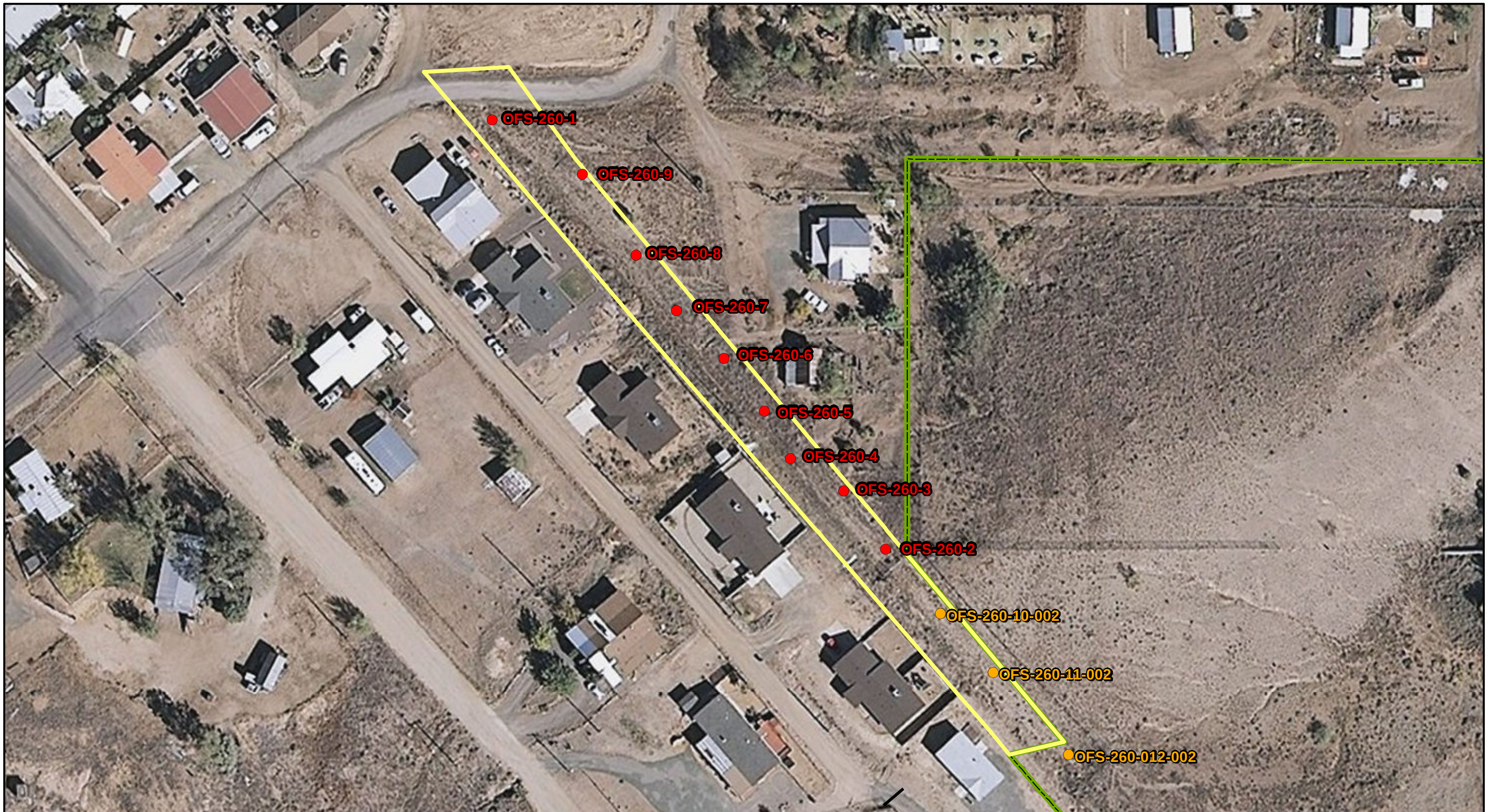
Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: ESRI World Imagery, Parcels - Yavapai County GIS 2010,




**LEGEND**

- START Soil Sample Location
- EA Soil Sample Location
- Parcel Boundary
- Humboldt Smelter

N

0 100 200 Feet

**Figure 16**
**OFS-260**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

ecology and environment, inc.
International Specialists in the Environment

Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: ESRI World Imagery, Parcels - Yavapai County GIS 2010,


**LEGEND**

START Composite Sample Location

Parcel Boundary

Humboldt Smelter

**Figure 17**
**OFS-301 Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

START Soil Sample Location

Parcel Boundary

Humboldt Smelter

**Figure 18**
**OFS-303**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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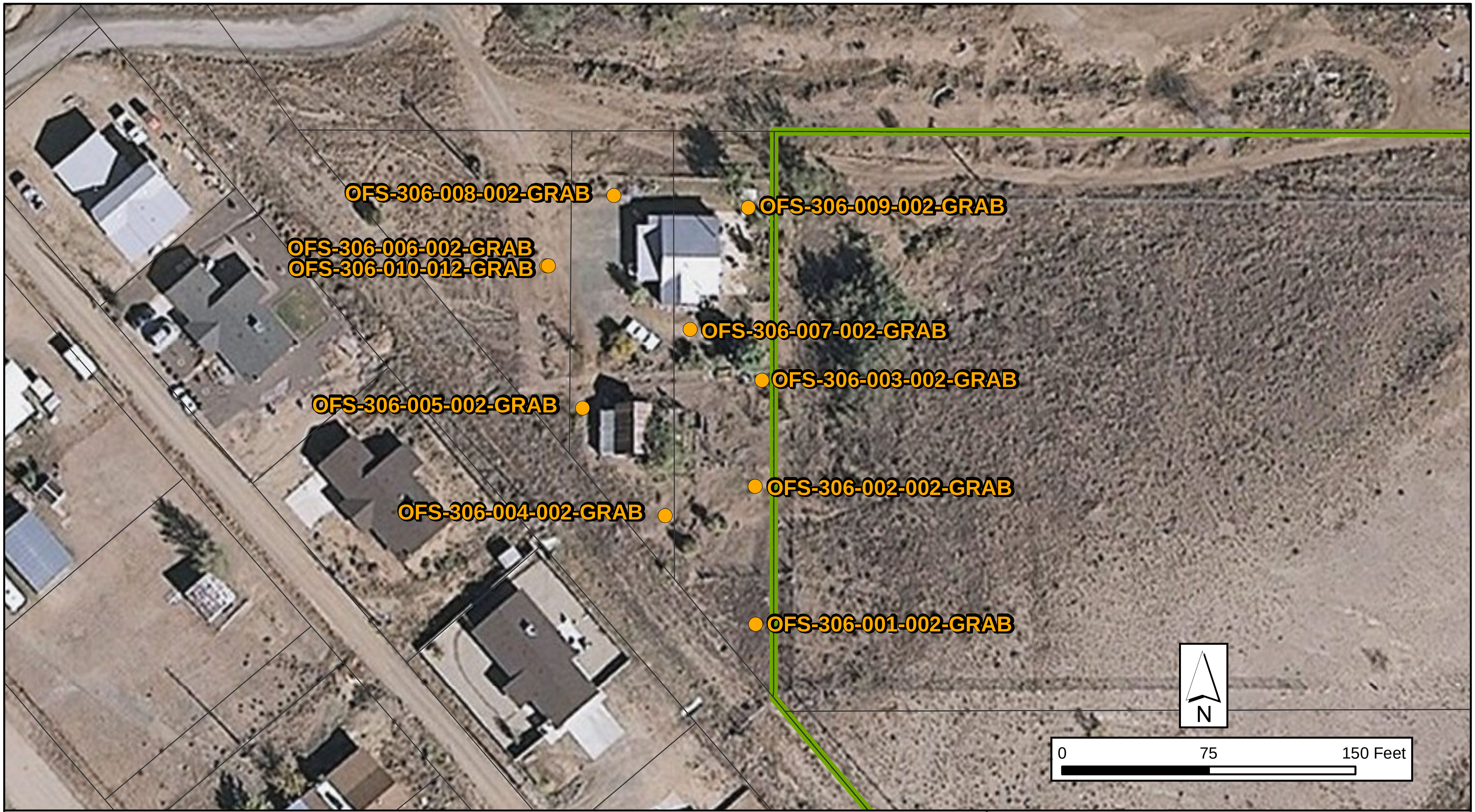
Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: ESRI World Imagery, Parcels - Yavapai County GIS 2010,




**LEGEND**

START Composite Soil Sample Location

Parcel Boundary

Humboldt Smelter

**Figure 19**
**OFS-306**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

START Soil Sample Location

Parcel Boundary

**Figure 20**
**OFS-307**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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International Specialists in the Environment

Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

START Soil Sample Location

Parcel Boundary

H

**Figure 21**
**OFS-308**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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International Specialists in the Environment

Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

START Soil Sample Location

Parcel Boundary

**Figure 22**
**OFS-309**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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International Specialists in the Environment

Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

START Soil Sample Location

Parcel Boundary

**Figure 23**
**OFS-310**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

ecology and environment, inc.
International Specialists in the Environment

Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

START Soil Sample Location

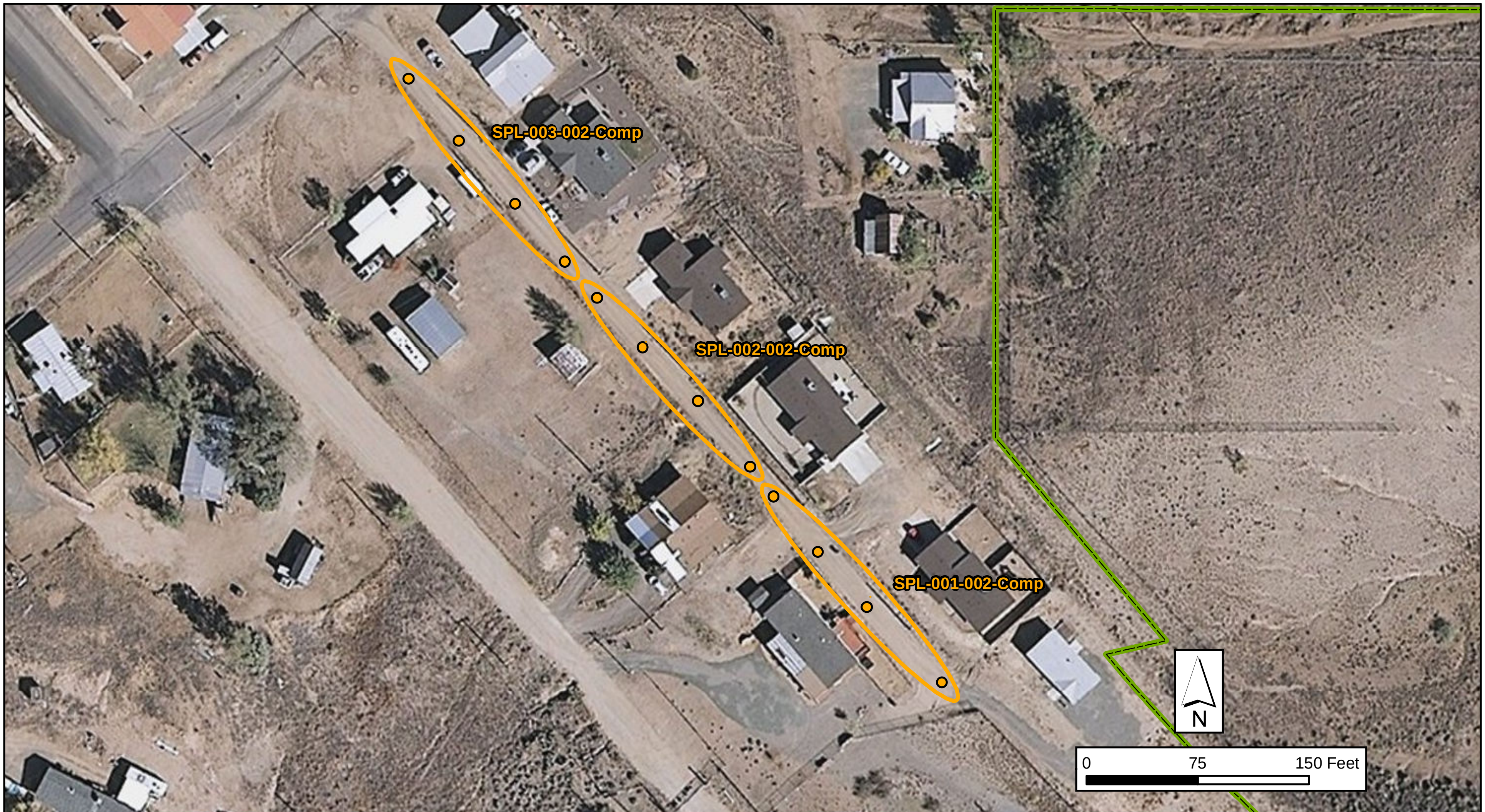
Parcel Boundary

**Figure 24**
**OFS-311**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

ecology and environment, inc.
International Specialists in the Environment

Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: ESRI World Imagery, Parcels - Yavapai County GIS 2010,




**LEGEND**

START Composite Sample Location

Humboldt Smelter

**Figure 25**
**Sweet Pea Lane**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

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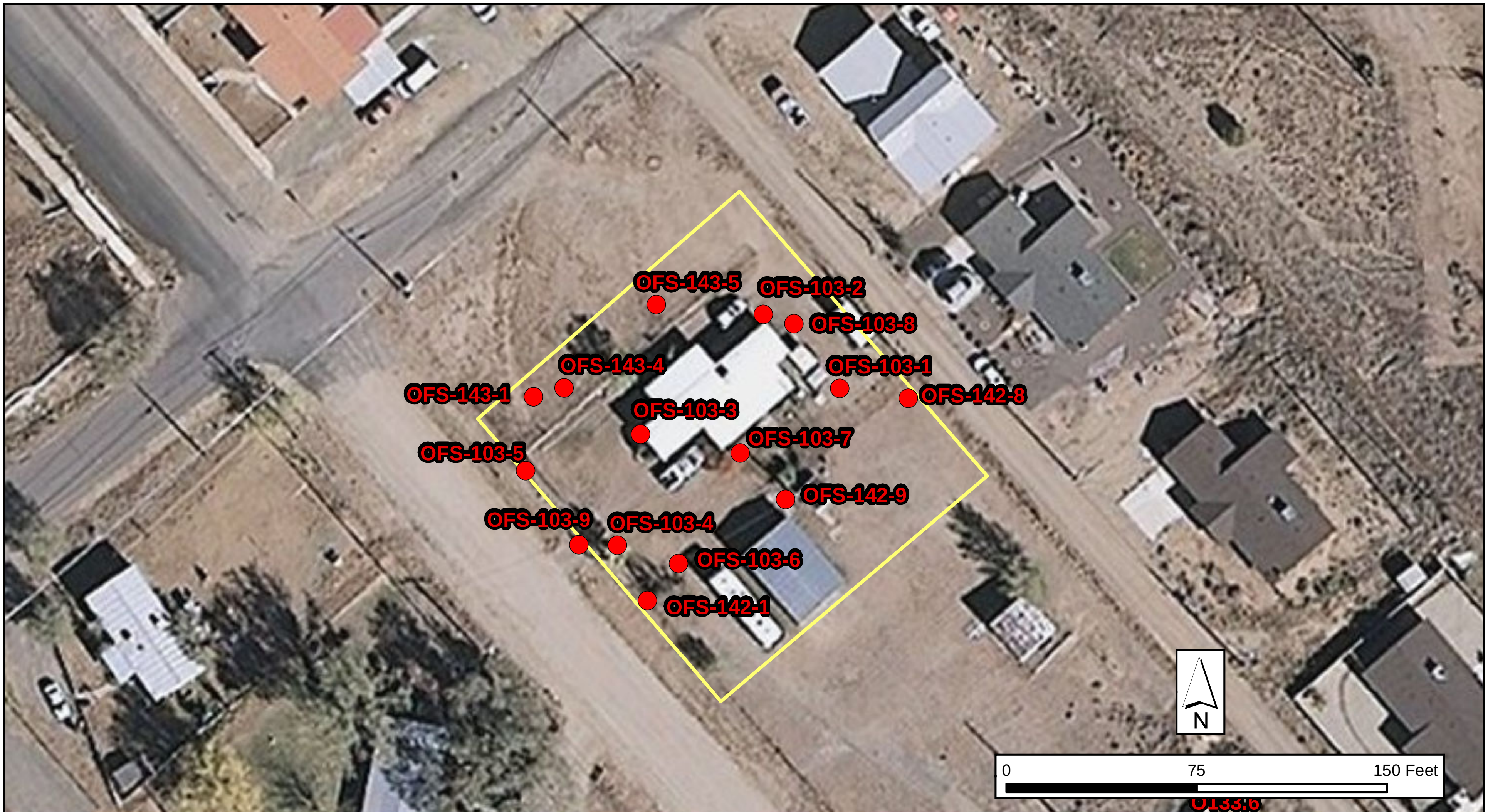
International Specialists in the Environment

Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: ESRI World Imagery, Parcels - Yavapai County GIS 2010,




**LEGEND**

EA Sample Location

Parcel Boundary

H

**Figure 26**
**OFS-103**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

ecology and environment, inc.
International Specialists in the Environment

Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010,
Sample Locations - EA Consultants, Off-Site Soil Arsenic and Lead 95UCLs - 10-22-10


**LEGEND**

EA Soil Sample Location

Parcel Boundary

N

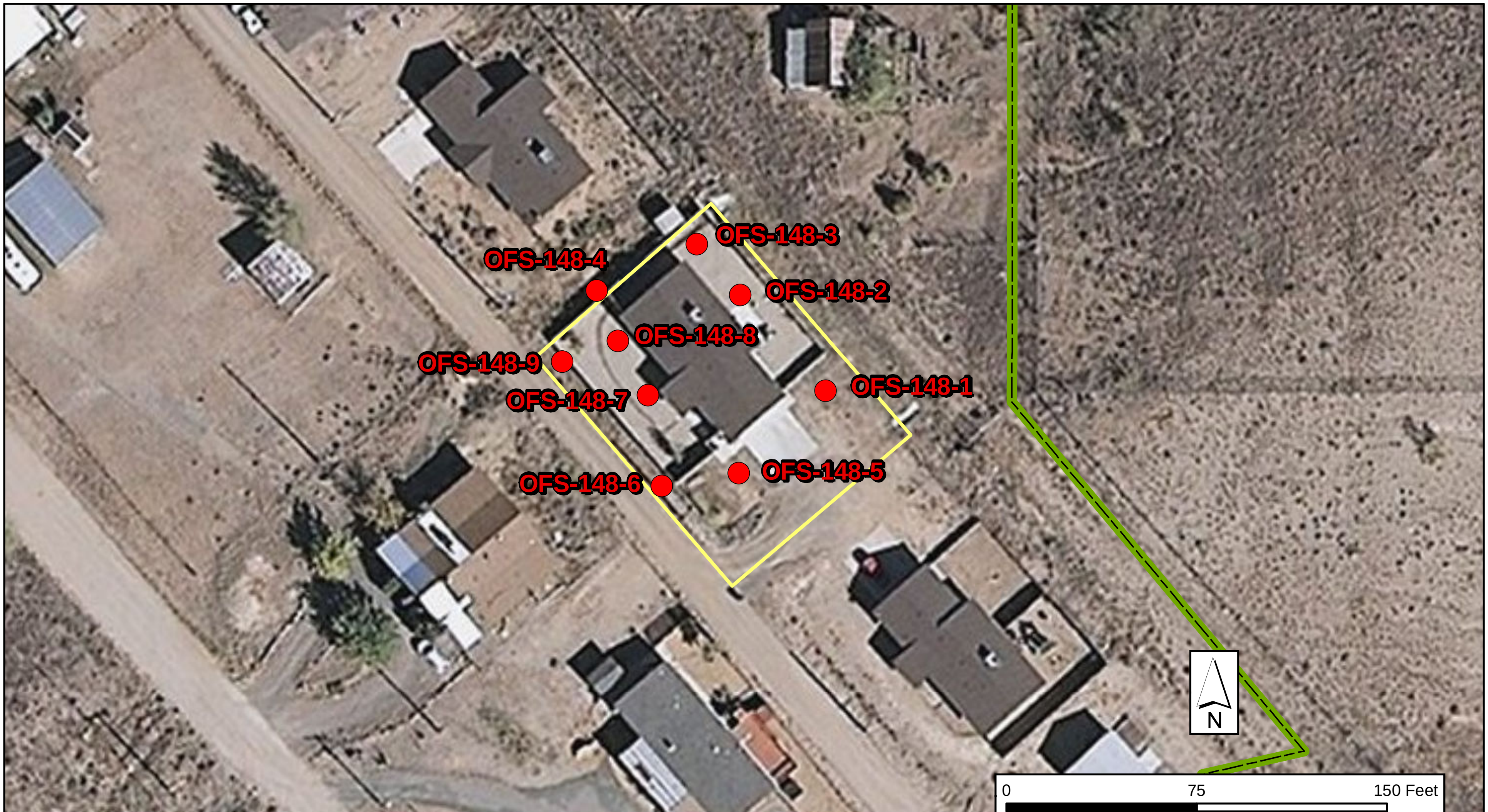
0 75 150 Feet

**Figure 27**
**OFS-119**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, Arizona**

ecology and environment, inc.
International Specialists in the Environment

Project # 002693.2110.01RA
TDD# T02-09-10-09-0004

Source: ESRI World Imagery, Parcels - Yavapai County GIS 2010,




**LEGEND**

EA Sample Location

Parcel Boundary

Humboldt Smelter

**Figure 28**
**OFS-148**
**Sample Locations**
**Iron King Mine - Humboldt Smelter Assessment**
**Yavapai County, AZ**

ecology and environment, inc.
International Specialists in the Environment

Table 1
Arsenic and Lead Analytical Results for Samples Collected by the START
Iron King Mine - Humboldt Smelter Assessment
Samples Collected March 8 - 10, June 1, and September 1, 2011
Results in mg/kg

TDD No. 02-09-10-09-0004

E&E Project No.: 002693.2110.01RA

| Sample ID | Arsenic | Lead |
|---|---|---|
| OFS-002-001-002-Comp | 330 | 660 |
| OFS-002-002-002-Comp | 410 | 220 |
| OFS-002-003-002-Comp | 530 | 350 |
| OFS-002-004-006-Grab | 1000 | 930 |
| OFS-002-005-048-Grab | 650 | 580 |
| OFS-002-006-024-Grab | 1500 | 2900 |
| OFS-002-007-006-Grab | 930 | 1600 |
| OFS-002-008-060-Grab | 1900 | 4100 |
| OFS-002-009-018-Grab | 500 | 400 |
| OFS-002-010-042-Grab | 85 | 35 |
| OFS-002-011-042-Grab | 1600 | 1500 |
| OFS-002-012-072-Grab | 79 | 11 |
| OFS-002-013-084-Grab | 25 | 8.9 |
| OFS-002-014-006-Grab | 1000 | 2200 |
| OFS-002-015-042-Grab | 650 | 360 |
| OFS-101-001-002-Grab | 32.8 | 43.3 |
| OFS-101-001-002-Grab | 73.7 | 165 |
| OFS-102-001-002-Comp | 21.2 | 26.8 |
| OFS-102-002-002-Grab | 16.9 | 25.4 |
| OFS-102-003-002-Grab | 12.9 | 12.1 |
| OFS-105-001-006-Comp | 15 | 26 |
| OFS-105-002-002-Comp | 16 | 26 |
| OFS-105-003-002-Comp | 130 | 40 |
| OFS-114-001-002-Comp | 82 | 57 |
| OFS-116-001-002-Comp | 35 | 41 |
| OFS-116-002-002-Comp | 150 | 200 |
| OFS-116-003-002-Comp | 19 | 23 |
| OFS-117-001-002-Comp | 64 | 51 |
| OFS-117-002-002-Comp | 30 | 30 |
| OFS-133-001-002-Comp | 380 | 1500 |
| OFS-133-002-002-Comp | 530 | 1400 |
| OFS-133-003-002-Comp | 320 | 1300 |
| OFS-157-001-002-Comp | 48 | 44 |
| OFS-203-001-002-Comp | 97 | 200 |
| OFS-203-002-002-Comp | 49 | 90 |
| OFS-203-003-002-Comp | 39 | 66 |
| OFS-208-001-002-Comp | 470 | 380 |
| OFS-227-001-002-Comp | 45 | 88 |
| OFS-227-002-002-Comp | 61 | 87 |
| OFS-244-001-002-Comp | 55 | 10 |
| OFS-260-010-002-Grab | 28 | 110 |
| OFS-260-011-002-Grab | 21 | 40 |
| OFS-260-012-002-Grab | 41 | 63 |
| OFS-301-001-002-Comp | 23 | 87 |
| OFS-301-002-002-Comp | 89 | 340 |
| OFS-301-003-002-Comp | 180 | 1200 |
| OFS-301-004-002-Comp | 48 | 180 |
| OFS-301-005-002-Grab | 25.2 | 54.8 |
| OFS-301-005-010-Grab | 25.9 | 68.7 |
| OFS-301-006-002-Grab | 19.2 | 34.0 |
| OFS-301-007-002-Grab | 33.0 | 137 |
| OFS-301-008-002-Comp | 24.9 | 67.1 |
| OFS-303-001-002-Grab | 19 | 34 |
| OFS-303-002-002-Grab | 25 | 22 |
| OFS-303-003-002-Grab | 35 | 14 |
| OFS-303-004-002-Grab | 34 | 34 |
| OFS-303-005-002-Grab | 33 | 19 |
| OFS-303-006-002-Grab | 23 | 18 |
| OFS-303-007-002-Grab | 27 | 15 |
| OFS-303-008-002-Grab | 29 | 25 |
| OFS-303-009-002-Grab | 45 | 22 |
| OFS-303-010-012-Grab | 32 | 8.8 |

| Sample ID | Arsenic | Lead |
|---|---|---|
| OFS-306-001-002-Grab | 54 | 170 |
| OFS-306-002-002-Grab | 110 | 340 |
| OFS-306-003-002-Grab | 61 | 260 |
| OFS-306-004-002-Grab | 210 | 300 |
| OFS-306-005-002-Grab | 84 | 360 |
| OFS-306-006-002-Grab | 29 | 31 |
| OFS-306-006-010-Grab | 16 | 7.1 |
| OFS-306-007-002-Grab | 37 | 82 |
| OFS-306-008-002-Grab | 53 | 140 |
| OFS-306-009-002-Grab | 54 | 180 |
| OFS-307-001-002-Grab | 26 | 83 |
| OFS-307-002-002-Grab | 17 | 27 |
| OFS-307-003-002-Grab | 31 | 3.4 |
| OFS-307-004-002-Grab | 11 | 8.7 |
| OFS-307-005-002-Grab | 12 | 15 |
| OFS-307-006-002-Grab | 25 | 160 |
| OFS-307-007-002-Grab | 17 | 23 |
| OFS-307-008-002-Grab | 18 | 39 |
| OFS-307-009-002-Grab | 17 | 34 |
| OFS-307-010-012-Grab | 9.5 | 12 |
| OFS-308-001-002-Grab | 33 | 110 |
| OFS-308-002-002-Grab | 62 | 90 |
| OFS-308-003-002-Grab | 44 | 230 |
| OFS-308-004-002-Grab | 40 | 420 |
| OFS-308-005-002-Grab | 24 | 93 |
| OFS-308-006-002-Grab | 54 | 180 |
| OFS-308-007-002-Grab | 11 | 14 |
| OFS-308-008-002-Grab | 24 | 92 |
| OFS-308-009-002-Grab | 21 | 48 |
| OFS-308-010-012-Grab | 16 | 14 |
| OFS-309-001-002-Grab | 19 | 6.9 |
| OFS-309-002-002-Grab | 14 | 6.4 |
| OFS-309-003-002-Grab | 24 | 5.8 |
| OFS-309-004-002-Grab | 18 | 8.5 |
| OFS-309-005-002-Grab | 19 | 6.5 |
| OFS-309-006-002-Grab | 19 | 6.8 |
| OFS-309-007-002-Grab | 16 | 7.4 |
| OFS-309-008-002-Grab | 19 | 6.5 |
| OFS-309-009-002-Grab | 18 | 6.6 |
| OFS-309-009-012-Grab | 15 | 8.3 |
| OFS-310-001-002-Grab | 21 | 38 |
| OFS-310-002-002-Grab | 43 | 97 |
| OFS-310-003-002-Grab | 190 | 35 |
| OFS-310-004-002-Grab | 17 | 19 |
| OFS-310-005-002-Grab | 21 | 37 |
| OFS-310-006-002-Grab | 17 | 66 |
| OFS-310-007-002-Grab | 18 | 43 |
| OFS-310-008-002-Grab | 18 | 43 |
| OFS-310-009-002-Grab | 46 | 130 |
| OFS-310-010-012-Grab | 21 | 8.1 |
| OFS-311-001-002-Grab | 15 | 32 |
| OFS-311-002-002-Grab | 19 | 57 |
| OFS-311-003-002-Grab | 21 | 50 |
| OFS-311-004-002-Grab | 13 | 19 |
| OFS-311-005-002-Grab | 20 | 32 |
| OFS-311-006-002-Grab | 20 | 26 |
| OFS-311-007-002-Grab | 19 | 26 |
| OFS-311-008-002-Grab | 17 | 33 |
| OFS-311-009-002-Grab | 23 | 55 |
| OFS-311-009-012-Grab | 14 | 7.1 |
| SPL-001-002-Comp | 33.6 | 89.9 |
| SPL-002-002-Comp | 40.7 | 125 |
| SPL-003-002-Comp | 18.9 | 46.0 |

Notes:
mg/kg - milligrams per kilogram
SPL - Sweet Pea Lane
Differences in significant figures are due to two laboratories being used.

Table 2
OFS-002 Soil Sample Results
12470 East Yavapai Road
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Sample ID | Date Sampled | Sample Depth (feet) | Arsenic | Cyanide | Lead |
|---|---|---|---|---|---|
| IKJ-537 | 8/21/2008 | 0 to 2 | 65.6 | NR | 36.8 |
| | | 4 to 7 | 24.7 | NR | 9.6 |
| IKJ-538 | 8/21/2008 | 0 to 2 | 35 | NR | 16.1 |
| | | 4 to 7 | 42.9 | NR | 22.9 |
| IKJ-539 | 8/21/2008 | 0 to 2 | 22 | NR | 13.8 |
| | | 4 to 7 | 57.3 | NR | 35.8 |
| IKJ-578 | 4/28/2009 | 0 to 0.5 | 1980 | NR | 2470 J |
| IKJ-579 | 5/3/2009 | 0 to 0.5 | 985 J | NR | 1400 |
| IKJ-580 | 4/28/2009 | 0 to 0.5 | 1510 | NR | 1180 |
| IKJ-581 | 4/28/2009 | 0 to 0.5 | 595 | NR | 480 |
| IKJ-582 | 4/28/2009 | 0 to 0.5 | 1020 | 0.55 | 1580 |
| | | 2 to 3 | 1160 | 0.22 J | 999 |
| IKV-113 | 8/21/2008 | 0 to 2 | 144 | NR | 109 |
| | | 4 to 7 | 37.3 | NR | 26.1 |
| IKV-114 | 8/21/2008 | 0 to 2 | 54.8 | NR | 36.4 |
| IKV-115 | 8/21/2008 | 0 to 2 | 99 | NR | 105 |
| IKV-116 | 8/21/2008 | 0 to 2 | 66.4 | NR | 34.7 |
| | | 4 to 7 | 141 | NR | 64.2 |
| IKV-117 | 8/21/2008 | 0 to 2 | 167 | NR | 161 |
| | | 4 to 7 | 79.5 | NR | 82.9 |
| OFS-002-001-002-Comp | 3/8/2011 | 0 to 0.2 | 330 | NA | 660 |
| OFS-002-002-002-Comp | 3/8/2011 | 0 to 0.2 | 410 | NA | 220 |
| OFS-002-003-002-Comp | 3/8/2011 | 0 to 0.2 | 530 | NA | 350 |
| OFS-002-004-006-Grab | 3/8/2011 | 0.25 to 0.5 | 1000 | NA | 930 |
| OFS-002-005-048-Grab | 3/8/2011 | 3.5 to 4 | 650 | NA | 580 |
| OFS-002-006-024-Grab | 3/8/2011 | 1.75 to 2 | 1500 | NA | 2900 |
| OFS-002-007-006-Grab | 3/8/2011 | 0.25 to 0.5 | 930 | 2.17 | 1600 |
| OFS-002-008-060-Grab | 3/8/2011 | 4.5 to 5 | 1900 | NA | 4100 |
| OFS-002-009-018-Grab | 3/8/2011 | 1.25 to 1.5 | 500 | NA | 400 |
| OFS-002-010-042-Grab | 3/8/2011 | 3.25 to 3.5 | 85 | <0.270 | 35 |
| OFS-002-011-042-Grab | 3/8/2011 | 3.25 to 3.5 | 1600 | NA | 1500 |
| OFS-002-012-072-Grab | 3/8/2011 | 5.75 to 6 | 79 | 28.7 | 11 |
| OFS-002-013-084-Grab | 3/8/2011 | 6.75 to 7 | 25 | <0.252 | 8.9 |
| OFS-002-014-006-Grab | 3/8/2011 | 0.25 to 0.5 | 1000 | NA | 2200 |
| OFS-002-015-042-Grab | 3/8/2011 | 3.25 to 3.5 | 650 | 0.272 J | 360 |

Source: EA Engineering, Science, and Technology, Inc. (2008 and 2009 samples)
mg/kg - milligrams per kilogram
NR - Not reported
NA - Not analyzed

Table 3
OFS-105
Soil Sample Results
2875 South Azurite Street
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Location | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| 1 | 9/15/2008 | 0 to 2 | 39.4 | NA |
| 2 | 9/15/2008 | 0 to 2 | 38.7 | NA |
| 3 | 9/15/2008 | 0 to 2 | 32.7 | NA |
| 3 | 9/15/2008 | 10 to 12 | 27.2 | NA |
| 4 | 9/15/2008 | 0 to 2 | 16.8 | NA |
| 5 | 9/15/2008 | 0 to 2 | 8.5 | NA |
| 6 | 9/15/2008 | 0 to 2 | 29.2 | NA |
| 7 | 9/15/2008 | 0 to 2 | 17.7 | NA |
| 8 | 9/15/2008 | 0 to 2 | 21 | NA |
| 9 | 9/15/2008 | 0 to 2 | 16.5 | NA |
| OFS-105-001-006-Comp | 3/10/2011 | 4 to 6 | 15 | 26 |
| OFS-105-002-002-Comp | 3/10/2011 | 0 to 2 | 16 | 26 |
| OFS-105-003-002-Comp | 3/10/2011 | 0 to 2 | 130 | 40 |

Source (For Locations 1 through 9): EA Engineering, Science, and Technology, Inc.
mg/kg: milligrams per kilogram
NA: Not available.

Table 4
OFS-114
Soil Sample Results
2655 Colina Lane
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Location | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| 1 | 9/15/2008 | 0 to 2 | 18.5 | NA |
| 1 | 9/15/2008 | 10 to 12 | 7.9 | NA |
| 2 | 9/15/2008 | 0 to 2 | 23.8 | NA |
| 3 | 9/15/2008 | 0 to 2 | 124 | NA |
| 4 | 9/15/2008 | 0 to 2 | 39.4 | NA |
| 5 | 9/15/2008 | 0 to 2 | 151 | NA |
| 6 | 9/15/2008 | 0 to 2 | 121 | NA |
| 7 | 9/15/2008 | 0 to 2 | 61.8 | NA |
| 8 | 9/15/2008 | 0 to 2 | 96.2 | NA |
| 9 | 9/15/2008 | 0 to 2 | 104 | NA |
| OFS-114-001-002-Comp | 3/8/2011 | 0 to 2 | 82 | 57 |

Source (For Locations 1 through 9): EA Engineering, Science, and Technology, Inc.

mg/kg: milligrams per kilogram
NA: Not available.

Table 5
OFS-116
Soil Sample Results
Iron King Mine - Humboldt Smelter Assessment
2840 Dana Street
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Location | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| 1 | 9/17/2008 | 0 to 2 | 667 | 49.6 |
| 1 | 9/17/2008 | 10 to 12 | 16.5 | 13.3 |
| 2 | 9/17/2008 | 0 to 2 | 29.1 | 27.8 |
| 3 | 9/17/2008 | 0 to 2 | 22.2 | 21.3 |
| 4 | 9/17/2008 | 0 to 2 | 47.7 | 23 |
| 5 | 9/17/2008 | 0 to 2 | 75.4 | 26.5 |
| 6 | 9/17/2008 | 0 to 2 | 75.9 | 116 |
| 7 | 9/17/2008 | 0 to 2 | 157 | 201 |
| 8 | 9/17/2008 | 0 to 2 | 25.4 | 27.9 |
| 9 | 9/17/2008 | 0 to 2 | 21.6 | 21.8 |
| OFS-116-001-002-Comp | 9/1/2011 | 0 to 2 | 35 | 41 |
| OFS-116-002-002-Comp | 9/1/2011 | 0 to 2 | 150 | 200 |
| OFS-116-003-002-Comp | 9/1/2011 | 0 to 2 | 19 | 23 |

Source (For Locations 1 through 9): EA Engineering, Science, and Technology, Inc.



J: Estimated concentration.
mg/kg: milligrams per kilogram

Table 6
OFS-117
Soil Sample Results
2845 South First Street
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Location | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| 1 | 9/17/2008 | 0 to 2 | 23.9 | NA |
| 1 | 9/17/2008 | 10 to 12 | 20 | NA |
| 2 | 9/17/2008 | 0 to 2 | 168 | NA |
| 3 | 9/17/2008 | 0 to 2 | 123 | NA |
| 4 | 9/17/2008 | 0 to 2 | 27.7 | NA |
| 5 | 9/17/2008 | 0 to 2 | 14.6 | NA |
| 6 | 9/17/2008 | 0 to 2 | 87.9 | NA |
| 7 | 9/17/2008 | 0 to 2 | 20.3 | NA |
| 8 | 9/17/2008 | 0 to 2 | 36.5 | NA |
| 9 | 9/17/2008 | 0 to 2 | 19.6 | NA |
| OFS-117-001-002-Comp | 3/8/2011 | 0 to 2 | 64 | 51 |
| OFS-117-002-002-Comp | 3/8/2011 | 0 to 2 | 30 | 30 |

Source (For Locations 1 through 9): EA Engineering, Science, and Technology, Inc.



mg/kg: milligrams per kilogram

NA: Not available.

Table 7
OFS-133
Soil Sample Results
13070 Main Street
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004

E&E Project No. 002693.2110.01RA

| Location | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| 1 | 5/1/2009 | 0 to 2 | 69.3 | 205 |
| 2 | 5/1/2009 | 0 to 2 | 158 | 680 |
| 3 | 5/1/2009 | 0 to 2 | 109 | 427 |
| 4 | 5/1/2009 | 0 to 2 | 348 | 1370 |
| 5 | 5/1/2009 | 0 to 2 | 20.7 | 67.1 |
| 6 | 5/1/2009 | 0 to 2 | 679 | 3130 |
| 7 | 5/1/2009 | 0 to 2 | 252 | 1110 |
| 8 | 5/1/2009 | 0 to 2 | 502 | 2510 |
| 9 | 5/1/2009 | 0 to 2 | 234 | 947 |
| 9 | 5/1/2009 | 10 to 12 | 97.3 | 66.3 |
| OFS-133-001-002-Comp | 3/10/2011 | 0 to 2 | 380 | 1500 |
| OFS-133-002-002-Comp | 3/10/2011 | 0 to 2 | 530 | 1400 |
| OFS-133-003-002-Comp | 3/10/2011 | 0 to 2 | 320 | 1300 |

Source (For Locations 1 through 9): EA Engineering, Science, and Technology, Inc.



mg/kg: milligrams per kilogram

Table 8
CAM-17 Metals Results
OFS-133
Iron King Mine - Humboldt Smelter Assessment
Samples Collected March 10, 2011
Results in mg/kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Analyte | TTLC | OFS-133-001-002-Comp | OFS-133-002-002-Comp | OFS-133-003-002-Comp |
|---|---|---|---|---|
| Antimony | 500 | 14 | 20 | 18 |
| Arsenic | 500 | 380 | 530 | 320 |
| Barium | 10,000 | 240 | 120 | 220 |
| Beryllium | 75 | 0.57 | 0.36 | 0.63 |
| Cadmium | 100 | 9.8 | 6.0 | 7.2 |
| Chromium | 2,500 | 24 | 22 | 30 |
| Cobalt | 8,000 | 12 | 7.8 | 15 |
| Copper | 2,500 | 390 | 340 | 250 |
| Lead | 1,000 | 1,500 | 1,400 | 1,300 |
| Mercury | 20 | 4.4 | 6.6 | 7.3 |
| Molybdenum | 3,500 | 3.9 | <5.6 | <5.6 |
| Nickel | 2,000 | 21 | 13 | 28 |
| Selenium | 100 | 3.4 | 6.6 | 6.0 |
| Silver | 500 | 6.5 | 8.9 | 8.2 |
| Thallium | 700 | <5.6 | <5.6 | <5.6 |
| Vanadium | 2,400 | 48 | 60 | 77 |
| Zinc | 5,000 | 4,100 | 1,600 | 2,200 |

mg/kg: milligrams per kilogram
TTLC: California Title 22 Total Threshold Limit Concentration

Table 9
OFS-157
Soil Sample Results
2560 South Colina Lane
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004

E&E Project No. 002693.2110.01RA

| Location | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| 1 | May 2010 | 0 to 2 | 146 | 121 J |
| 1 | May 2010 | 10 to 12 | 148 | 208 J |
| 2 | May 2010 | 0 to 2 | 538 | 115 J |
| 3 | May 2010 | 0 to 2 | 6.6 | 5.3 J |
| 4 | May 2010 | 0 to 2 | 7.1 | 7 J |
| 5 | May 2010 | 0 to 2 | 8.2 | 7.4 J |
| 6 | May 2010 | 0 to 2 | 4.7 | 5.2 J |
| 7 | May 2010 | 0 to 2 | 26.7 | 21.7 J |
| 8 | May 2010 | 0 to 2 | 8.8 | 11.8 |
| 9 | May 2010 | 0 to 2 | 11.6 | 13.1 |
| OFS-157-001-002-Comp | 3/8/2011 | 0 to 2 | 48 | 44 |

Source (For Locations 1 through 9): EA Engineering, Science, and Technology, Inc.



J: Estimated concentration.

mg/kg: milligrams per kilogram

Table 10
OFS-203
Soil Sample Results
13425 East Prescott Street
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Location | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| 1 | May 2010 | 0 to 2 | 237 | 469 |
| 1 | May 2010 | 10 to 12 | 45.9 | 88.5 |
| 2 | May 2010 | 0 to 2 | 58.3 | 126 |
| 3 | May 2010 | 0 to 2 | 110 | 306 |
| 4 | May 2010 | 0 to 2 | 89.3 | 214 |
| 5 | May 2010 | 0 to 2 | 55.6 | 95.7 |
| 6 | May 2010 | 0 to 2 | 59.1 | 166 |
| 7 | May 2010 | 0 to 2 | 80.3 | 173 |
| 8 | May 2010 | 0 to 2 | 25.3 | 36.9 |
| 9 | May 2010 | 0 to 2 | 46.6 | 77.5 |
| OFS-203-001-002-Comp | 3/8/2011 | 0 to 2 | 97 | 200 |
| OFS-203-002-002-Comp | 3/8/2011 | 0 to 2 | 49 | 90 |
| OFS-203-003-002-Comp | 3/8/2011 | 0 to 2 | 39 | 66 |

Source (For Locations 1 through 9): EA Engineering, Science, and Technology, Inc.

mg/kg: milligrams per kilogram

Table 11
OFS-208
Soil Sample Results
2565 Hill Street
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004

E&E Project No. 002693.2110.01RA

| Location | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| 1 | May 2010 | 0 to 2 | 45.3 | 46.7 |
| 1 | May 2010 | 10 to 12 | 14.7 | 14.5 |
| 2 | May 2010 | 0 to 2 | 13.2 | 34.0 |
| 3 | May 2010 | 0 to 2 | 817 | 576 |
| 4 | May 2010 | 0 to 2 | 28 | 33.3 |
| 5 | May 2010 | 0 to 2 | 14.1 | 14.8 |
| 6 | May 2010 | 0 to 2 | 19.4 | 22.1 |
| 7 | May 2010 | 0 to 2 | 19.4 | 16.7 |
| 8 | May 2010 | 0 to 2 | 27.1 | 31.5 |
| 9 | May 2010 | 0 to 2 | 15.6 | 26.2 |
| OFS-208-001-002-Comp | 3/8/2011 | 0 to 2 | 470 | 380 |

Source (For Locations 1 through 9): EA Engineering, Science, and Technology, Inc.



mg/kg: milligrams per kilogram

Table 12
OFS-227
Soil Sample Results
2670 South Jones Street
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Location | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| 1 | May 2010 | 0 to 2 | 137 | 171 |
| 1 | May 2010 | 10 to 12 | 40.2 | 110 |
| 2 | May 2010 | 0 to 2 | 34.1 | 138 |
| 3 | May 2010 | 0 to 2 | 38 | 402 |
| 4 | May 2010 | 0 to 2 | 234 | 244 |
| 5 | May 2010 | 0 to 2 | 103 | 121 |
| 6 | May 2010 | 0 to 2 | 31.4 | 69.2 |
| 7 | May 2010 | 0 to 2 | 29.7 | 39.6 |
| 8 | May 2010 | 0 to 2 | 31.1 | 38.6 |
| 9 | May 2010 | 0 to 2 | 667 J | 1270 J |
| OFS-227-001-002-Comp | 3/9/2011 | 0 to 2 | 45 | 88 |
| OFS-227-002-002-Comp | 3/9/2011 | 0 to 2 | 61 | 87 |

Source (For Locations 1 through 9): EA Engineering, Science, and Technology, Inc.


J: Estimated concentration
mg/kg: milligrams per kilogram

Table 13
OFS-244
Soil Sample Results
2575 Hill Street
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Location | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| 1 | May 2010 | 0 to 2 | 20.4 J | 22.4 |
| 1 | May 2010 | 10 to 12 | 15.6 J | 14.0 |
| 2 | May 2010 | 0 to 2 | 339 J | 11.9 |
| 3 | May 2010 | 0 to 2 | 28.5 J | 40.3 |
| 4 | May 2010 | 0 to 2 | 17.5 J | 23.2 |
| 5 | May 2010 | 0 to 2 | 91.2 J | 13.8 |
| 6 | May 2010 | 0 to 2 | 19.9 | 27.9 |
| 7 | May 2010 | 0 to 2 | 14.6 | 15.8 |
| 8 | May 2010 | 0 to 2 | 17.6 | 22.7 |
| 9 | May 2010 | 0 to 2 | 15.8 | 11.4 |
| OFS-244-001-002-Comp | 3/8/2011 | 0 to 2 | 55 | 10 |

Source (For Locations 1 through 9): EA Engineering, Science, and Technology, Inc.



J: Estimated concentration

mg/kg: milligrams per kilogram

Table 14
OFS-260
Soil Sample Results
Right-of-Way Behind Sweet Pea Lane
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Location | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| 1 | May 2010 | 0 to 2 | 127 | 547 |
| 1 | May 2010 | 10 to 12 | 84.9 | 564 |
| 2 | May 2010 | 0 to 2 | 51.1 | 149 |
| 3 | May 2010 | 0 to 2 | 133 | 570 |
| 4 | May 2010 | 0 to 2 | 94.9 | 348 |
| 5 | May 2010 | 0 to 2 | 186 | 802 |
| 6 | May 2010 | 0 to 2 | 184 | 742 |
| 7 | May 2010 | 0 to 2 | 209 | 1820 |
| 8 | May 2010 | 0 to 2 | 348 | 1280 |
| 9 | May 2010 | 0 to 2 | 158 | 646 |
| OFS-260-10-002 | 8/31/2011 | 0 to 2 | 28 | 110 |
| OFS-260-11-002 | 8/31/2011 | 0 to 2 | 21 | 40 |
| OFS-260-12-002 | 8/31/2011 | 0 to 2 | 41 | 63 |

Source (for locations 1 througth 9): EA Engineering, Science, and Technology, Inc.
mg/kg: milligrams per kilogram

Table 15
TCLP Arsenic and Lead Results
OFS-260
Iron King Mine - Humboldt Smelter Assessment
Sample Collected June 1, 2011
Results in mg/l

E&E Project No.: 002693.2110.01RA

| Analyte | TCLP* | OFS-260-002-Comp |
|---|---|---|
| Arsenic | 5 | 0.0738 |
| Lead | 5 | 0.233 |

Notes:
*Toxicity Characteristic Leaching Procedure Regulated level
mg/l: milligrams per liter

Table 16
OFS-103
Soil Sample Results
13030 East Main Street
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Location* | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| OFS-103-1 | 9/15/2008 | 0 to 2 | 17.5 | 37.4 |
| OFS-103-2 | 9/15/2008 | 0 to 2 | 17.5 | 20.1 |
| OFS-103-3 | 9/15/2008 | 0 to 2 | 37.8 | 79.5 |
| OFS-103-4 | 9/15/2008 | 0 to 2 | 33.8 | 68.9 |
| OFS-103-4 | 9/15/2008 | 10 to 12 | 53.8 | 195 |
| OFS-103-5 | 9/15/2008 | 0 to 2 | 42.2 | 163 |
| OFS-103-6 | 9/15/2008 | 0 to 2 | 116 | 665 |
| OFS-103-7 | 9/15/2008 | 0 to 2 | 46.5 | 54.3 |
| OFS-103-8 | 9/15/2008 | 0 to 2 | 25.7 | 41.1 |
| OFS-103-9 | 9/15/2008 | 0 to 2 | 62.6 | 12.7 |
| OFS-142-1 | 5/2/2009 | 0 to 2 | 331 | 1150 |
| OFS-142-8 | 5/2/2009 | 0 to 2 | 19.6 | 96.1 |
| OFS-142-9 | 5/2/2009 | 0 to 2 | 23.3 | 77.3 |
| OFS-143-1 | 5/2/2009 | 0 to 2 | 88.4 | NR |
| OFS-143-4 | 5/2/2009 | 0 to 2 | 21.3 | NR |
| OFS-143-5 | 5/2/2009 | 0 to 2 | 45.9 | NR |

Source: EA Engineering, Science, and Technology, Inc. (EA)



* - Also listed: samples collected by EA for parcels OFS-142 and OFS-143 that were actually collected on OFS-103 property.

mg/kg: milligrams per kilogram

NR: Not reported by EA

Table 17
OFS-119
Soil Sample Results
13080 East Main Street
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Location | Date Sampled | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|---|
| 1 | 9/18/2008 | 0 to 2 | 33.1 | 61.2 |
| 1 | 9/18/2008 | 10 to 12 | 15.7 | 11.3 |
| 2 | 9/18/2008 | 0 to 2 | 36.4 | 75.1 |
| 3 | 9/18/2008 | 0 to 2 | 30.1 | 62.6 |
| 4 | 9/18/2008 | 0 to 2 | 22 | 105 |
| 5 | 9/18/2008 | 0 to 2 | 103 | 356 |
| 6 | 9/18/2008 | 0 to 2 | 25.1 | 383 |
| 7 | 9/18/2008 | 0 to 2 | 14.8 | 49 |
| 8 | 9/18/2008 | 0 to 2 | 15.3 | 46.5 |
| 9 | 9/18/2008 | 0 to 2 | 47.2 | 22.8 |

Source: EA Engineering, Science, and Technology, Inc.
mg/kg: milligrams per kilogram

Table 18
OFS-148
Soil Sample Results
2945 Sweet Pea Lane
Samples Collected October 10, 2008
Iron King Mine - Humboldt Smelter Assessment
Dewey- Humboldt, AZ
mg/Kg

TDD No. 02-09-10-09-0004 E&E Project No. 002693.2110.01RA

| Location | Depth Interval (Inches) | Arsenic | Lead |
|---|---|---|---|
| 1 | 0 to 2 | 113 | 655 |
| 2 | 0 to 2 | 126 | 765 |
| 3 | 0 to 2 | 203 | 1040 |
| 4 | 0 to 2 | 89.4 | 510 |
| 5 | 0 to 2 | 118 | 561 |
| 6 | 0 to 2 | 36.1 | 175 |
| 7 | 0 to 2 | 55.7 | 358 |
| 8 | 0 to 2 | 86.8 | 547 |
| 9 | 0 to 2 | 90.7 | 428 |
| 1 | 10 to 12 | 142 | 536 |

Source: EA Engineering, Science, and Technology, Inc.

mg/kg: milligrams per kilogram

Table 19
Properties Subject to U.S. EPA Time-Critical Removal Action
Dewey-Humboldt, Arizona

TDD No. 02-09-10-09-0004 | E&E Project No. 002693.2110.01RA

| Removal Type | Site ID | Parcel No. | Physical Address | Mailing Address | Acres | Arsenic Average Concentration (mg/kg) | Arsenic 95% UCL[1] | Lead Average Concentration (mg/kg) | Lead 95% UCL[1] |
|---|---|---|---|---|---|---|---|---|---|
| Complete Removal | OFS 111 | 402-06-102L | 2925 South Sweet Pea Lane | PO Box 485<br>Humboldt, AZ 86329 | 0.27 | 115.6 | 165.2 | 638.8 | 923.9 |
| Complete Removal | OFS 118 | 402-06-102K | 2905 South Sweet Pea Lane | PO Box 508<br>Humboldt, AZ 86329 | 0.27 | 147.2 | 198.4 | 1148 | 1610 |
| Complete Removal | OFS 132 | 402-06-102P | 2875 South Third Street | PO Box 122<br>Humboldt, AZ 86329 | 0.25 | 102.5 | 130.7 | 949.7 | 1792 |
| Complete Removal | OFS 260 | 800-27-005T | Unsurfaced right-of-way behind Sweet Pea Lane | Municipal property | 0.5 (approx.) | 157.6 | 205.9 | 746.8 | 1025 |
| Complete Removal | OFS 148 | 402-06-102M | 2945 Sweet Pea Lane | 1575 Purple Sage Road<br>Chino Valley, AZ 86323 | 0.27 | 106.1 | 133.1 | 577.5 | 692.9 |
| Complete Removal | OFS 133[2] | 402-07-006 | 13070 Main Street | PO Box 338<br>Humboldt, AZ 86329 | 0.23 | 284.6 | 383.3 | 1132 | 1584 |
| Hot-Spot Removal | OFS-119 (NE corner of OFS-119 added to removal at OFS-133) | 402-07-007C | 13080 East Main Street | PO Box 552<br>Humboldt, AZ 86329 | 0.48[4] | | | | |
| Hot-Spot Removal | OFS-103 | 402-07-002B | 13030 East Main Street | PO Box 488<br>Humboldt, AZ 86329 | 0.46[4] | 45.77[5] | 92.86[5,6] | 134.5[5] | 605.3[5,6] |
| Hot-Spot Removal | OFS 208[2] | 402-09-016D | 2565 Hill Street | PO Box 32<br>Humboldt, AZ 86329 | 0.21[4] | 134.9 | 481[7] | 108.7 | 355.8[7] |
| Hot-Spot Removal | OFS-244 (one hot spot between two parcels) | 402-09-016H | 2575 Hill Street | PO Box 548<br>Humboldt, AZ 86329 | 0.21[4] | | | | |
| Hot-Spot Removal | OFS-002[2] (hot spot is the STP) | 402-08-034A | 12470 East Yavapai Road | PO Box 721<br>Dewey, AZ 86327 | 0.6[3] | 556.4 | 727.2 | 706.2 | 986.8 |
| Hot-Spot Removal | OFS-301 | 402-06-102N | 2965 Sweet Pea Lane | PO Box 905<br>Humboldt, AZ 86329 | 0.28[4] | 52.02 | 128.5[7] | 241 | 552[6] |
| Hot-Spot Removal | OFS-306 | 402-06-026<br>402-06-027B | 13087 E. Main Street<br>13089 E. Main Street | PO Box 699<br>Humboldt, AZ 86329 | 0.19[4]<br>0.32[4] | 70.8 | 111.3[6] | 187 | 259.7 |

[1] - Calculated as student's t-test for normal distribution unless otherwise noted.
[2] - For properties that were sampled by both EA and START, the START data was combined with EA data to generate new means and 95% UCLs.
[3] - The Small Tailings Pile has an area of approximately 0.6 acres and is situated on a parcel of approximately 40 acres.
[4] - These properties will be subjected to hot spot removals only.
[5] - Calculated based on samples listed in Table 15.
[6] - Gamma UCL
[7] - Non-parametric Chebyshev UCL

# B In-Town Parcel Data Summary

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EA Engineering, Science and Technology, Inc. 95% UCLs and Exposure Point Concentrations for Arsenic and Lead in In-Town Parcel Soil
Dewey-Humboldt, Arizona

| Property | Physical Address | Arsenic | | | | | Lead | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean Concentration (44 mg/kg Comparison) | Maximum Concentration (Qualifier) (66 mg/kg Comparison) | 95% UCL | Medium EPC | Exposure Point Concentration (41 mg/kg Comparison) | Mean Concentration (27 mg/kg Comparison) | Maximum Concentration (Qualifier) (58 mg/kg Comparison) | 95% UCL | Medium EPC | Exposure Point Concentration (150 mg/kg Comparison) |
| OFS002 | 12470 East Yavapai Road | 110.1 | 160 | 131.1 | 95%UCLM-N | 131.1 | 68.67 | 120 | 83.78 | 95%UCLM-N | 83.78 |
| OFS003 | 12514 East Yavapai Street | 76.73 | 160 | 100.3 | 95%UCLM-N | 100.3 | 37.09 | 79 | 46.81 | 95%UCLM-N | 46.81 |
| OFS004 | 12516 East Coreley Street | 113.2 | 180 | 136.1 | 95%UCLM-N | 136.1 | 76.45 | 130 | 93.95 | 95%UCLM-N | 93.95 |
| OFS006 | 12755 East Main Street | 31.45 | 75 | 42.11 | 95%UCLM-G | 42.11 | 43.43 | 85 | 56.06 | 95%UCLM-N | 56.06 |
| OFS007 | 12755 East Main Street | 86.91 | 570 | 297.9 | 95%UCLM-C | 297.9 | 56.72 | 100 | 71.18 | 95%UCLM-N | 71.18 |
| OFS008 | 2830 South First Street | 44.27 | 240 | 130.9 | 95%UCLM-C | 130.9 | 39.67 | 280 | 280.8 | Maximum | 280 |
| OFS009 | 12679 East Richards Lane | 32.88 | 69 | 47.72 | 95%UCLM-G | 47.72 | 27 | 61 | 50.12 | 95%UCLM-C | 50.12 |
| OFS010 | 12749 East Valley Street | 41.55 | 57 | 48.24 | 95%UCLM-N | 48.24 | 51.55 | 100 | 65.96 | 95%UCLM-N | 65.96 |
| OFS011 | 12690 Richards Lane | 31.25 | 86 | 45.94 | 95%UCLM-G | 45.94 | 191.2 | 1300 | 882.9 | 97.5%UCLM-C | 882.9 |
| OFS012 | 12712 East Richards Lane | 46.83 | 64 | 52.85 | 95%UCLM-N | 52.85 | 85.58 | 370 | 140 | 95%UCLM-G | 140 |
| OFS013 | 12689 East Richards Lane | 33.09 | 48 | 39.65 | 95%UCLM-N | 39.65 | 66.29 | 120 | 83.95 | 95%UCLM-N | 83.95 |
| OFS014 | 12701 East Richards Lane | 31.55 | 53 | 38.21 | 95%UCLM-N | 38.21 | 39.63 | 110 | 69.29 | 95%UCLM-G | 69.29 |
| OFS015 | 12721 East Richards Lane | 40.36 | 76 | 49.5 | 95%UCLM-N | 49.5 | 110.7 | 230 | 140 | 95%UCLM-G | 140 |
| OFS016 | 12761 East Richards Lane | 46.55 | 79 | 56.09 | 95%UCLM-N | 56.09 | 108.4 | 330 | 211.8 | 95%UCLM-C | 211.8 |
| OFS017 | 12752 East Richards Lane | 46.64 | 87 | 57.2 | 95%UCLM-N | 57.2 | 55.18 | 100 | 69.54 | 95%UCLM-N | 69.54 |
| OFS019 | 2971 South Third Street | 29.64 | 57 | 36.35 | 95%UCLM-N | 36.35 | 46.36 | 87 | 60.12 | 95%UCLM-N | 60.12 |
| OFS020 | 2973 South Third Street | 49.82 | 89 | 63.38 | 95%UCLM-N | 63.38 | 31.82 | 93 | 47 | 95%UCLM-G | 47 |
| OFS101 | 2997 Sweet Pea Lane | 53.25 | 318 | 133.5 | 95%UCLM-C | 133.5 | 103.1 | 238 | 130.4 | 95%UCLM-N | 130.4 |
| OFS102 | 2985 Sweet Pea Lane | 28.71 | 61.2 | 37.87 | 95%UCLM-N | 37.87 | 64.4 | 120 | 87.63 | 95%UCLM-N | 87.63 |
| OFS103 | 13030 Main Street | 45.77 | 116 | 66.25 | 95%UCLM-G | 66.25 | 134.5 | 665 J | 289.2 | 95%UCLM-G | 289.2 |
| OFS104 | 2851 Dana Street | 28.44 | 42.8 | 33.53 | 95%UCLM-N | 33.53 | 43.81 | 65.8 J | 54.26 | 95%UCLM-N | 54.26 |
| OFS105 | 2875 Azurite Street | 29.21 | 66.8 | 39.93 | 95%UCLM-N | 39.93 | 163 | 698 J | 388.5 | 95%UCLM-C | 388.5 |
| OFS106 | 13619 Agua Fria Lane | 40.98 | 68.3 | 49.01 | 95%UCLM-N | 49.01 | 35.1 | 81.7 | 48.06 | 95%UCLM-N | 48.06 |
| OFS107 | 13325 Prescott Street | 62.42 | 113 | 84.23 | 95%UCLM-N | 84.23 | 204.9 | 429 | 282 | 95%UCLM-N | 282 |
| OFS108 | Parcel: 402-06-028S | 70.93 | 256 | 119.7 | 95%UCLM-G | 119.7 | 268 | 1380 | 627.7 | 95%UCLM-G | 627.7 |
| OFS109 | Parcel: 402-06-028U | 50.42 | 113 | 70.02 | 95%UCLM-N | 70.02 | 224.5 | 464 | 297.7 | 95%UCLM-N | 297.7 |
| OFS110 | 2881 Second Street | 20.34 | 45.3 | 26.74 | 95%UCLM-G | 26.74 | 51.23 | 148 | 76.23 | 95%UCLM-N | 76.23 |
| OFS111 | 2925 Sweet Pea Lane | 115.6 | 290 | 165.2 | 95%UCLM-N | 165.2 | 638.8 | 1450 | 923.9 | 95%UCLM-N | 923.9 |
| OFS112 | 2680 Colina Street | 24.04 | 36.3 | 28.33 | 95%UCLM-N | 28.33 | 15.84 | 23 | 18.04 | 95%UCLM-N | 18.04 |
| OFS113 | 2655 Colina Street | 23.86 | 41.2 | 29.87 | 95%UCLM-KMC | 29.87 | 17.57 | 30.8 | 23.42 | 95%UCLM-N | 23.42 |
| OFS114 | Parcel: 401-08-012E | 74.76 | 151 | 104.3 | 95%UCLM-N | 104.3 | 51.42 | 117 | 72.49 | 95%UCLM-N | 72.49 |
| OFS115 | 13605 Agua Fria Lane | 23.92 | 56.6 | 34.51 | 95%UCLM-N | 34.51 | 36.3 | 94.1 | 66.69 | 95%UCLM-G | 66.69 |
| OFS116 | 2840 Dana Street | 114.8 | 677 | 246.1 | 95%UCLM-C | 246.1 | 52.82 | 201 | 111.2 | 95%UCLM-L | 111.2 |
| OFS117 | 2845 First Street | 54.15 | 168 | 123 | 95%UCLM-L | 123 | 49.15 | 162 J | 95.13 | 95%UCLM-G | 95.13 |
| OFS118 | 2905 Sweet Pea Lane | 147.2 | 308 | 198.4 | 95%UCLM-N | 198.4 | 1148 | 2950 | 1610 | 95%UCLM-N | 1610 |
| OFS119 | 13080 Main Street | 41.97 | 119 | 65.57 | 95%UCLM-G | 65.57 | 156 | 543 | 312.2 | 95%UCLM-G | 312.2 |
| OFS120 | 2832 Dana Street | 18.02 | 25.6 | 20.52 | 95%UCLM-N | 20.52 | 1826 | 18100 J | 19818 | Maximum | 18100 |
| OFS121 | 2660 Colina Street | 43.57 | 80 | 57.23 | 95%UCLM-N | 57.23 | 51.79 | 167 | 95.3 | 95%UCLM-G | 95.3 |
| OFS122 | 13420 Prescott Street | 21.05 | 33.1 | 25.07 | 95%UCLM-N | 25.07 | 55.88 | 192 | 123.1 | 95%UCLM-L | 123.1 |
| OFS123 | 2750 Corral Street | 20.62 | 37.3 | 26.53 | 95%UCLM-N | 26.53 | 29.28 | 65.5 | 41.21 | 95%UCLM-N | 41.21 |
| OFS124 | 2750 Corral Street | 21.97 | 37.2 | 26.73 | 95%UCLM-N | 26.73 | 36.57 | 63.9 | 47.07 | 95%UCLM-N | 47.07 |
| OFS125 | 2750 Corral Street | 17.51 | 34.5 | 22.53 | 95%UCLM-N | 22.53 | 29.31 | 68.3 | 108.9 | Maximum | 68.3 |
| OFS126 | 13645 Agua Fria Lane | 53.22 | 84.9 | 64.09 | 95%UCLM-N | 64.09 | 36 | 70.1 | 47.08 | 95%UCLM-N | 47.08 |
| OFS127 | 2973 Third Street | 75.24 | 313 | 435.6 | Maximum | 313 | 120.2 | 409 | 327.7 | 95%UCLM-C | 327.7 |
| OFS128 | 2973 Third Street | 113.9 | 633 | 737.4 | Maximum | 633 | 178.5 | 871 | 397.9 | 95%UCLM-G | 397.9 |
| OFS129 | 13394 Prescott Street | 22.55 | 34.6 | 26.7 | 95%UCLM-N | 26.7 | 42.75 | 101 | 57.46 | 95%UCLM-N | 57.46 |
| OFS130 | 2663 S. Old Black Canyon | 16.96 | 24.3 J | 18.71 | 95%UCLM-G | 18.71 | 39.37 | 65.8 J | 47.86 | 95%UCLM-N | 47.86 |
| OFS131 | 2820 Azurite Street | 18.94 | 41.6 | 24.5 | 95%UCLM-N | 24.5 | 38.03 | 63.6 | 49.76 | 95%UCLM-N | 49.76 |
| OFS132 | 2875 North Third Street | 102.5 | 176 | 130.7 | 95%UCLM-N | 130.7 | 949.7 | 4090 | 1792 | 95%UCLM-G | 1792 |
| OFS133 | 13070 Main Street | 246.9 | 679 | 368.2 | 95%UCLM-N | 368.2 | 1051 | 3130 | 1655 | 95%UCLM-N | 1655 |
| OFS134 | 12835 Main Street | 23.18 | 47.2 | 29.7 | 95%UCLM-G | 29.7 | 38.19 | 67.3 | 47.08 | 95%UCLM-N | 47.08 |
| OFS135 | 13239 Phoenix Street | 28.17 | 73.5 | 42.99 | 95%UCLM-G | 42.99 | 69.08 | 278 | 131.5 | 95%UCLM-G | 131.5 |
| OFS136 | 2820 Azurite Strret | 26.2 | 40.1 | 31.3 | 95%UCLM-N | 31.3 | 46.58 | 70.7 | 57.73 | 95%UCLM-N | 57.73 |
| OFS137 | 12821 East Chaparral Road | 15.58 | 19.6 | 17.39 | 95%UCLM-N | 17.39 | 47.68 | 93.8 | 64.98 | 95%UCLM-N | 64.98 |
| OFS138 | 2855 Hecla Street | 40.72 | 71.7 | 52.78 | 95%UCLM-N | 52.78 | 169.5 | 346 | 231.7 | 95%UCLM-N | 231.7 |

| | | Arsenic | | | | | | Lead | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Property** | **Physical Address** | **Mean Concentration (44 mg/kg Comparison)** | **Maximum Concentration (Qualifier) (66 mg/kg Comparison)** | | **95% UCL** | **Medium EPC** | **Exposure Point Concentration (41 mg/kg Comparison)** | **Mean Concentration (27 mg/kg Comparison)** | **Maximum Concentration (Qualifier) (58 mg/kg Comparison)** | | **95% UCL** | **Medium EPC** | **Exposure Point Concentration (150 mg/kg Comparison)** |
| OFS139 | 13197 Prescott Street | 16.56 | 18.9 | | 17.71 | 95%UCLM-N | 17.71 | 27.66 | 36.2 | | 30.65 | 95%UCLM-N | 30.65 |
| OFS140 | 13220 Prescott Street | 25.24 | 29.2 | J | 26.95 | 95%UCLM-N | 26.95 | 97.8 | 147 | | 118.5 | 95%UCLM-N | 118.5 |
| OFS141 | 2790 Calumet Street | 48.99 | 115 | J | 64.82 | 95%UCLM-G | 64.82 | 325.8 | 746 | | 435.2 | 95%UCLM-N | 435.2 |
| OFS142 | 13052 Main Street | 67.07 | 331 | | 377.4 | Maximum | 331 | 229.5 | 1150 | | 506.9 | 95%UCLM-G | 506.9 |
| OFS143 | 13030 Main Street | 53.04 | 146 | | 76.57 | 95%UCLM-N | 76.57 | 239.4 | 777 | | 371.6 | 95%UCLM-N | 371.6 |
| OFS144 | 13185 Prescott Street | 23.44 | 34.8 | | 27.12 | 95%UCLM-N | 27.12 | 66.55 | 119 | J | 81.99 | 95%UCLM-N | 81.99 |
| OFS145 | 13226 Phoenix Street | 33.59 | 97 | | 50.37 | 95%UCLM-G | 50.37 | 65.79 | 151 | | 88.25 | 95%UCLM-N | 88.25 |
| OFS146 | 2875 Dana Street | 30.95 | 67.7 | | 39.08 | 95%UCLM-N | 39.08 | 45.36 | 138 | | 67.66 | 95%UCLM-G | 67.66 |
| OFS147 | 2873 South First Street | 55.01 | 259 | J | 155.3 | 95%UCLM-C | 155.3 | 41.58 | 215 | | 126 | 95%UCLM-C | 126 |
| OFS148 | 2945 Sweet Pea Lane | 106.1 | 203 | | 133.1 | 95%UCLM-N | 133.1 | 557.5 | 1040 | | 692.9 | 95%UCLM-N | 692.9 |
| OFS149 | 2819 South Calumet<br>2909 South Calumet | 18.74 | 33.1 | | 22.4 | 95%UCLM-G | 22.4 | 130.4 | 362 | | 314.5 | 95%UCLM-C | 314.5 |
| OFS150 | 13530 E. Prescott Street | 14.65 | 22.5 | | 16.97 | 95%UCLM-N | 16.97 | 14.88 | 17.7 | | 16.1 | 95%UCLM-N | 16.1 |
| OFS151 | 2951 S. Third Street | 38.19 | 96.5 | | 54.82 | 95%UCLM-G | 54.82 | 111.3 | 207 | | 138.4 | 95%UCLM-N | 138.4 |
| OFS152 | 2775 S. Butte St. | 12.74 | 18.1 | | 14.37 | 95%UCLM-N | 14.37 | 21.6 | 37.6 | | 25.88 | 95%UCLM-N | 25.88 |
| OFS153 | 12838 Chaparral Alley | 24.85 | 57.6 | | 34.38 | 95%UCLM-N | 34.38 | 232.7 | 1020 | | 512.7 | 95%UCLM-G | 512.7 |
| OFS154 | 2734 S. Colina | 38.47 | 81.7 | | 49.97 | 95%UCLM-N | 49.97 | 41.18 | 126 | | 68.84 | 95%UCLM-G | 68.84 |
| OFS155 | 13370 E. Prescott St. | 32.1 | 84.9 | | 44.09 | 95%UCLM-M | 44.09 | 40.6 | 50.4 | | 44.82 | 95%UCLM-N | 44.82 |
| OFS156 | 2549 S. Parker | 39.17 | 177 | | 108 | 95%UCLM-C | 108 | 12.8 | 32 | J | 17.21 | 95%UCLM-M | 17.21 |
| OFS157 | 2560 Colina Lane | 90.57 | 538 | | 616.8 | Maximum | 538 | 51.55 | 208 | J | 275.3 | Maximum | 208 |
| OFS158 | 2630 S. Parker | 18.06 | 39.3 | | 22.84 | 95%UCLM-M | 22.84 | 13.9 | 34.9 | | 18.8 | 95%UCLM-M | 18.8 |
| OFS159 | 2555 S. Parker<br>2585 S. Parker | 18.78 | 35.4 | | 24.35 | 95%UCLM-L | 24.35 | 15.62 | 28.6 | | 19.64 | 95%UCLM-M | 19.64 |
| OFS160 | 2925 Holiday Drive | 29.17 | 36.5 | | 32.02 | 95%UCLM-N | 32.02 | 46.55 | 147 | | 69.08 | 95%UCLM-M | 69.08 |
| OFS161 | 13151 E Third Alley | 14.56 | 24.2 | | 17.41 | 95%UCLM-N | 17.41 | 25.24 | 50.2 | | 32.61 | 95%UCLM-N | 32.61 |
| OFS162 | 13029 E. Phoenix St. | 30.48 | 176 | | 101.5 | 95%UCLM-C | 101.5 | 171.2 | 1350 | | 668.5 | 99%UCLM-C | 668.5 |
| OFS163 | 2691 S. Old Black Canyon | 20.82 | 35.5 | | 25.07 | 95%UCLM-N | 25.07 | 75.84 | 373 | J | 159.9 | 95%UCLM-L | 159.9 |
| OFS164 | HWY 69 and Hill Street<br>2699 S. Hill Street | 61.91 | 191 | | 99.2 | 95%UCLM-G | 99.2 | 273.9 | 1120 | J | 491.3 | 95%UCLM-G | 491.3 |
| OFS165 | 2660 S. Jones St. | 24.7 | 44.1 | | 29.47 | 95%UCLM-N | 29.47 | 83.84 | 213 | | 118 | 95%UCLM-G | 118 |
| OFS166 | 2707 S. Colina | 24.22 | 43.5 | J | 29.46 | 95%UCLM-N | 29.46 | 20.23 | 36.3 | J | 35.63 | 95%UCLM-C | 35.63 |
| OFS167 | 3194 S. Green Valley Way<br>13601 E. Agua Fria Lane | 50.42 | 87.2 | J | 61.37 | 95%UCLM-N | 61.37 | 74.74 | 166 | J | 107.3 | 95%UCLM-N | 107.3 |
| OFS168 | 2745 S. Hecla St. | 18.35 | 32.1 | | 22.36 | 95%UCLM-N | 22.36 | 85.73 | 262 | | 144.6 | 95%UCLM-G | 144.6 |
| OFS169 | 2810 Dana St. | 16.02 | 25.7 | J- | 18.41 | 95%UCLM-N | 18.41 | 38.75 | 135 | | 74.27 | 95%UCLM-L | 74.27 |
| OFS170 | 2550 Parker<br>no physical address | 21.78 | 34.1 | J- | 25.55 | 95%UCLM-N | 25.55 | 18.62 | 35 | | 23.55 | 95%UCLM-N | 23.55 |
| OFS171 | 12516 Corley | 59.31 | 97.6 | | 73.43 | 95%UCLM-N | 73.43 | 62.77 | 110 | | 79.77 | 95%UCLM-N | 79.77 |
| OFS172 | 2591 S. Colina | 10.26 | 13.9 | | 11.77 | 95%UCLM-N | 11.77 | 9.66 | 11.8 | | 10.72 | 95%UCLM-N | 10.72 |
| OFS173 | 2725 S. Jones Street | 21.07 | 27.1 | | 23.17 | 95%UCLM-N | 23.17 | 22.27 | 32.5 | | 25.4 | 95%UCLM-N | 25.4 |
| OFS174 | 2701 S. Jones Street | 30.05 | 55.1 | | 36.4 | 95%UCLM-N | 36.4 | 51.3 | 84.9 | | 63.76 | 95%UCLM-N | 63.76 |
| OFS175 | 2583 Colina | 24.35 | 52.6 | | 32.7 | 95%UCLM-N | 32.7 | 20.94 | 52 | | 32 | 95%UCLM-G | 32 |
| OFS176 | 12972 Main Street | 35.87 | 106 | J | 55.7 | 95%UCLM-G | 55.7 | 365.9 | 760 | J | 502.8 | 95%UCLM-N | 502.8 |
| OFS177 | 12945 E. Prescott | 15.28 | 22.3 | J | 17.73 | 95%UCLM-N | 17.73 | 77.25 | 228 | J | 118.4 | 95%UCLM-G | 118.4 |
| OFS178 | 13022 E. Prescott St. | 35.32 | 79.1 | J | 46.24 | 95%UCLM-G | 46.24 | 160.5 | 234 | | 195.7 | 95%UCLM-N | 195.7 |
| OFS179 | 2816 S. Butte St. | 22.99 | 39.1 | J | 28.31 | 95%UCLM-N | 28.31 | 68.71 | 121 | | 89.4 | 95%UCLM-N | 89.4 |
| OFS180 | 2787 Hecla<br>no adress | 49.18 | 241 | J | 107.6 | 95%UCLM-C | 107.6 | 113 | 368 | | 207.7 | 95%UCLM-G | 207.7 |
| OFS181 | 2770 S. Butte | 53.48 | 102 | | 69.85 | 95%UCLM-N | 69.85 | 263.7 | 958 | | 503.8 | 95%UCLM-G | 503.8 |
| OFS182 | 13065 E. Prescott | 36.58 | 84 | | 47.26 | 95%UCLM-G | 47.26 | 316.2 | 1250 | | 588.9 | 95%UCLM-G | 588.9 |
| OFS183 | 13650 E. Agua Fria | 30.43 | 35.7 | | 32.69 | 95%UCLM-N | 32.69 | 31.09 | 39.8 | | 35.03 | 95%UCLM-N | 35.03 |
| OFS184 | 2945 S. 3rd Street | 9.84 | 14.7 | | 11.37 | 95%UCLM-N | 11.37 | 21.96 | 48 | | 29.83 | 95%UCLM-N | 29.83 |
| OFS185 | 3026 S. 3rd Street | 29.56 | 121 | J | 82.25 | 95%UCLM-C | 82.25 | 23.77 | 98.5 | | 65.37 | 95%UCLM-C | 65.37 |
| OFS186 | 2826 S. Butte St. | 12.18 | 16.9 | | 14.11 | 95%UCLM-N | 14.11 | 33.93 | 83.5 | | 45.95 | 95%UCLM-N | 45.95 |
| OFS187 | 2770 Azurite | 21.86 | 36.3 | J | 26.9 | 95%UCLM-N | 26.9 | 28.04 | 56.1 | | 37.48 | 95%UCLM-N | 37.48 |
| OFS188 | 13059 E. Prescott | 37.12 | 72.6 | | 47.1 | 95%UCLM-G | 47.1 | 193.2 | 479 | | 265.8 | 95%UCLM-N | 265.8 |
| OFS189 | no address<br>2775 Hecla | 20.59 | 32.8 | | 24.41 | 95%UCLM-N | 24.41 | 49.77 | 101 | | 64.61 | 95%UCLM-N | 64.61 |
| OFS190 | 13003 Main Street<br>13005 Main Street | 32.53 | 71.7 | J | 49.5 | 95%UCLM-L | 49.5 | 89.76 | 228 | | 164.5 | 95%UCLM-G | 164.5 |
| OFS191 | 13600 Lazy River Drive | 39.66 | 52.2 | | 43.97 | 95%UCLM-N | 43.97 | 16.7 | 27.7 | | 19.77 | 95%UCLM-N | 19.77 |
| OFS192 | 2895 S. Butte St. | 21.3 | 45.8 | J | 27.14 | 95%UCLM-M | 27.14 | 46.98 | 172 | | 76.94 | 95%UCLM-L | 76.94 |
| OFS193 | 1875 Dana | 15.67 | 21.1 | | 17.36 | 95%UCLM-N | 17.36 | 31.46 | 58.7 | | 38.4 | 95%UCLM-N | 38.4 |

| Property | Physical Address | Arsenic: Mean Concentration (44 mg/kg Comparison) | Arsenic: Maximum Concentration (Qualifier) (66 mg/kg Comparison) | | Arsenic: 95% UCL | Arsenic: Medium EPC | Arsenic: Exposure Point Concentration (41 mg/kg Comparison) | Lead: Mean Concentration (27 mg/kg Comparison) | Lead: Maximum Concentration (Qualifier) (58 mg/kg Comparison) | | Lead: 95% UCL | Lead: Medium EPC | Lead: Exposure Point Concentration (150 mg/kg Comparison) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OFS194 | 13155 Prescott | 15.8 | 25.9 | | 18.35 | 95%UCLM-N | 18.35 | 23.03 | 58.1 | | 32.99 | 95%UCLM-G | 32.99 |
| OFS195 | 12967 E. Main Street | 33.69 | 151 | | 90.85 | 95%UCLM-C | 90.85 | 112 | 350 | | 199.4 | 95%UCLM-G | 199.4 |
| OFS196 | 12928 Chaparral Alley | 27.28 | 37 | | 30.59 | 95%UCLM-N | 30.59 | 123.9 | 287 | | 167.5 | 95%UCLM-N | 167.5 |
| OFS197 | 2627 S. Reno Dr. | 14.15 | 22.9 | | 17.15 | 95%UCLM-N | 17.15 | 10.76 | 15.2 | | 12.39 | 95%UCLM-N | 12.39 |
| OFS198 | 12995 Main Street | 14.1 | 21.9 | | 17.32 | 95%UCLM-N | 17.32 | 49.82 | 113 | | 72.04 | 95%UCLM-N | 72.04 |
| OFS199 | 13611 E. Agua Fria Ln. | 57.24 | 165 | J | 85.42 | 95%UCLM-G | 85.42 | 91.35 | 253 | | 137.2 | 95%UCLM-G | 137.2 |
| OFS200 | 3360 Green Valley Way | 22.88 | 32.1 | J | 26.78 | 95%UCLM-N | 26.78 | 29.68 | 45.6 | | 36.07 | 95%UCLM-N | 36.07 |
| OFS201 | 3350 or 3250 Green Valley Way | 39.88 | 69.8 | | 51.71 | 95%UCLM-N | 51.71 | 26.97 | 89.7 | | 56.54 | 95%UCLM-G | 56.54 |
| OFS202 | 2971 S. Third Street | 20.2 | 29.9 | | 22.98 | 95%UCLM-N | 22.98 | 40.79 | 134 | | 72.74 | 95%UCLM-G | 72.74 |
| OFS203 | 13425 E. Prescott | 80.74 | 237 | | 120.3 | 95%UCLM-G | 120.3 | 175.3 | 469 | | 250.1 | 95%UCLM-N | 250.1 |
| OFS204 | 2737 Old Black Canyon | 27.22 | 35.3 | J | 30.93 | 95%UCLM-N | 30.93 | 43.09 | 56 | | 50.5 | 95%UCLM-N | 50.5 |
| OFS205 | 2749 S. Old Black Canyon | 23.24 | 39.8 | J | 27.33 | 95%UCLM-N | 27.33 | 38.72 | 76.6 | | 55.06 | 95%UCLM-L | 55.06 |
| OFS206 | 13211 or 13215 Shawnee Lane | 22.35 | 26.5 | | 24.17 | 95%UCLM-N | 24.17 | 42.47 | 64.2 | | 49.69 | 95%UCLM-N | 49.69 |
| OFS207 | 2745 Jones St. | 18.33 | 35.6 | | 23.57 | 95%UCLM-N | 23.57 | 23.08 | 46.7 | | 31.53 | 95%UCLM-G | 31.53 |
| OFS208 | 2565 Hill Street | 101.4 | 817 | | 893.1 | Maximum | 817 | 81.58 | 576 | | 629.1 | Maximum | 576 |
| OFS209 | 2669 Hill Street | 18.05 | 33 | | 22.69 | 95%UCLM-N | 22.69 | 16.88 | 34.9 | | 23.53 | 95%UCLM-G | 23.53 |
| OFS210 | 2858 Hill Street | 22.24 | 42.9 | | 27.3 | 95%UCLM-N | 27.3 | 23.19 | 41 | | 28.58 | 95%UCLM-N | 28.58 |
| OFS211 | 2557 S. Hill Street | 21.62 | 35.7 | | 25.65 | 95%UCLM-N | 25.65 | 62.74 | 253 | | 134.8 | 95%UCLM-L | 134.8 |
| OFS212 | 2578 Huron St. | 12.31 | 16.1 | J | 13.44 | 95%UCLM-N | 13.44 | 12.45 | 28.2 | J | 15.83 | 95%UCLM-G | 15.83 |
| OFS213 | 13190 Prescott St. | 38.48 | 66.4 | | 48.7 | 95%UCLM-N | 48.7 | 147.6 | 343 | | 199.1 | 95%UCLM-N | 199.1 |
| OFS214 | 12767 E. Richards Ln. no physical address | 36.5 | 51.6 | | 42.99 | 95%UCLM-N | 42.99 | 136 | 274 | | 189 | 95%UCLM-N | 189 |
| OFS215 | 2910 S. Third 2940 S. Third | 106.6 | 441 | | 207.7 | 95%UCLM-G | 207.7 | 111.6 | 515 | | 218.5 | 95%UCLM-G | 218.5 |
| OFS216 | 2690 Butte St. | 16.21 | 31.9 | J | 19.94 | 95%UCLM-G | 19.94 | 22.1 | 39 | J | 26.26 | 95%UCLM-N | 26.26 |
| OFS217 | 13070 Phoenix St. | 17.69 | 22.8 | J | 19.3 | 95%UCLM-N | 19.3 | 22.01 | 35.3 | J | 26.08 | 95%UCLM-N | 26.08 |
| OFS218 | 2595 Hill Street | 24.43 | 69.6 | J | 37.98 | 95%UCLM-G | 37.98 | 55.07 | 202 | | 98.69 | 95%UCLM-G | 98.69 |
| OFS219 | 2625 Hill Street | 16.12 | 26.5 | J | 19.2 | 95%UCLM-N | 19.2 | 18.17 | 28.5 | | 22.52 | 95%UCLM-N | 22.52 |
| OFS220 | 2631 Hill Street 2635 Hill Street | 22.12 | 37 | | 27 | 95%UCLM-N | 27 | 27.12 | 48 | | 33.43 | 95%UCLM-N | 33.43 |
| OFS221 | 13475 E. Prescott | 75.33 | 150 | | 99.35 | 95%UCLM-N | 99.35 | 136.7 | 307 | | 192.7 | 95%UCLM-N | 192.7 |
| OFS222 | 2820 Hecla | 54.6 | 175 | | 85.53 | 95%UCLM-G | 85.53 | 1102 | 9150 | | 10008 | Maximum | 9150 |
| OFS223 | 12743 Richards Lane | 134.2 | 579 | | 253.1 | 95%UCLM-G | 253.1 | 219.3 | 456 | | 296.2 | 95%UCLM-N | 296.2 |
| OFS224 | 12770 E. Richards | 36.99 | 78.7 | | 48.51 | 95%UCLM-N | 48.51 | 69.63 | 185 | | 98.56 | 95%UCLM-N | 98.56 |
| OFS225 | 12732 E. Richards 12773 E. Richards | 82.51 | 157 | | 119.1 | 95%UCLM-G | 119.1 | 153 | 351 | | 209.6 | 95%UCLM-N | 209.6 |
| OFS226 | 12818 E. Richards 12708 E. Richards | 207 | 618 | | 336.4 | 95%UCLM-G | 336.4 | 312.5 | 904 | | 462.8 | 95%UCLM-N | 462.8 |
| OFS227 | no address 2670 S JONES ST | 134.6 | 667 | J | 759.5 | Maximum | 667 | 260.3 | 1270 | J | 535 | 95%UCLM-G | 535 |
| OFS228 | 2655 S JONES ST . | 17.88 | 36.6 | | 22.99 | 95%UCLM-N | 22.99 | 60.51 | 107 | J | 81.07 | 95%UCLM-N | 81.07 |
| OFS229 | 13336 E WELLS ST . | 130.5 | 652 | | 299.3 | 95%UCLM-G | 299.3 | 572.6 | 2360 | | 1322 | 95%UCLM-G | 1322 |
| OFS230 | 2745 Calumet St. | 31.39 | 135 | | 54.93 | 95%UCLM-G | 54.93 | 144.9 | 1060 | | 1159 | Maximum | 1060 |
| OFS231 | 2778 Hecla St. | 22.54 | 30.2 | J | 25.65 | 95%UCLM-N | 25.65 | 74.63 | 150 | | 95.73 | 95%UCLM-N | 95.73 |
| OFS232 | 12908 Main St. | 16.78 | 28.1 | J | 20.09 | 95%UCLM-N | 20.09 | 768.7 | 7310 | | 8001 | Maximum | 7310 |
| OFS233 | 2931 S. Third Street | 44.32 | 64.2 | J | 51.92 | 95%UCLM-N | 51.92 | 298.7 | 633 | J | 416.8 | 95%UCLM-N | 416.8 |
| OFS234 | 2645 S JONES ST . | 27.33 | 40.7 | J | 31.07 | 95%UCLM-N | 31.07 | 90.58 | 184 | J | 115.2 | 95%UCLM-N | 115.2 |
| OFS235 | 13230 E THIRD ST . | 29.62 | 37.9 | | 32.81 | 95%UCLM-N | 32.81 | 44.49 | 69.8 | J | 54.63 | 95%UCLM-N | 54.63 |
| OFS236 | 2685 Jones St. | 36.95 | 52.3 | | 43.44 | 95%UCLM-N | 43.44 | 104.9 | 150 | | 160.8 | Maximum | 150 |
| OFS237 | 2900 or 2930 Holiday Dr. | 40.58 | 73.7 | | 52.42 | 95%UCLM-N | 52.42 | 52.09 | 80.1 | | 64.3 | 95%UCLM-N | 64.3 |
| OFS238 | 13150 Prescott St. | 19.13 | 21.9 | | 20.62 | 95%UCLM-N | 20.62 | 43.09 | 63.4 | | 50.66 | 95%UCLM-N | 50.66 |
| OFS239 | 13215 Prescott St. | 20.38 | 26.3 | | 22.62 | 95%UCLM-N | 22.62 | 42.15 | 87.3 | | 55.23 | 95%UCLM-N | 55.23 |
| OFS240 | 2874 Dana St. | 21.94 | 34.2 | | 27.11 | 95%UCLM-N | 27.11 | 47.1 | 112 | | 67.91 | 95%UCLM-N | 67.91 |
| OFS241 | 2630 Hill Street | 18.23 | 28.7 | | 21.01 | 95%UCLM-N | 21.01 | 19.19 | 37.6 | | 23.85 | 95%UCLM-N | 23.85 |
| OFS242 | 13825 Bradshaw | 53.07 | 82.8 | | 60.46 | 95%UCLM-M | 60.46 | 25.73 | 40.4 | | 30.17 | 95%UCLM-N | 30.17 |
| OFS243 | 13165 Prescott St. | 21.87 | 28.8 | J+ | 24.42 | 95%UCLM-N | 24.42 | 40.7 | 89.6 | | 60.17 | 95%UCLM-G | 60.17 |
| OFS244 | 2575 Hill Street | 58.01 | 339 | J+ | 377.1 | Maximum | 339 | 20.34 | 40.3 | | 25.55 | 95%UCLM-N | 25.55 |
| OFS245 | 1660 S. Colina Lane | 11.75 | 18.2 | | 13.68 | 95%UCLM-N | 13.68 | 8.19 | 10.9 | | 9.234 | 95%UCLM-N | 9.234 |
| OFS246 | 13330 E WELLS ST . 13318 E. Wells St. | 109.9 | 525 | | 215.5 | 95%UCLM-G | 215.5 | 349.6 | 2120 | | 755.5 | 95%UCLM-C | 755.5 |
| OFS247 | 13032 E. Prescott St. | 105.2 | 785 | | 858.8 | Maximum | 785 | 173.4 | 1170 | | 453.5 | 95%UCLM-G | 453.5 |
| OFS248 | 2797 Dana Street/1861 Dana | 27.47 | 38.1 | J | 31.56 | 95%UCLM-N | 31.56 | 59.98 | 201 | | 98.23 | 95%UCLM-G | 98.23 |

| Property | Physical Address | Arsenic | | | | | | Lead | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean Concentration (44 mg/kg Comparison) | Maximum Concentration (Qualifier) (66 mg/kg Comparison) | | 95% UCL | Medium EPC | Exposure Point Concentration (41 mg/kg Comparison) | Mean Concentration (27 mg/kg Comparison) | Maximum Concentration (Qualifier) (58 mg/kg Comparison) | | 95% UCL | Medium EPC | Exposure Point Concentration (150 mg/kg Comparison) |
| OFS249 | 2885 S. Omega | 12.54 | 15.4 | J | 13.63 | 95%UCLM-N | 13.63 | 11.69 | 19.3 | | 13.44 | 95%UCLM-M | 13.44 |
| OFS250 | 2280 Edd's Sand Trail | 21.03 | 35 | | 24.7 | 95%UCLM-N | 24.7 | 32.36 | 61.4 | J | 42.07 | 95%UCLM-N | 42.07 |
| OFS251 | 2735 S Corral St | 33.06 | 170 | | 100.1 | 95%UCLM-C | 100.1 | 10.64 | 15.3 | J | 12.08 | 95%UCLM-N | 12.08 |
| OFS252 | 3047 S. Third St. | 37.45 | 48.9 | | 43.39 | 95%UCLM-N | 43.39 | 84.65 | 140 | | 104.2 | 95%UCLM-N | 104.2 |
| OFS253 | 2846 S. Holiday Dr. | 58.01 | 77.8 | | 65.25 | 95%UCLM-N | 65.25 | 58.41 | 99.4 | | 71.88 | 95%UCLM-N | 71.88 |
| OFS254 | 2480 S. S.R. 69 | 53.13 | 119 | | 71.06 | 95%UCLM-G | 71.06 | 52.01 | 139 | | 77.38 | 95%UCLM-G | 77.38 |
| OFS255 | 2430 S. S.R. 69 | 30.4 | 51.8 | | 37.96 | 95%UCLM-N | 37.96 | 31.38 | 64 | | 41.11 | 95%UCLM-N | 41.11 |
| OFS256 | 13220 E THIRD ST . | 29.45 | 36.2 | | 31.66 | 95%UCLM-N | 31.66 | 31.8 | 46.8 | | 38.68 | 95%UCLM-N | 38.68 |
| OFS257 | 2650 Butte St. | 23.68 | 28.9 | | 26.87 | 95%UCLM-N | 26.87 | 47.98 | 69.9 | | 58.96 | 95%UCLM-N | 58.96 |
| OFS258 | 13300 E WELLS ST . | 39.47 | 89.9 | | 52.69 | 95%UCLM-G | 52.69 | 148 | 516 | | 255.6 | 95%UCLM-G | 255.6 |
| OFS259 | Third Alley and Sweet Pea Alley (East-West Alley - Parsons) | 30.44 | 52.4 | | 35.75 | 95%UCLM-G | 35.75 | 56.14 | 119 | | 111.3 | 95%UCLM-C | 111.3 |
| OFS260 | Third Alley and Sweet Pea Alley (Northwest to Southeast) | 157.6 | 348 | | 205.9 | 95%UCLM-N | 205.9 | 746.8 | 1820 | | 1025 | 95%UCLM-N | 1025 |
| OFS261 | 13625 E. Lazy River Dr. | 53.82 | 70.8 | | 58.24 | 95%UCLM-N | 58.24 | 45 | 164 | | 73.85 | 95%UCLM-G | 73.85 |
| OFS262 | 13040 E. Phoenix St. | 27 | 44.7 | | 33.29 | 95%UCLM-N | 33.29 | 89.5 | 305 | | 179.7 | 95%UCLM-G | 179.7 |
| OFS263 | 2792 Dana Street | 20.86 | 30.7 | | 23.33 | 95%UCLM-N | 23.33 | 28.04 | 75.1 | | 38.77 | 95%UCLM-M | 38.77 |
| OFS264 | East of NAI Trailer | 307.7 | 741 | | 417.9 | 95%UCLM-N | 417.9 | 195.1 | 419 | | 255.7 | 95%UCLM-N | 255.7 |
| OFS265 | 2790 S. Azurite | 34.25 | 66.4 | | 43.32 | 95%UCLM-G | 43.32 | 78.93 | 196 | | 123.8 | 95%UCLM-G | 123.8 |
| OFS266 | Town Hall - Joel Berman | 13.32 | 14.9 | | 14.02 | 95%UCLM-N | 14.02 | 12.32 | 18.4 | | 14.43 | 95%UCLM-N | 14.43 |
| OFS267 | 2689 Hill Street | 65.78 | 128 | | 86.31 | 95%UCLM-N | 86.31 | 139.7 | 285 | | 193.1 | 95%UCLM-N | 193.1 |
| OFS268 | Lazy River Drive | 67.49 | 124 | | 90.58 | 95%UCLM-G | 90.58 | 91.7 | 234 | | 153.1 | 95%UCLM-G | 153.1 |

Definitions:
95%UCL = 95 percent upper confidence limit of the mean
NA = Not Applicable
mg/kg = milligrams per kilogram
USEPA = United States Environmental Protection Agency

Notes:
Statistics calculated by the USEPA program ProUCL 4.0. ProUCL outputs are presented in Appendix X.
Low %Detects indicates low percentage of detects.
UCLM>Maximum indicates that the recommended 95 UCL exceeds the maximum detected value, therefore the maximum detected value is used.
95%UCLM-N indicates that the 95 percent upper confidence limit on the mean is based on the student's t-test for normal distributions.
95%UCLM-C indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Chebyshev test.
99%UCLM-C indicates that the 99 percent upper confidence limit on the mean is based on the non-parametric Chebyshev test.
95%UCLM-L indicates that the 95 percent upper confidence limit on the mean is based on the Land (H) statistic for lognormal distributions.
95%UCLM-G indicates that the 95 percent upper confidence limit on the mean is based on the approximate or adjusted gamma distribution.
95%UCLM-M indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric modified t-test.
97.5%UCLM-C indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Chebyshev test.
95%UCLM-KMC indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) Chebyshev test.
95%UCLM-BCA indicates that the 95 percent upper confidence limit on the mean is based on the Kaplan-Meier (KM) Bias-Corrected Accelerated (BCA) percentile bootstrap test.
USEPA 1994 = The arithmetic mean is used per USEPA lead model guidance (USEPA 1994).

# C Laboratory Data Sheets

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# D Photo Documentation

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**ECOLOGY AND ENVIRONMENT, INC.**
**Superfund Technical Assessment and Response Team**
Iron King Mine – Humboldt Smelter Assessment
Dewey-Humboldt, Yavapai County, Arizona

E&E Project. No.: 002693. 2110.01RA

TDD No: TO2-09-10-09-0004
Contract No. EP-S5-08-01

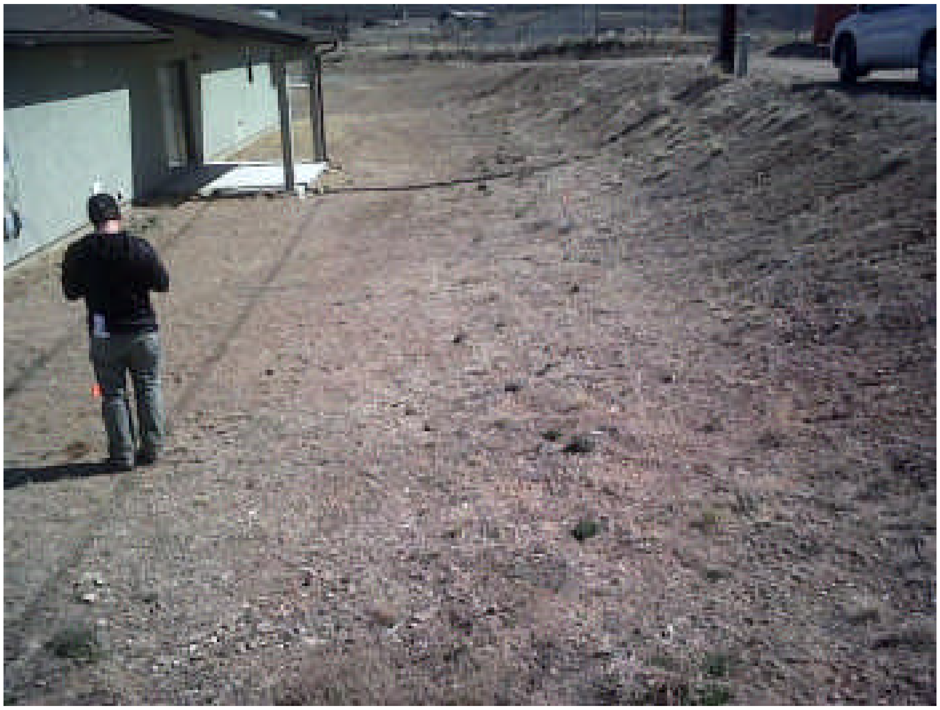

**PHOTO 1**

**Date**: 3/8/11

**Direction**: Southeast

**Photographer**: M. Tymkow, START

**Description**: START member C. Myers flags sampling location in front of OFS-301 home on Sweet Pea Lane.

**PHOTO 2**

**Date**: 3/8/11

**Direction**: Northwest

**Photographer**: M. Schwennesen, START

**Description**: Area of confirmed "hot spot" (in front of boat trailer) at OFS-208, South Hill Street.

E&E Project. No.: 002693. 2110.01RA

TDD No: TO2-09-10-09-0004
Contract No. EP-S5-08-01

**PHOTO 3**

**Date**: 3/8/11

**Direction**: West

**Photographer**: M. Schwennesen, START

**Description**: Small tailings pile visible as artificial ridge in the middle distance.

**PHOTO 4**

**Date**: 3/8/11

**Direction**: North

**Photographer**: M. Schwennesen, START

**Description**: Top of Small Tailings Pile.

# D3. Removal Report
(Ecology and Environment, Inc., 2012)

09:002693.2155.01RF

# Iron King Mine – Humboldt Smelter
# Removal Report
# Dewey-Humboldt
# Yavapai County, Arizona

**Contract Number: EP-S5-08-01**
**TDD No.: T02-09-11-08-0005**
**PAN No.: 002693.2155.01RF**

**June 2012**

**Prepared for:**

**U.S. ENVIRONMENTAL PROTECTION AGENCY**
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**Prepared by:**

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Lakewood, California 90712

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# Table of Contents

**Section** **Page**

**Table of Contents (cont.)**

**Section** **Page**

# List of Tables

**Table** **Page**

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# List of Figures

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# List of Abbreviations and Acronyms

| | |
|---|---|
| ADEQ | Arizona Department of Environmental Quality |
| bgs | Below ground surface |
| CAM | California Assessment Manual |
| E & E | Ecology and Environment, Inc. |
| ERRS | U.S. EPA Emergency and Rapid Response Services contractor |
| ERS | Emergency Response Section |
| ERT | U.S. EPA Environmental Response Team |
| FOSC | Federal On-Scene Coordinator |
| GPS | Global Positioning System |
| MS/MSD | Matrix Spike/Matrix Spike Duplicate |
| mg/kg | Milligrams per kilogram |
| $mg/m^3$ | Milligrams per cubic meter |
| MDI | Material Delivery, Inc. |
| NAI | North American Industries |
| NPL | National Priorities List |
| RA | Removal Assessment |
| RCRA | Resource Conservation and Recovery Act |
| RI | Remedial Investigation |
| SAP | Sampling and Analysis Plan |
| START | Superfund Technical Assessment and Response Team |
| U.S. EPA | United States Environmental Protection Agency |

# 1 Introduction

From September 13, 2011, through November 15, 2011, the United States Environmental Protection Agency (U.S. EPA), Region 9 Emergency Response Section conducted a removal of arsenic- and lead-contaminated soil at the Iron King Mine – Humboldt Smelter Superfund Site (the site), located in Dewey-Humboldt, Arizona. U.S EPA Federal On-Scene Coordinator (FOSC) Craig Benson tasked the Ecology and Environment, Inc. (E & E) Superfund Technical Assessment and Response Team (START) to provide technical assistance to support the removal. The removal was conducted after a U.S. EPA/START assessment determined that 13 properties within the site should be subject to a time-critical removal action (TCRA). The assessment activities were documented in the START document, *Iron King Mine – Humboldt Smelter Assessment Report, Dewey-Humboldt, Yavapai County, Arizona* (September 2011) (Technical Direction Document No. T02-09-10-09-0004). The TCRA described in this report is an interim U.S. EPA removal activity while U.S. EPA works toward identifying a long-term remedial action for the site.

The TCRA consisted of the removal of surface and near-surface contaminated soil from 11 private residential properties and from one municipal property. At one additional residential property, a small tailings pile (STP) of approximately 21,500 cubic yards was removed and placed on the main tailings pile at the Iron King Mine. As an additional remedial action under the TCRA, ash material on the Humboldt Smelter property was sprayed with a fixative agent to minimize dispersal of the ash by wind and rain.

This report describes the activities conducted to perform the TCRA.

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# 2 Site Description

## 2.1 Site Location

The Iron King Mine – Humboldt Smelter site is located in Dewey-Humboldt, Yavapai County, Arizona (Appendix A, Figure 1). The approximate geographical coordinates of the Dewey-Humboldt town hall are latitude 34.503043° north; longitude 112.243559° west. The town of Dewey-Humboldt was incorporated on December 20, 2004, from the existing unincorporated towns of Dewey and Humboldt, located adjacent to one another in the Agua Fria River Valley, 11 miles east of Prescott, Arizona. Dewey-Humboldt is located between the mine and the smelter (Appendix A, Figure 2). The population of the town was 3,613 in 2005 according to a census estimate. Three waterways (Chaparral Gulch, Galena Gulch, and Agua Fria River) transect the site.

## 2.2 Iron King Mine

The Iron King Mine property is approximately 153 acres in size. It is located west of Highway 69, bordered by the Chaparral Gulch and residences to the north; Highway 69 to the east; Galena Gulch to the south; and undeveloped land to the west. The Iron King Mine was a periodically-active gold, silver, copper, lead, and zinc mine from 1906 until 1969. The present owner of the 85-acre portion of the Iron King Mine area of interest referred to as the Iron King Mine Proper Area is North American Industries (NAI), which produces Hydromax fertilizers and soil supplements. Previous ownership included Ironite Products Company, which marketed Ironite fertilizer produced from mine tailings from 1989 to 2006. The principal feature of the Iron King Mine Proper Area is a large (more than 50 acres) tailings pile that contains high concentrations of arsenic and lead. The tailings are subject to off-site migration mainly via air particulate migration and surface water transport.

## 2.3 Humboldt Smelter

The Humboldt Smelter property is located less than one mile east of the Iron King Mine property, on the east side of Highway 69. The approximately 189-acre smelter property is bounded by residences to the north and west; the Agua Fria River to the east; and Chaparral Gulch to the south. The majority of the Humboldt Smelter is owned by Greenfields Enterprises, LLC, which purchased the property in 2003. No businesses are currently operating on the property. The Humboldt Smelter area of interest includes tailings and slag deposit areas and numerous ash piles. The ash pile material has been subject to off-site migration mainly via air particulate migration and surface water transport.

## 2.4 Small Tailings Pile

The STP was comprised of approximately 21,500 cubic yards of mine tailings containing high concentrations of arsenic and lead and detectable concentrations of cyanide. It was located immediately to the north of the Iron King Mine Proper Area on a 40-acre private parcel designated as OFS-002[1]. Although located on private residential property, the STP was associated with historical mining activities at the Iron King Mine. Anecdotal information from NAI President S. Schuchardt suggests that the STP resulted from a short-lived gold and silver extraction processing attempt that was conducted in or around the 1960s. Mining of the same ore also resulted in the main tailings pile on NAI property (primarily for zinc recovery), but a cyanide extraction process was used in an Iron King Mine operations area, and the slurry was either hydraulically conveyed or piped to a tailings pond at the STP location.

The Chaparral Gulch bordered the STP to the northeast-to-southeast. Surface water readily flowed in, around, and through the area into the Upper Chaparral Gulch. Hay Bale Ravine bordered the STP to the south and flowed northeast into Chaparral Gulch (Appendix A, Figure 3). There were no storm water controls mitigating surface water migration from this area. In addition, much of this area was devoid of vegetation, and STP soils were subject to migration. The STP was considered source material because it is a source of contamination to other media such as surface water and air.

The STP was removed as part of the activities described in this report. The STP material was placed on the main tailings pile at Iron King Mine.

[1] Previous site studies at the Iron King Mine – Humboldt Smelter used the term “OFS”, which stands for “off-site soil”, to describe in-town soil sample properties. To avoid confusion when comparing new data to old data for particular properties, the convention of using “OFS” is continued although the properties are no longer considered “off site.”

# 3 Previous Investigations

At least 185 residential and commercial properties located in the town of Dewey-Humboldt have been sampled to date in an effort to evaluate metals (primarily arsenic and lead) contamination in shallow soils (surface to up to 18-inch-depth profile). Sample locations have been selected from parcels that were suspected of being impacted by historical mining and smelting operations. In general, for those parcels found to exhibit arsenic and lead above background concentrations, the near surface soils (i.e., 0 – 2 inches below ground surface [bgs]) of these parcels are impacted to a higher degree than the deeper surface soils (i.e., 10 – 18 inches bgs). Parcels with elevated arsenic and lead have been found to be located in closer proximity to the Iron King Mine and Humboldt Smelter. Parcels farther away from these source areas are less likely to have been impacted from particulate migration or surface water transport. A map showing all in-town parcels that were either sampled or were visually assessed and determined to not require sampling is provided in Appendix A, Figure 4.

## 3.1 Arizona Department of Environmental Quality, 2002

In April 2002, the Arizona Department of Environmental Quality (ADEQ) sampled sediment near residential parcels throughout the Chaparral Gulch as part of a Preliminary Assessment/Site Inspection. The investigation revealed arsenic concentrations of up to 509 milligrams per kilogram (mg/kg) and lead concentrations of up to 513 mg/kg. The current U.S. EPA Regional Screening Levels for arsenic and lead in residential soil are 0.39 and 400 mg/kg, respectively. As discussed in Section 4, the current site-specific background concentrations for arsenic and lead in the Dewey-Humboldt area, determined by EA Engineering, Science and Technology, Inc. (EA) on behalf of the U.S. EPA Remedial Program, have been determined to be 38 and 23 mg/kg, respectively (EA, 2011).

## 3.2 U.S. EPA/START 2005

In 2005, ADEQ requested that the U.S. EPA assess surface soils at residential properties in the vicinity of the Chaparral Gulch and Iron King Mine. In response to the request, the U.S. EPA and START conducted a site assessment of 17 properties along the Chaparral Gulch (E & E, 2005). Soil samples were collected to determine arsenic and lead concentrations on these properties. Ten samples were collected from each property, which included nine surface samples (0-6 inches bgs) and one subsurface sample (18 inches bgs). Analytical results from the sampling event identified lead and arsenic concentrations in surface soil samples at four of the properties that were sufficiently high to warrant a removal action. The removal action was conducted by Brown and Caldwell in late 2006 (EA, 2010).

## 3.3 EA Engineering, Science and Technology, Inc., 2008-2010

In 2008, the Iron King Mine – Humboldt Smelter site was listed on the National Priorities List (NPL), and a Remedial Investigation (RI) was conducted by EA for the U.S. EPA's Remedial Program. From 2008 to 2010, as part of the RI, EA collected soil samples at 168 parcels within the town. The parcels sampled were selected from areas suspected of being impacted by historical mining and smelting operations (based on wind patterns) and where homeowner sampling access agreements could be obtained. The objective of the RI sampling was to identify levels of metals contamination in soil resulting from the site, and specifically to evaluate impacts on the community of Dewey-Humboldt. Nine discrete samples from the 0 to 2-inch depth interval and one discrete sample from the 10 to 12-inch depth interval were collected at each parcel. The deeper-depth interval was selected at random from beneath one of the nine surface sample locations. The nine surface sample locations were selected on a parcel-by-parcel basis (judgmentally) with an attempt to be spatially representative while taking into account site features (e.g., driveways and landscaping) and roof drainage patterns. The RI samples were analyzed for 23 "target analyte list" metals, including arsenic and lead.

Also as part of the RI, EA collected background soil samples from several different soil types and areas about the site. Background Soil Type 1 was identified as the predominant soil type for the study area, and a background concentration of 48 mg/kg for arsenic and 44 mg/kg for lead was established (EA, 2010). A subsequent addendum to the EA RI report revised the average background concentrations of arsenic and lead in Soil Type 1 to 38 and 23 mg/kg, respectively (EA, 2011).

## 3.4 U.S. EPA Removal Assessment

In the fall of 2010, the U.S. EPA Remedial Program requested that the U.S. EPA Emergency Response Section provide support to conduct a Removal Assessment (RA) at the site. The RA included site inspections and additional sampling in order to determine what properties should be subject to a TCRA. The RA determined that 13 properties should be subject to the TCRA. The properties are listed in Appendix A, Table 1. The RA was documented in the START report, *Iron King Mine – Humboldt Smelter Assessment Report, Dewey-Humboldt, Yavapai County, Arizona* (September 2011) (TDD No. T02-09-10-09-0004).

# 4 U.S. EPA and START Removal Activities

Removal activities were conducted from September 13, 2011, through November 15, 2011. Appendix A, Figure 4 presents a map of all properties previously investigated at the site and indicates the properties where removals were conducted. Four types of removal activities were conducted at the site:

- Removal of arsenic- and lead-contaminated soil at 11 residential properties and at one municipal property. This activity also included confirmation soil sampling, site restoration to pre-removal conditions using clean borrow material, and hydroseeding of removed, stockpiled soil.
- Periodic sampling of borrow material prior to use, to ensure that the material was not contaminated with arsenic or lead at concentrations greater than the site-specific action levels.
- Application of Gorilla-Snot® fixative agent to the surface of ash piles at the Humboldt Smelter to reduce ash dispersion by wind or rain.
- Removal of the STP and restoration of the surface water drainage pathway that was blocked by the pile. This activity also included confirmation soil sampling to document post-removal conditions, and hydroseeding of removed, stockpiled tailings.

During the previous U.S. EPA assessment activities at the site, it became evident to the U.S. EPA and START that the most-contaminated properties identified for the TCRA were, in all but one case, grouped around Sweet Pea Lane and that the grouping was not consistent with arsenic and lead contamination being caused by wind distribution or surface water deposition from Iron King Mine or Humboldt Smelter. As removal work progressed, all properties subject to the TCRA along the Sweet Pea Lane corridor were found to still contain concentrations of arsenic and/or lead at a two-foot depth that exceeded the site-specific action levels for these analytes. Historical aerial photographs showed that the area of Sweet Pea Lane was the location of a former railroad spur leading into the Humboldt Smelter. Local citizens visiting the U.S. EPA command post at the site during the removal confirmed the railroad's previous existence and, in one case, described how the railroad bed had been bulldozed flat in order to make an area for houses to be built upon, on the northeast side of Sweet Pea Lane. Corroboration of the bulldozing was found in the form of heavy iron girder pieces and railroad ties that were uncovered and removed during U.S. EPA removal activities at some of the properties.

Site-specific action levels for all removal work conducted at the site were determined by the U.S. EPA to be:

- 38 mg/kg for arsenic
- 23 mg/kg for lead.

These action levels are based on average concentrations of arsenic and lead in soil in the vicinity of the site, determined through an interim U.S. EPA background study (EA, 2011). Additional background information is being collected by the U.S. EPA and the average background concentrations for arsenic and lead are likely to be revised over time.

## 4.1 General Information Regarding Removal Activities

During the period September 13, 2011, through November 7, 2011, 12 residential and municipal properties were excavated; confirmation sampling was conducted; and the removed soil was replaced with clean fill material. In certain cases, fences or small structures that had been removed to facilitate soil removal were replaced, and some properties were re-sodded or hydroseeded.

During the period October 27, 2011, through November 15, 2011, the STP was removed and the removal area was re-shaped to restore the original drainage pathway into Chaparral Gulch.

All removal work was conducted in accordance with the *Iron King Mine – Humboldt Smelter Removal Work Plan* (Work Plan) (September 2011). The Work Plan was prepared by the U.S. EPA's Emergency and Rapid Response Services (ERRS) contractor, with some support from the START. Confirmation sampling was conducted in accordance with Appendix D of the Work Plan, the START-prepared *Sampling and Analysis Plan, Iron King Mine – Humboldt Smelter Removal, Yavapai County, Arizona* (SAP) (September 2011) (Appendix B). The SAP includes a consolidated health and safety plan functional for the START, ERRS, and U.S. EPA as an appendix.

There were no deviations from the Work Plan or SAP, with the following two exceptions:

- Nine borrow material samples were analyzed for a different analytical suite than specified in the Work Plan (see Sections 4.1.3 and 4.1.6).
- One sample from the STP was analyzed for additional analytical parameters at U.S. EPA request (see Sections 4.1.3 and 4.3.4).

### 4.1.1 Property Assessment Form and Access Agreements

Prior to the removal activities, the U.S. EPA obtained signed access agreements from all property owners subject to the TCRA. In addition, FOSC Benson, a representative of the START, and a representative of the U.S. EPA's ERRS contractor met with each property owner and discussed the planned removal activities; the methods for dealing with underground utilities; the method for dealing with outdoor pets; and other issues. Information was solicited from the property owners regarding their knowledge of septic tank and leach field locations and other underground utility locations. A "Pre-Removal and Post-Restoration Property Assessment Form" was filled out for each property, which the property owner signed twice: once before the removal was conducted, and once after the removal was completed and found acceptable by the property owner. Copies of the Pre-Removal and Post-Restoration Property Assessment Forms for each property are maintained in the project file. For the STP, because the STP is at a distance from the owner's home, no property assessment form was prepared. However, an access agreement was obtained.

### 4.1.2 Sampling Design

Removals at each property were conducted as described in the Work Plan. Excavators, backhoes, bobcats, and skid steers were used to remove contaminated soil into dump trucks, and hand-shoveling was employed to remove soil near foundations, fences, trees, and subsurface utilities. The U.S. EPA *Superfund Lead-Contaminated Residential Sites Handbook* (OSWER Directive 9285.7-50) (August, 2003) (Lead Handbook) was referenced during development of the sampling design and was used as a guideline where possible.

Following guidelines in the Lead Handbook, the START collected removal confirmation composite samples after a one-foot lift of contaminated soil had been removed, with one five-point composite sample collected from each front, back, and side yard of a residential property. In all cases, the five points of the composite sample were well-distributed in order to best-represent the area being sampled, and all samples were obtained from a depth of 0-2 inches. This procedure was also used for individual hot spot removals.

If composite samples from any area exceeded the site-specific action levels for arsenic and/or lead, another one-foot lift was removed in that area and another composite sample was then collected at the two-foot depth. In cases where contaminated soil was still found at the two-foot depth, plastic snow fence material was placed at that depth prior to placing backfill material in the excavation. The intention for the placement of the snow fence was to provide a visual barrier between clean backfill material and the still-contaminated soil beneath it. In some cases, by U.S. EPA decision, some properties were excavated directly to a two-foot depth, and other properties were pot-holed to one- and two-foot depths to determine the depth to be excavated. At properties where excavations were conducted initially to a one-foot depth, these properties were put on a stand-by status and protected with temporary fencing pending receipt and review of the confirmation sample analytical results.

### 4.1.3 Sample Analysis and Data Validation

All samples were submitted to TestAmerica Laboratories, Inc. (TestAmerica) in Phoenix, Arizona, for analysis. All samples were analyzed for total arsenic and total lead by U.S. EPA Method 6010B. All but nine borrow area samples were analyzed for eight Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). Nine borrow samples were only analyzed for total arsenic and lead. As discussed in Section 4.3.4, one sample collected from the STP was analyzed for 17 California Assessment Manual metals (CAM-17 metals) and for total cyanide.

A START chemist performed a Tier 2 validation of all sample data in accordance with *Quality Assurance/Quality Control Guidance for Removal Activities, Sampling QA/QC Plan and Data Validation Procedures* (1990), *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (2004), and *U.S. EPA Region IX Superfund Data Evaluation/ Validation Guidance R9QA/006* (2001). Blind duplicate samples were submitted with the samples at a frequency of approximately 10 percent, and additional sample volumes were provided for matrix spike/matrix spike duplicate (MS/MSD) sample analysis at a frequency of approximately 5 percent. The duplicate and MS/MSD results were evaluated as part of the data validation process. The data were found to be acceptable as definitive category data, and the data were determined to be usable to meet project use objectives. The data validation reports are archived in the project file. Validated laboratory data sheets are presented in Appendix C.

### 4.1.4 Air Monitoring and Sampling

A weather station with logging capability was operated during all removal operations. The weather station measured and logged wind direction, speed, temperature, and other weather factors on a per-minute basis, and the resulting data are archived in the START project file. Continuous air monitoring and air sampling was conducted by the START for every day that removal operations involving the movement of soil or tailings occurred. Three to four air stations (depending on the activities being conducted and the extent of the disturbed area) were placed about the perimeter of the removal activities. Each air station included one dust monitor equipped with data logging capability and alarm, and one air sampler comprised of an air pump and attached mixed cellulose ester cartridge. Air monitors were set to alarm at 2.5 milligrams per cubic meter ($mg/m^3$), the action level specified in the Work Plan assuming a protection factor of 2.

Air monitoring instruments were zeroed at the beginning of each day, and air sampling pump flow rates were logged at the beginning and end of each day. Air monitoring results were logged on a per-minute basis and the results downloaded and archived at the end of each day. No air monitoring result maximum per-minute average exceeded the action level of 2.5 $mg/m^3$. Instances of brief spikes that did not exceed the action level were often found to coincide with activity unrelated to the removal activities, such as trash truck operations and dust devils.

Air samples for six days of air sampling (a total of 19 samples) collected during the beginning, the middle, and the end of removal operations were submitted to TestAmerica for analysis. None of the air samples analyzed were found to contain detectable concentrations of arsenic. One of the 19 samples analyzed was found to contain lead at a concentration of 0.000447 mg/m$^3$. The current Occupational Safety and Health Administration permissible exposure limit is 0.05 mg/m$^3$ (as a time-weighted average). Air samples that were not analyzed have been archived by the START. Appendix A, Table 2 presents the air monitoring and air sampling results for the TCRA.

### 4.1.5 Transport and Hydroseeding of Removed Soil

#### 4.1.5.1 Residential Area Soil

Prior to the start of removal activities, S. Schuchardt of NAI agreed, at FOSC Benson's request, to accept the contaminated soil for placement on the top of the Iron King Mine main tailings pile. The soil, together with hydroseeding, will act as a dust suppression cover on the surface of the main tailings pile. All excavated soil from the eastern side of Highway 69 (that is, from all removal sites except the STP) was therefore transported to the main tailings pile. A total of 6,339 cubic yards of contaminated soil was removed from the residential properties and the municipal property. When the transfer of soil was completed, the transferred soil was hydroseeded to control wind and rain dispersion of the soil. Appendix A, Figure 5 shows the footprint of the contaminated soil placed upon the main tailings pile. The footprint covers 100,350 square feet (2.3 acres) to a depth of from one to approximately four feet bgs.

The hydroseed mixture used is known as "Prescott Blend," and is comprised of:

28% Blue Gramma
16% Sheep Fescue
11% Western Wheat Grass
11% Arizona Fescue
4% Curly Mesquite
12% Side Oats Gramma
18% Other

The University of Arizona is reportedly conducting a phytostabilization study with a small portion of the hydroseeded contaminated soil. This work is being conducted with U.S. EPA approval, but it is not part of the TCRA and the U.S. EPA has no involvement in the study, its processes, or conclusions.

#### 4.1.5.2 STP Tailings Material

Tailings material from the STP was transported to a temporary pad on the southeast side of the Iron King Mine main tailings pile. This activity is described in Section 4.3. A total of 21,500 cubic yards of contaminated soil were removed from the STP. After transport, the STP tailings material was not hydroseeded, but a fixative agent, Gorilla-Snot®, was applied to its surface.

### 4.1.6 Determination of Borrow Sources and Borrow Source Sampling

The START collected 35 soil samples from nine different borrow soil suppliers in order to determine which available soil met the site-specific action level requirements for arsenic and lead. Four suppliers were chosen, based on analytical results; cost of the material; availability; and ease of delivery:

Material Delivery, Inc. (MDI)
10233 W. Northern Avenue
Glendale, AZ 85355

MDI
2815 East Rose Garden Lane
Phoenix, AZ 85050

MDI
8524 North Morning Glory Road
Paradise Valley, AZ 85253

C&R Arrowhead
1405 Road 6 North
Chino Valley, AZ 86323

A memorandum prepared by the START during the removal describing the borrow material sampling and import quantities is provided in Appendix D. Appendix A, Table 3 presents the borrow soil sampling results. Nine of the samples were only analyzed for the parameters total arsenic and total lead. Twenty-six borrow samples were analyzed for RCRA 8 metals.

### 4.1.7 Photographic Documentation

For each of the 13 properties subjected to the TCRA, pre-removal and post-restoration photographs were taken and are maintained in the project file. Photographic documentation of typical removal activities is presented in Appendix E.

### 4.1.8 Information Packets

Upon completion of removal activities, the U.S. EPA provided information packets to each of the property owners involved in the TCRA. Each packet contained a CD-ROM and hard copies of some or all of the following types of information:

- Personalized cover letter from FOSC Benson
- Sample locations figure and table presenting all property-specific data for the parameters arsenic and lead
- Signed copies of the Property Assessment Form and Access Agreement
- Plot plans and schematics (if any)

## 4.2 Removal of Contaminated Soil at Residential Properties and Municipal Property

The following sections describe the removal activities that were conducted at the 11 residential properties and the municipal property located on the east side of Highway 69. Table 4 presents all confirmation sample results for the removal activities.

### 4.2.1 OFS-103

One hot spot was identified on this property during previous U.S. EPA sampling events. As a result, an area of 35 feet by 35 feet was excavated and removed around the hot spot, to a depth of two feet bgs. The area to be excavated was determined by FOSC Benson and was extended well beyond the original area of the hot spot. FOSC Benson determined that the excavation should be conducted directly to the two-foot depth (by-passing the one-foot depth) and immediately backfilled with clean fill material after confirmation sampling and placement of snow fence, in order to minimize inconvenience to the property owner.

A map showing the area of the removal at OFS-103 is provided in Appendix A, Figure 6. One five-point composite sample was collected at the two-foot bgs depth prior to installation of snow fence and backfilling with clean fill material. The results are presented in Appendix A, Table 4. Both arsenic and lead were found to still exceed their site-specific action levels at the two-foot depth.

The property owner of OFS-103 is also the owner of adjacent properties OFS-142 and OFS-143. These two other properties were not subject to the TCRA. The U.S. EPA obtained permission from the property owner, for a small fee, to use OFS-142 as a staging area for mechanical equipment and incoming borrow material. Parts of the fence around OFS-142 were removed and, at the completion of the removal activities, replaced. The disrupted areas of OFS-103 and OFS-142 were restored to pre-removal conditions and then hydroseeded.

### 4.2.2 OFS-111

OFS-111 was initially excavated to a one-foot bgs depth and confirmation sampled by the START. All of the one-foot bgs samples were found to contain arsenic and lead at levels greater than the site-specific action levels. The property was therefore excavated to a two-foot depth; confirmation sampled; and a snow fence barrier was placed prior to backfilling the excavation with clean fill material. An area on the southeast corner of the property where a shed had to be temporarily removed was excavated directly to two feet bgs, sampled, snow fenced; and subsequently backfilled with clean fill material before replacement of the shed.

The confirmation sample analytical results are presented in Appendix A, Table 4. All one-foot and two-foot bgs samples exceeded the site-specific action levels for arsenic and lead. Appendix A, Figure 7 shows the area of the removal.

### 4.2.3 OFS-118

Before the TCRA, OFS-118 had fairly new landscaping that included plants, a decorative brick wall, decorative gravel, and a paver-block back patio. ERRS contracted a local landscaper to document pre-removal property conditions and to restore the property to pre-removal conditions after the removal of contaminated soil had been completed and backfill had been placed. The property owner subsequently had additional work done by the landscaper that the U.S. EPA was not involved with.

OFS-118 was excavated directly to a two-foot depth; confirmation sampled; snow fence was placed; and the excavated area was backfilled with clean fill material.

Appendix A, Figure 8 shows the area of the removal. All confirmation samples exceeded the site-specific action levels at the two-foot depth. The analytical results are presented in Appendix A, Table 4.

### 4.2.4 OFS-132

OFS-132 was initially pot-holed and sampled at one foot bgs. Pot-holing required the use of a shovel to reach the one-foot depth at 5 locations in each quadrant of the property. The sample results indicated that all four samples exceeded one or both of the site-specific action levels for arsenic and lead. All quadrants of the property were therefore excavated to two feet bgs; the excavation floor was sampled; snow fence was placed; and the excavated area was backfilled with clean fill material. All two-foot-depth confirmation samples met or exceeded the site-specific action levels for arsenic and/or lead. The analytical results are presented in Appendix A, Table 4. Appendix A, Figure 9 shows the area of the removal.

### 4.2.5 OFS-133 and OFS-119

A 10-foot-wide strip of soil on the northwestern border of OFS-119 was included in the removal conducted at the OFS-133 property. The southeastern confirmation sampling quadrant of OFS-133 included the strip of soil from OFS-119.

OFS-133 was excavated directly to a two-foot depth; sampled; snow fence was placed; and the excavated area was backfilled with clean fill material. Prior to excavation on the southeast border of OFS-133, a fence was removed with the property owner’s approval. After backfilling with clean soil was completed, a new fence was installed at U.S. EPA expense.

Appendix A, Figure 10 shows the area of the removal. All confirmation samples exceeded the site-specific action levels at the two-foot depth. The analytical results are presented in Appendix A, Table 4.

### 4.2.6 OFS-148

OFS-148 was excavated to a one-foot depth and confirmation sampled. All the samples exceeded the site-specific levels for arsenic and/or lead. Excavation was continued to a two-foot depth; the excavation was confirmation sampled; snow fence was placed; and the excavated area was backfilled with clean fill material. Landscaping gravel and a rock drainage channel at the front of the house were restored to pre-removal conditions.

Appendix A, Figure 11 shows the area of the removal. All confirmation samples exceeded the site-specific action levels at the two-foot depth. The analytical results are presented in Appendix A, Table 4

### 4.2.7 OFS-208 and OFS-244

A hot spot was removed along the property line between OFS-208 and OFS-244. This hot spot was the only area identified as requiring a removal under the TCRA that was not associated with the Sweet Pea Lane corridor. The approximate dimensions for the removal area were 12 by 15 feet. To minimize the time of disruption for the property owners, the removal was conducted directly to a two-foot depth; the excavation was confirmation sampled; snow fence was placed; and the excavation was backfilled with clean fill material. The confirmation sample at the two-foot depth did not exceed the site-specific action levels for either arsenic or lead. Appendix A, Table 4 presents the confirmation sample results. Appendix A, Figure 12 shows the approximate location of the removal.

### 4.2.8 OFS-260

OFS-260 is a municipal corridor under the jurisdiction of the town of Dewey-Humboldt. A portion of this property is composed of a berm or hillside leading up to the parcels on the northeast side of Sweet Pea Lane, with the remainder of the OFS-260 property being a dirt road and an overgrown vehicle access-way leading to the Humboldt Smelter property.

This property is split into two areas by a fence located near the northern corner of the OFS-301 property. The portion of OFS-260 that is located to the north-northwest of OFS-301 was determined through assessment sampling to require a removal of contaminated soil. This long and narrow property that contains no dwellings was divided into two approximately-equal rectangular areas for the purpose of confirmation sampling. The northern area was pot-holed to one foot bgs at five locations and sampled, with the five aliquots composited into one sample for analysis. That confirmation sample exceeded both site-specific action levels, and therefore soil was removed to a two-foot depth. Two confirmation samples were collected at the two-foot depth. Because removal was not complete to the two-foot depth at the time of sampling, the three northern-most portions of composite sample 003 were collected via potholing. Once soil was removed to two feet bgs, snow fence was placed, and the excavated area was backfilled with clean fill material. The analytical results for the confirmation samples are presented in Appendix A, Table 4. All results exceeded the site-specific action levels for arsenic and lead. To prevent soil erosion on the hillside, the hillside was hydroseeded. Appendix A, Figure 13 shows the area of the removal.

### 4.2.9 OFS-301

Hot spots were removed from inside the back yard fence of this property, and from an area immediately outside of the fence to the northeast. The northwest wall of the wood fence was temporarily removed to facilitate contaminated soil removal. To minimize the time of disruption for the homeowner, the removal was conducted directly to a two-foot depth; the excavation was confirmation sampled; snow fence was placed; and the excavation was backfilled with clean fill material. As the area within the fence had originally been covered with grass, new sod was installed and the fence was restored to its original condition. The confirmation sample analytical results are presented in Appendix A, Table 4. Both samples exceeded the site-specific action levels at the two-foot depth. Appendix A, Figure 14 shows the area of the removal.

### 4.2.10 OFS-306

This property is located directly to the northeast of the OFS-260 property. The southern portion of OFS-306, a roughly-triangular area, was subject to the TCRA. The southern portion was divided in two areas for the purpose of confirmation sampling. One-foot-depth confirmation samples, collected by pot-holing, exceeded the site-specific action level for lead. Only one of the one-foot-depth confirmation samples did not exceed the action level for arsenic. The removal was therefore conducted to a two-foot depth; confirmation samples were collected; snow fence was placed; and the removal area was backfilled with clean fill material. The two-foot-depth confirmation samples also exceeded the site-specific action levels for lead. At one of the confirmation sample areas, arsenic did not exceed the site-specific action level of 38 mg/kg.

The confirmation sample analytical results are presented in Appendix A, Table 4. Appendix A, Figure 15 shows the area of the removal.

## 4.3 Small Tailings Pile Removal

The STP originally had a footprint of approximately 36,000 square feet and a height of from approximately 6 to 15 feet as measured from the southeastern toe of the pile. STP removal and site restoration activities were conducted during the period October 27, 2011, through November 15, 2011. A total of approximately 21,500 cubic yards of tailings material were removed and placed on a temporary pad lined with geosynthetic material located on the “lower bench” of the Iron King Mine main tailings pile, which is located to the southeast of the main pile. The STP material stored on the pad is expected to be used, with additional import material from future remediation activities, to help buttress the main tailings pile.

Appendix A, Figure 16 presents the former location of the STP, along with the location of the temporary road constructed to transfer out the STP tailings material. Appendix A, Table 4 presents STP sample analytical results for confirmation samples collected from the floor of the removal excavation, as well as from other material sampled from the pile.

### 4.3.1 STP Removal Process

To accomplish the removal, a 1,250-foot long temporary road was constructed by bulldozer to provide a means for trucking tailings material up to the storage pad. STP excavation and load-out was conducted using an excavator and two 70-ton dump trucks. Tailings removed were generally reddish in color (with the exception of a gray material described below) and were easily discernable from the native soils beneath the pile. As removal work progressed, the START recorded the progress using a global positioning system (GPS) on a daily basis to document STP footprint extent (Appendix A, Figure 17). Upon completion of the removal, the tailings on the pad were compacted with an excavator and the surface was given a heavy application of Gorilla-Snot®.

### 4.3.2 STP Confirmation Sampling

Confirmation samples were collected by the START following guidelines described in the SAP. Confirmation samples were collected from the "floor" of the STP in native material as it was uncovered. Although the SAP specified that one composite sample would be collected for every 4,000 square feet of area, a total of 12 confirmation samples (not including quality control samples) were collected from the STP floor, for an average frequency of one per 3,000 square feet. The five points of each composite sample were well-distributed in order to best-represent the area being sampled. All samples were obtained from a depth of 0-2 inches. Appendix A, Figure 17 shows the locations from which the confirmation samples were collected. A GPS instrument was used to document the boundaries of each composite confirmation sample location.

Five of the STP confirmation samples indicated concentrations of arsenic and lead that were below the site-specific action levels. The STP was only removed to the depth of the original grade, and no additional removal was conducted at confirmation sample locations that were found to exceed the action level for one or both analytes.

### 4.3.3 Additional STP Characterization Sampling

Four samples were collected by the START to additionally characterize the material of the STP. One sample of a gray sludge material is described in Section 4.3.4, below. Three other samples were collected from the southern berm of the STP, and from excavation sidewalls. All four samples exceeded the site-specific action levels for arsenic and lead. The results for the additional characterization samples are included in Appendix A, Table 4.

### 4.3.4 STP Gray Sludge Material

A gray sludge material was encountered in a bowl formation within the northern quarter of the tailings pile. The material was moist and elastic, and totaled approximately 1,400 cubic yards. When removed from the STP, this material was kept in a separate location from other tailings material, in an area immediately south of the temporary pad. A START-collected sample of the material contained concentrations of arsenic and lead at 5,000 and 5,100 mg/kg, respectively. The sample was also analyzed for CAM-17 metals and total cyanide, at U.S. EPA request. The analytical results are presented in Appendix A, Table 5. Other than high concentrations of arsenic and lead, the most significant results were mercury at 17 mg/kg, cadmium at 120 mg/kg, zinc at 48,000 mg/kg, and cyanide at 1.9 mg/kg.

### 4.3.5 Hydrogeologic Restoration of STP Area

The U.S. EPA's Environmental Response Team (ERT) was responsible for restoring grades and drainage patterns upon completion of the removal of the STP. A 50-year return period storm for the local area was used for the design. The design included:

- Completion of surface grading within the area of the former STP.
- Installation of polypropylene filter fabric and coarse riprap over a 65-foot wide, 3-foot high vertical "spill point" leading from Iron King Mine property and a steep, adjoining downstream area.
- Completion of a 400-foot diversion channel constructed with filter fabric and riprap for conveying stormwater from the spillway into Chaparral Gulch. The channel is approximately three feet deep, 21 feet wide at the top, and three feet wide at the bottom.
- Installation of approximately 675 feet of straw wattle on the steep slopes to protect against future erosion.

Appendix A, Figure 16 shows the location of the completed diversion channel. Appendix F presents ERT's Site Restoration and Design Implementation report, prepared by ERT's contractor, Lockheed Martin.

## 4.4 Application of Fixative to Humboldt Smelter Ash Piles

Approximately 12 acres of ash piles on the Humboldt Smelter property were sprayed with a fixative called Gorilla-Snot®. The application of the fixative was conducted in order to reduce dispersion of the ash by wind and rain. The application was conducted by ERRS over a period of three non-consecutive days. Appendix A, Figure 18 presents a map showing the ash pile areas treated with fixative.

# 5 Summary

Over the period September 13, 2011, through November 15, 2011, the U.S. EPA conducted a TCRA at the Iron King Mine – Humboldt Smelter NPL site located in Dewey-Humboldt, Arizona.

At 11 residential properties and at one municipal property, soil contaminated with arsenic and lead was removed to a depth of two feet below ground surface. A total of 6,339 cubic yards of contaminated soil were removed from the 12 properties. The contaminated soil was moved to the top of the Iron King Mine main tailings pile and was subsequently hydroseeded. START confirmation sampling documented concentrations of arsenic and lead at the two-foot depth at each property. In all removal locations except OFS-208/244, arsenic and/or lead concentrations found at the two-foot depth exceeded the site-specific action levels, and snow fence was placed in the excavation to provide a visual barrier between clean backfill material and the still-contaminated soil beneath it. Removed contaminated soil was replaced with soil documented to be below the site-specific action levels for arsenic and lead. Upon completion of backfill with clean material, each property was restored to pre-removal conditions.

At the STP, 21,500 cubic yards of contaminated soil were moved to a temporary, lined pad located on the southeast side of the Iron King Mine main tailings pile. START confirmation sampling documented concentrations of arsenic and lead at the excavation floor. Five of the 12 STP confirmation samples collected from the excavation floor indicated concentrations of arsenic and lead that were below the site-specific action levels. The STP was only removed to the depth of the original grade, and no additional removal was conducted at confirmation sample locations that were found to exceed the action level for one or both analytes. The area of the former tailings pile was re-contoured and a drainage pathway into Chaparral Gulch was restored.

Approximately 12 acres of loose ash material on the Humboldt Smelter property was sprayed with a fixative in order to reduce the amount of ash dispersed through wind and rain.

The TCRA was conducted as an interim U.S. EPA removal activity while the U.S. EPA works toward identifying a long-term remedial action for the site.

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# 6 References


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# B Sampling and Analysis Plan

# Sampling and Analysis Plan
# Iron King Mine – Humboldt Smelter Removal
# Yavapai County, Arizona

**TDD No.: TO-02-09-11-08-0005**
**Project No.: 002693.2155.01RF**

**September 2011**

**Prepared for:**

**U.S. ENVIRONMENTAL PROTECTION AGENCY**
**Region IX**

**Prepared by:**

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**Superfund Technical Assessment and Response Team**

Sampling and Analysis Plan
Iron King Mine – Humboldt Smelter Removal
Yavapai County, Arizona

TDD No.: TO2-09-11-08-0005
Project No.: 002693.2155.01RF

September 2011

Approved by: ______________________
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Approved by: 9/1/2011
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# Table of Contents

**Table of Contents (cont.)**

**Section** **Page**

Table of Contents (cont.)

# List of Tables



# List of Figures

# List of Abbreviations and Acronyms

| | |
|---|---|
| ADEQ | Arizona Department of Environmental Quality |
| bgs | below ground surface |
| COPC | contaminant of potential concern |
| DQI | Data Quality Indicator |
| DQO | Data Quality Objective |
| EA | EA Engineering, Science and Technology, Inc. |
| E&E | Ecology and Environment, Inc. |
| ERS | Emergency Response Section |
| FOSC | Federal On-Scene Coordinator |
| $ft^2$ | square foot |
| GPS | Global Positioning System |
| IDW | investigation-derived waste |
| LCS | laboratory control sample |
| MS/MSD | matrix spike/matrix spike duplicate |
| mg/kg | milligrams per kilogram |
| NIOSH | National Institute for Occupational Safety and Health |
| OSHA | U.S. Occupational Safety and Health Administration |
| PM | Project Manager |
| PPE | personal protective equipment |
| QA | quality assurance |
| QC | quality control |

## List of Abbreviations and Acronyms (cont.)

| | |
|---|---|
| RI Report | Remedial Investigation Report |
| RPD | relative percent difference |
| RSL | Regional Screening Level |
| SAP | Sampling and Analysis Plan |
| SOP | standard operating procedure |
| SRL | Arizona Soil Remediation Level |
| STP | Small Tailings Pile |
| START | Superfund Technical Assessment and Response Team |
| TDD | Technical Direction Document |
| TCRA | time-critical removal action |
| TM | Task Monitor |
| UCL | upper confidence limit |
| U.S. EPA | United States Environmental Protection Agency |

# 1 Introduction

The United States Environmental Protection Agency (U.S. EPA) tasked Ecology and Environment, Inc.'s (E & E's) Superfund Technical Assessment and Response Team (START) to support a U.S. EPA-funded removal at the Iron King Mine – Humboldt Smelter Superfund Site (the site), located in Dewey-Humboldt, Arizona. In order to support the U.S. EPA's environmental data collection activities, the START has identified project data quality objectives and developed this Sampling and Analysis Plan (SAP).

Beginning September 12, 2011, the U.S. EPA Region IX Emergency Response Section (ERS) will conduct a time-critical removal action (TCRA) to remove arsenic- and lead-contaminated soil from 13 properties within a residential neighborhood at the site. The 13 properties were identified through START assessment activities described in the document, *Iron King Mine – Humboldt Smelter Assessment Report, Dewey-Humboldt, Yavapai County, Arizona* (August 2011)(technical direction document [TDD] No. T02-09-10-09-0004).

Sampling activities described in this SAP will include:

- Surface and sub-surface sampling of borrow material to ensure that clean soil is used to replace the removed soil;
- Surface soil sampling during excavation activities to determine whether contamination is still present.
- Post-excavation surface soil sampling  to document  concentrations of arsenic and lead in an excavated area; and
- Air sampling to document concentrations of arsenic and lead in ambient air during removal activities.

With the exception of the borrow samples which will be analyzed for eight metals (including arsenic and lead), the only analyses conducted under this SAP will be for arsenic and lead.

The scope of work and objectives outlined in this SAP are derived from the direction of the U.S. EPA. This SAP describes the project and data use objectives, data collection rationale, data 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 accurately reflect the planned data-gathering activities for this support activity.  However, site conditions, budget, and additional U.S. EPA direction may warrant modifications. All significant changes are to be documented in site records.

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 (EPA QA/R 5, March 2001, EPA/240/B 01/003); Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G 4, February 2006, EPA/240/B-06/001); Guidance on Choosing a Sampling Design for Environmental Data Collection (EPA QA/G 5S, December 2002, EPA/240/R 02/005); Superfund Lead-Contaminated Residential Sites

Handbook (OSWER 9285.7-90, August 2003); and Uniform Federal Policy for Implementing Environmental Quality System (EPA/505/F-03/001, March 2005).

## 1.1 Project Organization

**U.S. EPA Federal On-Scene Coordinator (FOSC) –** The U.S. EPA FOSC is Mr. Craig Benson. Mr. Benson 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 coordination of communication with the START Project Manager, U.S. EPA Quality Assurance (QA) Office, and community residents.

**START Project Manager (PM) –** Mr. Michael Schwennesen is the START PM. The PM manages the project's data collection efforts and is responsible for implementing the SAP, coordinating project tasks and field sampling, managing field data, and completing 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 the removal activities.

**START Quality Assurance Coordinator –** Mr. Howard Edwards is responsible for the development of this SAP. Specifically, Mr. Edwards is responsible for the documentation of project objectives and for preparation and review of the draft and final SAP document. Mr. Edwards will coordinate with the U.S. EPA's Quality Assurance Office as needed.

**Sample Analysis and Laboratory Support –** Mr. Erik Faasen of TestAmerica laboratory in Phoenix, Arizona will be responsible for all sample analyses. TestAmerica contact information is provided below:

TestAmerica
4625 E Cotton Center Blvd. Suite 189
Phoenix, AZ 85040
Tel 602-437-3340

## 1.2 Distribution List

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

- Craig Benson, U.S. EPA Region IX
- U.S. EPA Region IX, Quality Assurance Office
- E & E START Field Team
- E & E START project files

## 1.3 Statement of the Specific Problem

The U.S. EPA will perform a TCRA at 13 properties at the site that have been documented to be contaminated with arsenic and lead at concentrations that exceed the US EPA's site-specific action levels. Analytical data is need to confirm that the soil in the borrow areas which will be used as backfill is not also contaminated with arsenic, lead, or any other of the eight Resource Conservation and Recovery Act metals (RCRA 8 metals).

After the excavation, analytical data is needed to document a successful removal or document post-removal remaining subsurface concentrations of arsenic and lead. Ambient air samples will also be collected to document concentrations of arsenic and lead in ambient air during removal operations. The site-specific action levels for arsenic and lead are currently established at 38 and 23 milligrams per kilogram (mg/kg), respectively. The action levels for barium, cadmium, chromium, mercury, selenium and silver in soil are listed in Table 3-1.

# 2 Site Background

## 2.1 Site Location and Description

The Iron King Mine – Humboldt Smelter site is located in Dewey-Humboldt, Yavapai County, Arizona (Figure 2-1). The approximate geographical coordinates of the Dewey-Humboldt town hall are latitude 34.503043° north; longitude 112.243559° west. The town of Dewey-Humboldt was incorporated on December 20, 2004 from the existing unincorporated towns of Dewey and Humboldt, located adjacent to one another in the Agua Fria River Valley, 11 miles east of Prescott. Dewey-Humboldt is located between the mine and the smelter (Figure 2-2). The population of the town was 3,613 in 2005 according to a census estimate. Three waterways (Chaparral Gulch, Galena Gulch, and Agua Fria River) transect the site.

The Iron King Mine property is approximately 153 acres in size. It is located west of Highway 69, bordered by the Chaparral Gulch and residences to the north; Highway 69 to the east; Galena Gulch to the south; and undeveloped land to the west. The Iron King Mine was a periodically-active gold, silver, copper, lead, and zinc mine from 1906 until 1969. The present owner of the 85-acre portion of the Iron King Mine area of interest referred to as the Iron King Mine Proper Area is North American Industries (NAI), which produces Hydromax fertilizers and soil supplements. Previous ownership included Ironite Products Company, which marketed Ironite fertilizer produced from mine tailings from 1989 to 2006. The principal feature of the Iron King Mine Proper Area is a large (more than 50 acres) tailings pile, which contains high concentrations of arsenic and lead. The tailings are subject to off-site migration mainly via air particulate migration and surface water transport.

The Humboldt Smelter property is located less than one mile east of the Iron King Mine property, on the east side of Highway 69. The approximately 189-acre smelter property is bounded by residences to the north and west; the Agua Fria River to the east; and Chaparral Gulch to the south. The majority of the Humboldt Smelter is owned by Greenfields Enterprises, LLC, which purchased the property in 2003. No businesses are currently operating on the property. The Humboldt Smelter area of interest includes tailings and slag deposit areas and an approximately 23-acre ash pile. The ash pile material is subject to off-site migration mainly via air particulate migration and surface water transport.

One of the 13 properties subject to the TCRA contains a small tailings pile (STP) of approximately 12,000 to 20,000 cubic yards. The STP will be moved onto the Iron King Mine tailings pile as part of the TCRA. The STP contains relatively high concentrations of arsenic and lead and detectable concentrations of cyanide, and is located immediately to the north of the Iron King Mine Proper Area on a 40-acre private parcel designated as OFS-0021. Although located on private residential property, the STP has been associated with historical mining activities at the Iron King Mine.

## 2.2 Previous Investigation and Activities

### 2.2.1 ADEQ

In April 2002, the Arizona Department of Environmental Quality (ADEQ) sampled sediment near residential parcels throughout the Chaparral Gulch as part of a Preliminary Assessment/Site Inspection. The investigation revealed arsenic concentrations of up to 509 milligrams per kilogram (mg/kg) and lead concentrations of up to 513 mg/kg.

### 2.2.2 U.S. EPA / START 2005

In 2005, ADEQ requested that the U.S. EPA assess surface soils at residential properties in the vicinity of the Chaparral Gulch and Iron King Mine. In response to the request, the U.S. EPA and START conducted a site assessment of 17 properties along the Chaparral Gulch (E & E, 2005). Soil samples were collected to determine arsenic and lead concentrations on these properties. Ten samples were collected from each property, which included nine surface samples (0-6 inches bgs) and one subsurface sample (18 inches bgs). Analytical results from the sampling event identified lead and arsenic concentrations in surface soil samples at four of the properties that were sufficiently high to warrant a removal action. The removal action was conducted by Brown and Caldwell in late 2006 (EA, 2010).

### 2.2.3 U.S. EPA / EA Engineering, Science and Technology, Inc.

In 2008, the Iron King Mine – Humboldt Smelter site was listed on the National Priorities List and a Remedial Investigation (RI) was conducted by EA for the U.S. EPA's Remedial Program. From 2008 to 2010, as part of the RI, EA collected soil samples at 168 parcels within the town. The parcels sampled were selected from areas suspected of being impacted by historical mining and smelting operations (based on wind patterns) and where homeowner sampling access agreements could be obtained. The objective of the RI sampling was to identify levels of metals contamination in soil resulting from the site, and specifically to evaluate impacts on the community of Dewey-Humboldt. Nine discrete samples from the 0 to 2-inch depth interval and

ii

ii

[1] Previous site studies at the Iron King Mine – Humboldt Smelter used the term "OFS", which stands for "off-site soil", to describe in-town soil sample properties. To avoid confusion when comparing new data to old data for particular properties, the convention of using "OFS" is continued in this assessment although the properties are no longer considered "off site."

one discrete sample from the 10 to 12-inch depth interval were collected at each parcel. The deeper-depth interval was selected at random from beneath one of the nine surface sample locations. The nine surface sample locations were selected on a parcel-by-parcel basis (judgmentally) with an attempt to be spatially representative while taking into account site features (e.g., driveways and landscaping) and roof drainage patterns. The RI samples were analyzed for 23 “target analyte list” metals, including arsenic and lead.

Also as part of the RI, EA collected background soil samples from several different soil types and areas about the site. Background Soil Type 1 was identified as the predominant soil type for the study area, and a background concentration of 48 mg/kg for arsenic and 44 mg/kg for lead was established (EA, 2010). A subsequent addendum to the EA RI report revised the average background concentrations of arsenic and lead in Soil Type 1 to 38 and 23 mg/kg, respectively (EA 2011).

EA tabulated analytical data for the 185 in-town parcels sampled (including the 17 parcels sampled by the START in 2005). EA also calculated the 95% upper confidence limit (UCL) on the arithmetic mean from the sample data for each parcel, following U.S. EPA guidance and using U.S. EPA’s ProUCL 4.0 software. This summary data was used by the U.S. EPA in 2010 to determine what properties would be subject to the TCRA.

### 2.2.4 U.S. EPA / START 2010-2011

In the fall of 2010, the U.S. EPA Remedial Program requested that the U.S. EPA Emergency Response Section provide support to conduct an RA at the site. To determine which in-town properties to investigate for the RA, the START prepared an interim “hot list” of residential and city-owned properties that had already been sampled and that could potentially be candidates for a removal action. To compile the list, the START used the EA table presenting data for 185 in-town properties, which included average concentrations and 95% UCLs for arsenic and lead in soil for each property. Each property was then placed on a list of descending order (highest to lowest) based on its calculated 95% UCL concentration of arsenic and/or lead. In order to limit the initial scope of the RA and the potential removal actions to those properties that could be considered time critical, the U. S. EPA determined that only the upper 10 percent of the in-town properties (as ranked by relative arsenic and/or lead contamination) would be placed on the hot list. Properties with 95% UCLs for arsenic that were greater than or equal to 165.2 mg/kg and properties with 95% UCLs for lead that were greater than or equal to 512.7 mg/kg were designated for the interim hot list. Some properties were identified for the interim hot list based on the 95% UCLs for both arsenic and lead.

During several site visits which included sampling activities, the U.S. EPA and the START eventually reduced the number of properties to be subjected to the TCRA to 13 properties. Table 2-1 lists the 13 properties. Figures showing these properties are available in the Work Plan.

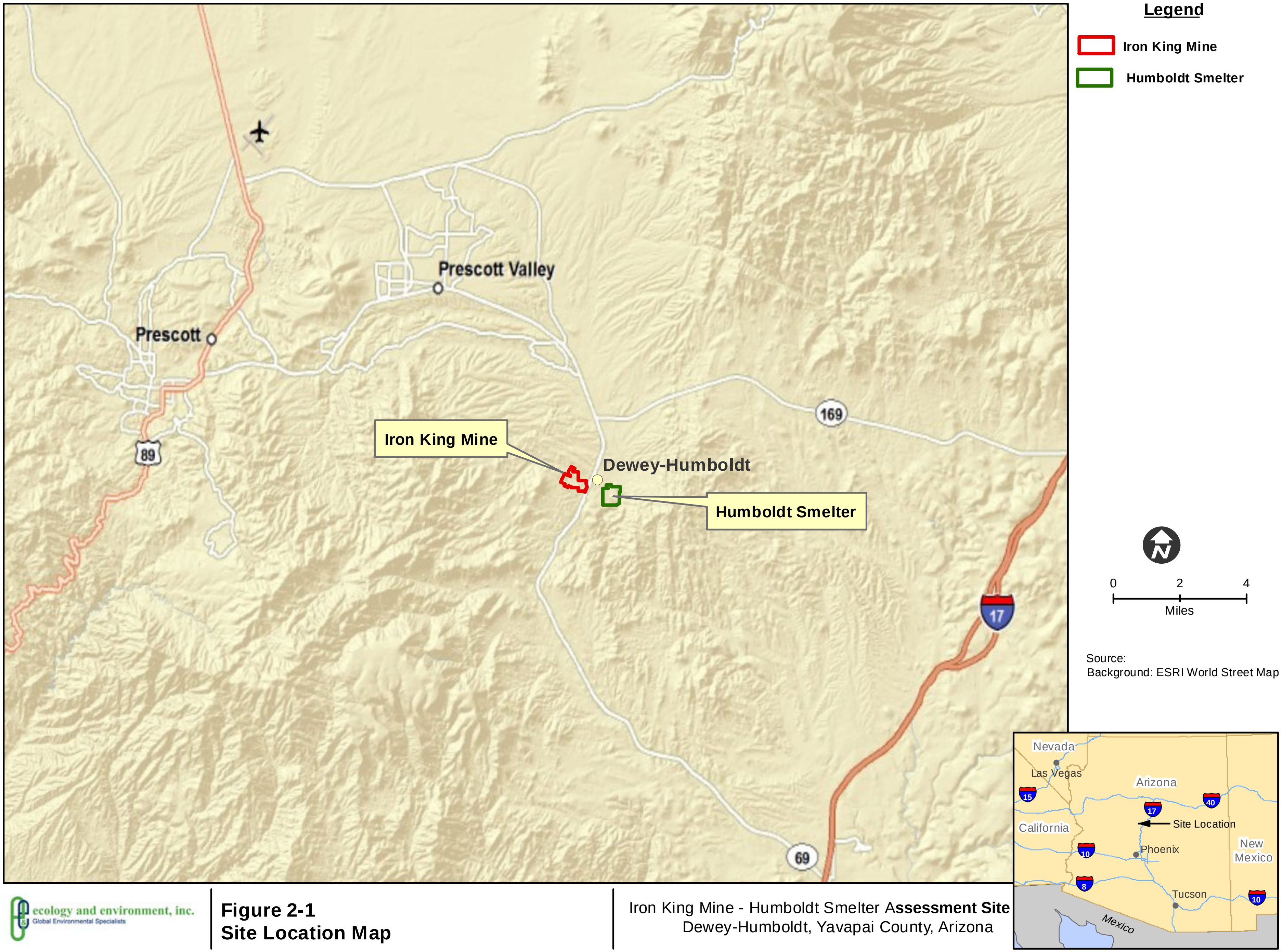


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**Figure 2-1**
**Site Location Map**

Iron King Mine - Humboldt Smelter Assessment Site
Dewey-Humboldt, Yavapai County, Arizona

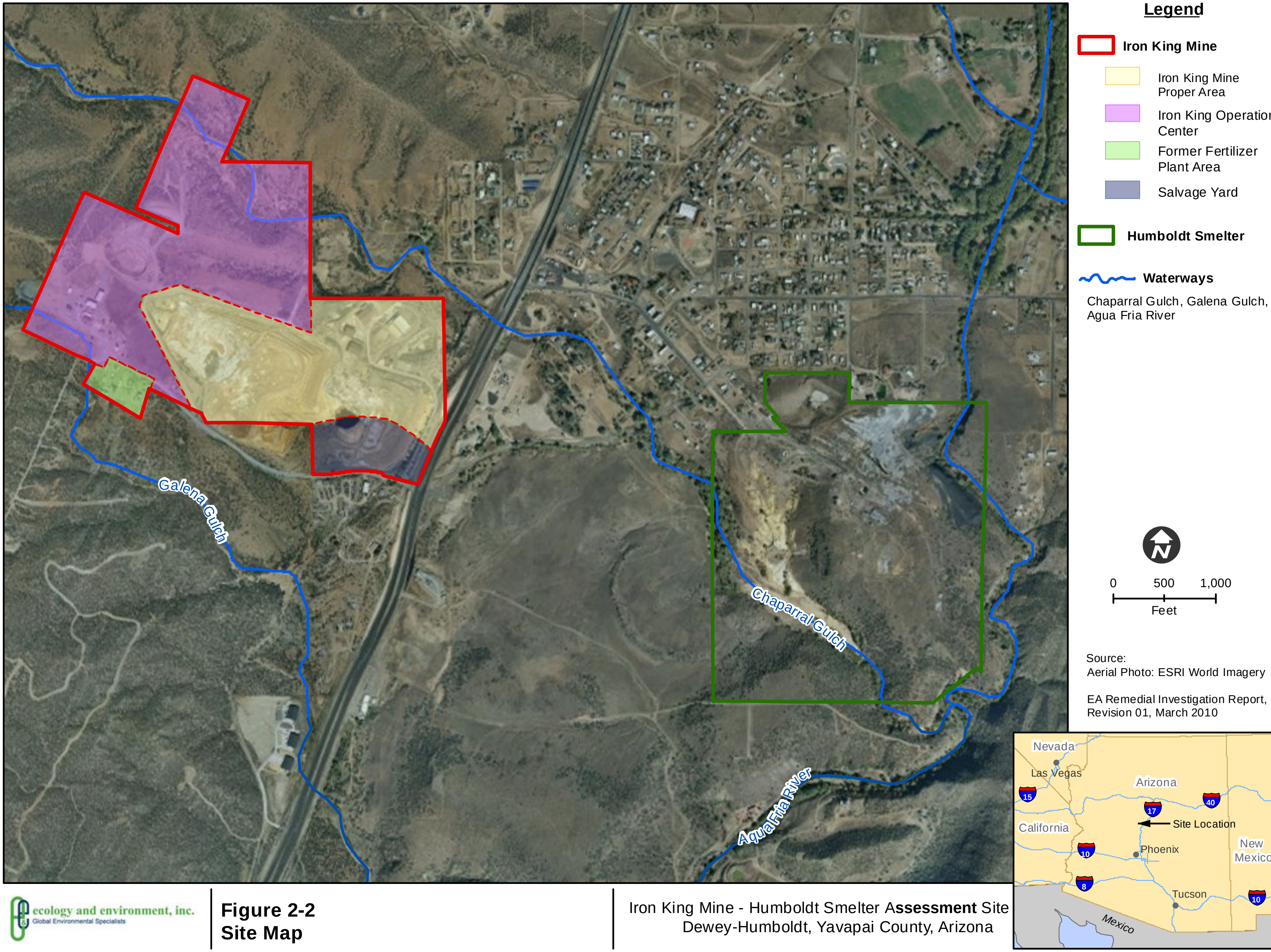


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**Figure 2-2**
**Site Map**

Iron King Mine - Humboldt Smelter Assessment Site
Dewey-Humboldt, Yavapai County, Arizona

Table 2-1
Properties Subject to U.S. EPA Time-Critical Removal Action
Dewey-Humboldt, Arizona

E & E Project No. 002693.2155.01.RF

TDD No. TO2-09-11-08-0005

| | Site ID | Parcel No. | Physical Address | Mailing Address | Acres | Arsenic Average Concentration (mg/kg) | Arsenic 95% UCL[1] | Lead Average Concentration (mg/kg) | Lead 95% UCL[1] |
|---|---|---|---|---|---|---|---|---|---|
| Complete Removal | OFS 111 | 402-06-102L | 2925 South Sweet Pea Lane | PO Box 485 Humboldt, AZ 86329 | 0.27 | 115.6 | 165.2 | 638.8 | 923.9 |
| Complete Removal | OFS 118 | 402-06-102K | 2905 South Sweet Pea Lane | PO Box 508 Humboldt, AZ 86329 | 0.27 | 147.2 | 198.4 | 1148 | 1610 |
| Complete Removal | OFS 132 | 402-06-102P | 2875 South Third Street | PO Box 122 Humboldt, AZ 86329 | 0.25 | 102.5 | 130.7 | 949.7 | 1792 |
| Complete Removal | OFS 260 | 800-27-005T | Unsurfaced right-of-way behind Sweet Pea Lane | Municipal property | 0.5 (approx.) | 157.6 | 205.9 | 746.8 | 1025 |
| Complete Removal | OFS 148 | 402-06-102M | 2945 Sweet Pea Lane | 1575 Purple Sage Road Chino Valley, AZ 86323 | 0.27 | 106.1 | 133.1 | 577.5 | 692.9 |
| Complete Removal | OFS 133[2] OFS-119 (NE corner of OFS-119 added to removal at OFS-133) | 402-07-006 | 13070 Main Street | PO Box 338 Humboldt, AZ 86329 | 0.23 | 284.6 | 383.3 | 1132 | 1584 |
| Hot-Spot Removal | | 402-07-007C | 13080 East Main Street | PO Box 552 Humboldt, AZ 86329 | 0.48[4] | | | | |
| Hot-Spot Removal | OFS-103 | 402-07-002B | 13030 East Main Street | PO Box 488 Humboldt, AZ 86329 | 0.46[4] | 45.77[5] | 92.86[5,6] | 134.5[5] | 605.3[5,6] |
| Hot-Spot Removal | OFS 208[2] OFS-244 (one hot spot between two parcels) | 402-09-016D | 2565 Hill Street | PO Box 32 Humboldt, AZ 86329 | 0.21[4] | 134.9 | 481[7] | 108.7 | 355.8[7] |
| Hot-Spot Removal | | 402-09-016H | 2575 Hill Street | PO Box 548 Humboldt, AZ 86329 | 0.21[4] | | | | |
| Hot-Spot Removal | OFS-002[2] (hot spot is the STP) | 402-08-034A | 12470 East Yavapai Road | PO Box 721 Dewey, AZ 86327 | 0.6[3] | 556.4 | 727.2 | 706.2 | 986.8 |
| Hot-Spot Removal | OFS-301 | 402-06-102N | 2965 Sweet Pea Lane | PO Box 905 Humboldt, AZ 86329 | 0.28[4] | 52.02 | 128.5[7] | 241 | 552[6] |
| Hot-Spot Removal | OFS-306 | 402-06-026 402-06-027B | 13087 E. Main Street 13089 E. Main Street | PO Box 699 Humboldt, AZ 86329 | 0.19[4] 0.32[4] | 70.8 | 111.3[6] | 187 | 259.7 |

1 - Calculated as student's t-test for normal distribution unless otherwise noted.
2 - For properties that were sampled by both EA and START, the START data was combined with EA data to generate new means and 95% UCLs.
3 - The Small Tailings Pile has an area of approximately 0.6 acres and is situated on a parcel of approximately 40 acres.
4 - These properties will be subjected to hot spot removals only.
5 - Calculated based on samples listed in Table 15.
6 - Gamma UCL
7 - Non-parametric Chebyshev UCL

# 3 Project Objectives

## 3.1 Data Use Objectives

Based on available information documented by the previous investigations and at the request of the Remedial Program of the U.S. EPA, the U.S. EPA ERS is conducting a TCRA to:

- Remove surface and near-surface soils from 13 site properties in order to reduce arsenic and lead exposure risk to human health and the environment.

The lead, arsenic, and RCRA 8 metals concentration data generated by this assessment will be used to:

- Ensure that borrow soil concentrations of RCRA 8 metals are at or below the concentrations presented in Table 3-1.

- Direct additional excavation activities for depths below one foot bgs.

- Confirm a successful arsenic- and lead-contaminated soil removal or document post-removal remaining subsurface concentrations of arsenic and lead.

- Document the concentrations of arsenic and lead in ambient air collected during removal activities.

Analytical data collected as part of the TCRA will be used to answer the following site-specific study questions:

What are the RCRA 8 metals concentrations in borrow soil?

What are the arsenic and lead concentrations in post-removal "confirmation" soil samples?

What are the concentrations of arsenic and lead in air samples collected downwind of the site during soil removal operations?

## 3.2 Project Sampling Objectives

The data obtained through the implementation of this SAP will be used to ensure that clean backfill soil is used at 12 of the residential properties (the STP property will not receive backfill), and to either document a need for additional soil removal or document post-removal concentrations of arsenic and lead in soil. No borrow material will be used for backfill unless it achieves the action levels listed in Table 3-1. If arsenic and/or lead exceed the action levels of Table 3-1 in confirmation samples collected after a one-foot lift of soil is removed from a particular property, an additional one-foot lift of soil will be removed. At the two-foot depth, "confirmation" samples will again be collected but only to document arsenic and lead concentrations at that depth. No further removal will occur below a depth of two feet below ground surface (bgs).

Soil and air sampling, followed by definitive laboratory sample analysis, will be performed to accomplish the project objectives. Sampling objectives include:

- Obtain data for RCRA 8 metals concentrations in soil that can be used to determine whether the borrow soil can be used as backfill material.
- Determine whether arsenic and lead concentrations in confirmation samples are below the site-specific action levels.
- Document arsenic and lead concentrations in surface soil samples collected during removal operations.
- Document arsenic and lead concentrations in air samples collected during removal operations.

## 3.3 Action Levels

The site-specific action levels for the TCRA were determined by FOSC Benson and are presented in Tables 3-1 and 3-2. These tables also present information regarding data quality indicator goals for this project.

**Table 3-1**
**Benchmarks and Data Quality Indicator Goals –**
**Definitive Data for EPA Method 6010B/7471A in Borrow Soil Samples and Post-Removal Confirmation Samples**

**Iron King Mine – Humboldt Smelter Removal**
**Yavapai County, Arizona**

E & E Project No. 002693.2155.01.RF TDD No. TO2-09-11-08-0005

| Constituent | Site-Specific Action Level for Confirmation Samples[1] (mg/kg) | Site-Specific Action Level for Borrow Soil (mg/kg) | Arizona Residential SRL (mg/kg) | U.S. EPA Residential RSL (mg/kg) | TestAmerica (Phoenix) Reporting Limits | Accuracy (% Recovery for MS/ MSD) | Precision (RPD from MS/MSD and Duplicates) | Percent Completeness |
|---|---|---|---|---|---|---|---|---|
| Lead | 23 | 23 | 400 | 400 | 5.0 | 75 – 125 | 20% | > 90% |
| Arsenic | 38 | 38 | 10 | 0.39 | 5.0 | 75 – 125 | 20% | > 90% |
| Barium | NA | 5,300 | 5,300 | 15,000 | 5.0 | 75 – 125 | 20% | > 90% |
| Cadmium | NA | 38 | 38 | 70[2] | 0.50 | 75 – 125 | 20% | > 90% |
| Chromium | NA | 2,100 | 2,100 | None | 2.0 | 75 – 125 | 20% | > 90% |
| Mercury | NA | 6.7 | 6.7 | 10 | 0.10 | 75 – 125 | 20% | > 90% |
| Selenium | NA | 380 | 380 | 390 | 5.0 | 75 – 125 | 20% | > 90% |
| Silver | NA | 380 | 380 | 390 | 2.5 | 75 – 125 | 20% | > 90% |

Notes:
1 - Action levels do not apply to the small tailings pile
2 - Dietary

mg/kg = milligrams per kilogram
MS/MSD = Matrix Spike/Matrix Spike Duplicate
NA = Not applicable
RSL = U.S. EPA Regional Screening Level (June 2011)
RPD = Relative Percent Difference
SRL = Soil Remediation Level

**Table 3-2**
**Benchmarks and Data Quality Indicator Goals - Definitive Data for NIOSH Method 7300 Air Sample Analysis**

**Iron King Mine – Humboldt Smelter Removal**
**Yavapai County, Arizona**

E & E Project No. 002693.2155.01.RF TDD No. TO2-09-11-08-0005

| Constituent | OSHA PEL ($mg/m^3$) | TestAmerica (Phoenix) Reporting Limits[1] ($mg/m^3$) | Accuracy (% Recovery for BS/BSD) | Precision (RPD from BS/BSD and Duplicates) | Percent Completeness |
|---|---|---|---|---|---|
| Lead | 0.050 | 0.0032 | 80 – 120 | 25% | > 90% |
| Arsenic | 0.010 | 0.0026 | 80 – 120 | 25% | > 90% |

[1] Assumes sample collected at 2 liters per minute over an 8-hour period
$mg/m^3$ = milligrams per cubic meter
BS/BSD = Blank Spike/Blank Spike Duplicate
NIOSH = National Institute for Occupational Safety and Health
OSHA = U.S. Occupational Safety and Health Administration
PEL = Permissible Exposure Level (8-hour time-weighted average)
RPD = Relative Percent Difference

## 3.4 Data Quality Objectives

The data quality objective (DQO) process, as set forth in the U.S. EPA *Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA/240/B-06/001)* (U.S. EPA, 2006), was followed to establish the DQOs for this project. An outline of the process and the outputs for this project are included in Appendix A.

## 3.5 Data Quality Indicators (DQIs)

Data quality indicators (DQIs) are defined as: precision, accuracy, representativeness, completeness, comparability, and method detection limits. The DQIs for this project were developed following the guidelines in the U.S. EPA *Requirements for Quality Assurance Project Plans* (U.S. EPA, 2001). All sampling procedures are documented in Sections 6.2 and 6.3. Standard operating procedures 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 document the site-specific DQI goals for lead and arsenic.

## 3.6 Schedule of Sampling Activities

The field sampling and analysis activities are scheduled to commence on September 12, 2011. The field activities are expected to last approximately 7 weeks.

## 3.7 Special Training Requirements/Certifications

Data validation requires specialized training and experience. The START PM will ensure that a qualified START chemist will perform a Tier 2 validation of 100 percent of the data (as defined in the U.S. EPA document, *Requirements for Quality Assurance Project Plans* (March 2001). Specific data validation requirements are discussed in Section 9.4.

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

# 4 Sampling Rationale and Design

The START reviewed available site information, including previous sampling data, and took into account the U.S. EPA FOSC's objectives for the TCRA to determine the specific sampling design.

Identification of useable borrow material sources and post-removal documentation of arsenic and lead concentrations in residential soils are the principal objectives of the activities described in this SAP. A secondary objective is to collect air samples to document concentrations of arsenic and lead in airborne particulates generated by removal activities.

The locations of the 13 properties which will undergo TCRA removal activities are presented in Table 2-1. Maps of the individual properties are presented in the Work Plan.

The U.S. EPA *Superfund Lead-Contaminated Residential Sites Handbook* (OSWER Directive 9285.7-50 (August, 2003) (Lead handbook) was referenced during development of the sampling design and will be used as a guideline where applicable. Previous sampling methodology has also been considered, in order to obtain data in a similar manner to that historically conducted. After collection, samples will be handled and analyzed according to Sections 5.1, 6.2, and 6.3 of this SAP. Sample locations will be recorded in the field logbook as sampling is completed. Individual sample-point locations will be recorded using GPS equipment, whenever possible.

## 4.1 Analytes of Concern

The analytes of concern are arsenic and lead. All samples collected in the field will be analyzed for arsenic and lead using TestAmerica laboratory in Phoenix, Arizona. Borrow samples will be analyzed for RCRA 8 metals. The definitive methods to be used are described in Tables 3-1 and 3-2.

## 4.2 Borrow Material Sampling

Five-point composite samples will be collected from potential borrow sources. One composite sample will be collected for each separate area within a borrow source from which soil may be used for fill material. Composite sample aliquots will be collected from 0 to 6 inches into the soil, and the sample aliquots will be spatially distributed in a manner to achieve a composite sample that well-represents its source. The composite sample aliquots will be collected into a plastic baggie; homogenized; and then transferred into a four-ounce glass jar. Additional borrow samples will be collected from each source periodically, and before soil from a new source is used. Borrow material will not be used for backfill until analytical results have documented that arsenic and lead concentrations are below the action levels

## 4.3 Residential Properties Sampling

Whether a particular property will undergo a hot spot removal or a removal of all accessible soil, the removal and sampling procedure will be the same. The removal contractor will remove soil to a one-foot depth bgs. Following guidelines in the Lead Handbook, the START will then collect composite samples at the one-foot depth, with one five-point composite sample collected from each front, back, and side yard. This procedure will also be used for individual hot spot removals. If samples from any area (front, back, side yard, or hot spot) exceed the action levels for arsenic and/or lead, another one-foot lift will be removed in that area and another composite sample will be collected. Soil removal will not exceed a two-foot bgs depth. A material such as snow fencing will then be placed at the total removal depth, and clean borrow material will be placed over it to return the area to grade. In certain situations, the FOSC may elect to remove soil directly to a two-foot depth, collect composite samples for documentation purposes, emplace snow fencing, and backfill with borrow material without sampling at the one-foot depth or waiting for analytical results. Such a situation may occur in areas where a minimal amount of disturbance to the homeowner is desired.

Air samples will be collected during the earth-moving activities. Three air samplers will be placed about the work area in approximated upwind, downwind, and crosswind locations. They will be placed, when possible, between the work area and adjacent homes. A weather station will be used to document and archive wind direction and velocity. Locations of the air samplers and weather station will be documented in the site log book. It is anticipated that for the first several days, the air samples will be delivered to TestAmerica on a daily basis and analyzed on a fast-turnaround basis. If analytical results indicate that dust suppression activities are adequate, air samples will continue to be collected but will be archived and only analyzed upon the specific request of the FOSC.

## 4.4 Small Tailings Pile Sampling

As part of the TCRA, the STP (OFS-002) will be relocated onto Iron King Mine property. The removal will be limited to the STP itself. The alluvial apron to the east of the STP will not be considered a part of the TCRA. The STP will be removed to a depth approximating the original grade, which will be determined visually in the field. Periodically as the STP material is removed, confirmation samples will be collected in the footprint of the removal. A sampling frequency of at least one composite sample for every 1000 square yards of surface area will be utilized. Each composite sample will be made up of five sample aliquots which will be chosen judgmentally with the goal of obtaining material representative of that 1000-square-yard portion of the footprint. Because the STP will only be removed to original grade, the confirmation sample results will only be used to document post-removal site conditions. The results will not be compared to the site-specific action levels for arsenic or lead.

## 4.5 Ambient Air Sampling

During earth-moving activities at residential locations, at least three air samples will be collected on a daily basis. The sampling strategy requires sample collection at locations upwind from the residential structures and downwind of the excavation location. The location upwind of excavation must also be sampled to determine the background contributions It is anticipated that all but the first few days of air samples collected will be archived and only analyzed if needed.

Actual sampling locations will be determined daily based upon the wind direction and location of excavation.

# 5 Request for Analyses

Soil samples will be analyzed for lead and arsenic by U.S. EPA SW-846 Method 6010B. Borrow soil samples will be analyzed for RCRA 8 metals by U.S. EPA SW-846 Methods 6010B/7471A. Selected air samples will be analyzed for arsenic and lead by National Institute for Occupational Safety and Health (NIOSH) Method 7300. The remainder of the air samples will be archived for potential analysis.

## 5.1 Laboratory Analysis

TestAmerica Laboratory in Phoenix, Arizona will he used for all sample analyses. Sample containers, preservatives, and holding times, and the estimated number of samples including 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 five percent of soil samples, to be utilized for matrix spike/matrix spike duplicate (MS/MSD) analysis.

- Duplicate soil samples will be collected from 10 percent of the sampling locations and submitted for soil analysis as “blind” duplicates. A duplicate soil sample will be prepared by collecting a double-volume of soil into a plastic baggie, homogenizing the contents, and then splitting the soil between two sample jars.

For air samples, duplicates and spike samples cannot be collected. A method blank air sample cassette will be submitted with the regular air samples at a frequency of approximately five percent (1 in 20) (see Section 6.3).

**Table 5-1 Assessment Sampling and Analysis Summary**
**Iron King Mine – Humboldt Smelter**
**Yavapai County, Arizona**

E & E Project No. 002693.2110.01RA — TDD No. TO2-09-10-09-0004

| Method | Lead, Arsenic, and RCRA 8 Metals by U.S. EPA Methods 6010B/7471A | Lead and Arsenic by NIOSH Method 7300 |
|---|---|---|
| Sample Container | 4-ounce glass jar | 37-mm MCE cassette |
| Preservation | none | none |
| Analysis Holding Time | 6 months* | 6 months |
| Estimated Number of Unique Composite Samples | 100 | N/A |
| Estimated Number of Unique Discrete Samples | 0 | 120 |
| Estimated Number of Split Duplicate Samples | 10 | N/A |
| Minimum Total Site Sample Analyses | 110 | 120 |
| Matrix Spike/Matrix Spike Duplicates | 1 per 20 samples (1) Submit one 4-ounce glass jar | N/A |
| **Equipment Rinse Blanks (if non-dedicated equipment is used)** | | |
| Sample Container | 500 milliliter plastic bottle | N/A |
| Preservation | $HNO_3$ | N/A |
| Analysis Holding Time | 14 days | N/A |
| Number of Samples | 1 per day | N/A |

*the holding time for mercury is 28 days
MCE = Mixed Cellulose Ester
mm = millimeter
NIOSH = National Institute for Occupational Safety and Health

# 6 Field Methods and Procedures

## 6.1 Field Procedures

The following sections describe the field procedures and equipment that will be used during the site activities.

### 6.1.1 Standard Operating Procedures and Equipment

The equipment listed below may be utilized to obtain environmental samples from the respective media in accordance with the following sampling standard operating procedures (SOPs) or their equivalent:

- Environmental Response Team SOP #2012 Soil Sampling
- Ecology and Environment Inc. SOP # ENV 3.13: Soil Sampling
- Ecology and Environment Inc. SOP# ENV 3.15: Sampling Equipment Decontamination

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

- Trowels or scoops
- Stainless steel buckets or glass containers
- Dedicated plastic baggies and disposable trowels

### 6.1.2 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 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.

### 6.1.3 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.

### 6.1.4 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 and measured distances
- 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
- Field instrument reading (such as dust meter readings for health and safety purposes, etc.)
- Shipping arrangements (air bill numbers)
- Receiving laboratory(ies)

Several START team members may be on site performing different duties related to sample collection, processing, and analysis. If more than one sampling team is used, individual logbooks will be maintained for each sampling team. Each logbook will document the information relevant to the site activity, and at a minimum will include:

- Team members and their responsibilities
- Time of activities
- Deviations from sampling plans, site safety plans, and SAP procedures
- Levels of safety protection
- Calibration information
- Analytical data

### 6.1.5 Photographs

Photographs will be taken at representative sampling locations and at other areas of interest on site. They will serve to document field operations. 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

### 6.1.6 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, 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 field management software will require that the field team have 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.

### 6.1.7 Mapping Equipment
Sample points and site features will be located and documented with a GPS unit. The GPS will be used to assign precise geographic coordinates 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 Soil Sampling Procedures
All sample locations will be recorded in the field logbook as sampling is completed. Each field sampling team will document each individual sampling location in a field logbook, which will include: the site address, area sample was collected with a quick representative sketch of the area, photographs taken, date, time, and sampling team members.

### 6.2.1 Discrete Sampling
Discrete sampling methodology is not anticipated for the work described in this SAP.

### 6.2.2 Composite Sampling
#### 6.2.2.1 Borrow Material Sampling
Five-point composite samples will be collected from borrow sources.  One composite sample will be collected for each separate area within a borrow source from which soil may be used for fill material.  Composite sample aliquots will be collected from 0 to 6 inches into the soil. The collection points for the sample aliquots will be uniformly spatially distributed over the area.

The composite sample aliquots will be collected into a plastic baggie; homogenized; and then transferred into a four-ounce glass jar. Additional borrow samples will be collected from each source at a rate of one for approximately every 300 cubic yards of soil removed. Borrow material will not be used for backfill until analytical results have documented that arsenic and lead concentrations are below the action levels.

#### 6.2.2.2 Pre-Excavation Soil Sampling

At the FOSC's discretion, some properties may be "potholed" to one-foot or two-foot depths to collect five-point composite samples. One set of five-point composite samples would be collected for each quadrant of a property's yard (front, back, and side yards). The analytical results would provide the removal contractor with information regarding whether they will ultimately need to excavate to two feet bgs.

The collection points for the composite sample aliquots will be uniformly spatially-distributed within each area. A dedicated sampling spoon will be used to collect each composite sample. The composite sample aliquots will be collected into a plastic baggie; homogenized; and then transferred into a four-ounce glass jar.

#### 6.2.2.3 Post-Excavation Soil Sampling

After an area has been excavated to an approximate depth of one-foot depth bgs, following guidelines in the Lead Handbook, the START will then collect one five-point composite sample from each front, back, and side yard. This procedure will also be used for individual hot spot removals. If samples from any area (front, back, side yard, or hot spot) exceed the action levels for arsenic and/or lead, another one-foot lift will be removed in that area and another composite sample will be collected. Soil removal will not exceed a two-foot bgs depth. As described in Section 4.3, the one-foot depth sampling interval may be by-passed in certain situations

The collection points for the composite sample aliquots will be uniformly spatially-distributed within each area. Each sample aliquot will be collected from 0 to 2 inches bgs. A dedicated sampling spoon will be used to collect each composite sample. The composite sample aliquots will be collected into a plastic baggie; homogenized; and then transferred into a four-ounce glass jar.

## 6.3 Air Sampling Procedures

The air samples collected during this project will be used to document arsenic and lead concentrations in air during the removal activities. Air samples will be analyzed only for the first several days of removal operations. The quick-turnaround results will be reviewed to determine whether the START's real-time air monitoring protocol for total particulates is effectively controlling fugitive dust emissions during removal operations. Air samples will continue to be collected on a daily basis, but will be archived in sealed and labeled boxes that will be kept with the project files.

Air samples will be collected using NIOSH Method 7300. Mixed cellulose ester (MCE) sample cassettes of 37-millimeter diameter and 0.8 micrometer pore size will be used to collect the sample. A low flow (2 to 3 liters per minute) air sampling pump will be used to draw ambient air into the sample cassette. At least three air samples will be collected from locations spatially distributed about the removal area, as described in Section 4.2.

The air sample will be collected using the following process:

- Uncap both ends of a new sample cassette and label it as a daily calibrator. Attach the cassette upstream of the sampling pump using tubing which comes with the pump. Make sure that the direction arrow on the cassette points in the direction of the air flow. Attach a pump calibrator to the exhaust of the pump.

- Turn on the pump, adjust the flow rate to 2 to 3 liters per minute, and log the exact flow rate on an air sampling form such as that which is presented in Figure 6-1.

**Figure 6-1 Example Air Sampling Form**

IRON KING MINE – HUMBOLDT SMELTER REMOVAL
DAILY AIR SAMPLING LOG SHEET

Date:

OFS-

| Unit ID | Location | Time On | Time Off | Initial Flow Rate | Final Flow Rate | Average Flow Rate | Total Volume |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

- Turn off the pump, remove the calibrator, place the pump at the sampling location, and attach a new, labeled sample cassette. Do not uncap the upstream side of the cassette until ready to start the pump.

- Turn on the pump and log the time the pump was turned on.

- At the end of the work day, place the calibrator on the exhaust of the pump and note the flow rate.

- Turn off the pump and note the time the pump was turned off.

- Remove the sample cassette, cap both ends, and package it in a plastic baggie for archive or shipment to the laboratory.

- Determine the average flow rate for the sample by adding the beginning flow rate and ending flow rate together and dividing by two.

- Determine the volume of air (in liters) that flowed through the sample by multiplying the flow rate by the sampling time (in minutes).

- Write the volume of air which flowed through the sample on the chain of custody form, along with the sample identifier.

A weather station will be set up near the removal area to record wind direction and velocity continuously during removal operations.  The weather station data will be downloaded and archived on a daily basis.

# 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:

- Used personal protective equipment (PPE)
- Disposable sampling equipment
- Decontamination fluids
- Extra sample soil remaining in plastic baggies

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 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, if any, will consist of water with residual contaminants and/or non-phosphate detergent. These fluids will be poured onto removed, contaminated soil which will then be transported for stockpiling at the Iron King Mine.
- Extra sample soil remaining in plastic baggies will be placed with removed, contaminated soil which will then be transported for stockpiling at the Iron King Mine.

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# 8 Sample Identification, Documentation and Shipment

## 8.1 Sample Nomenclature

A unique, identifiable name will be assigned to each sample. Samples will have a prefix indicating the project: IKMHSR (Iron King Mine – Humboldt Smelter Removal), followed by and identifier of the property from which they were collected (e.g., OFS-133). The property identifier will be followed by a sequential number starting with 01 corresponding to the sample number from that particular property. The sample identifier will be followed by a number indicating depth (002 represents 2 inches bgs). Equipment rinsate blank samples will be designated as Metals-EB-(type of equipment [e.g., trowel])-date.

Air samples will be designated by IKMHSR-Date-Air-#, where # will be the air sampling station number (1, 2, or 3).

Field duplicate samples will have a fictitious sample identifier, which will be noted in the logbook. A summary of this sample naming system is shown in Table 8-1.

**Table 8-1 Soil Sample Numbering System**
**Iron King Mine – Humboldt Smelter**
**Yavapai County, Arizona**

E & E Project No. 002693.2155.01RF | TDD No. TO2-09-11-08-0005

| Type of Sample | Site Area | Sample ID |
|---|---|---|
| Primary Field Sample<br><br>Example:<br><br>Surface soil sample from side yard of OFS-133 | Decision Unit Area | IKMHSR-<OFS number>-<sequential number starting with 1>-<depth in inches>-<composite or aliquot if applicable><br><br>IKMHSR-OFS-133-002-002 |
| Field Duplicate<br><br>Example:<br><br>Duplicate soil sample from side yard of OFS-133 | All | IKMHSR-<OFS number>-<fictitious number>-<depth in inches><br><br>IKMHSR-OFS-133-007-002 |



## 8.2 Container, Preservation, and Holding Time Requirements

All sample containers will have been delivered to the START in a pre-cleaned condition. Container, preservation, and holding time requirements are summarized in Table 5-1.

## 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 will contain the following information:

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

Samples will be stored in a secure location on site pending delivery to the 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 soil samples are:

- If ice is used then it will be packed in double zip-lock plastic bags.
- The drain plug of the cooler will be sealed with tape to prevent melting ice from leaking.
- The bottom of the cooler will be lined with bubble wrap to prevent breakage during shipment.
- Screw caps will be checked for tightness.
- Containers will have custody seals affixed so as to prevent opening of the container without breaking the seal.
- All glass sample containers will be wrapped in bubble wrap.
- All containers will be sealed in zip-lock plastic bags.

All samples will be placed in coolers with the appropriate chain-of-custody forms. All forms will be enclosed in plastic bags and affixed to the underside of the cooler lid. If samples require refrigeration during shipment then 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, right, and back of each cooler.

Samples will be shipped for immediate delivery to the contracted laboratory. Upon shipping, the laboratory will be notified of:

- Sampling contractor's name.
- The name of the site.
- Shipment date and expected delivery date.
- Total number of samples, by matrix and the relative level of contamination for each sample (i.e., low, medium, or high).

- Carrier; air bill number(s), method of shipment (e.g., priority).
- Irregularities or anticipated problems associated with the samples.
- Whether additional samples will be sent; whether 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 disposition. 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 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 MS/MSD purposes
- Site name
- Sample date
- Number and volume of sample containers
- Required analyses
- 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.

A QA/QC sample summary form will be completed for each method and each matrix of the sampling event. The sample number for all blanks, reference samples, laboratory QC samples (MS/MSDs), and duplicates will be documented on this form. This form is not sent to the laboratory. The original form will be sent to the reviewer who is validating and evaluating the data; a photocopy of the original will be made for the project manager master file.

# 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

Dedicated sampling equipment will be used. However, if non-dedicated equipment, such as stainless steel trowels or hand augers, is used to collect samples, equipment rinsate blanks will be collected at a rate of one per day to evaluate field sampling and decontamination procedures.

#### 9.1.1.2 Field Blanks

Field blanks will be collected for air samples, only. They will consist of sample cassettes from the same sample batch as the real samples. The “blank” cassette will be left un-capped during the day of sampling, then capped and submitted to the laboratory with the regular samples. The blank results will be used to evaluate whether contaminants have been introduced into the samples through a means other than the sampling pump.

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

Duplicate soil samples will be collected at selected sample locations. These locations will be chosen randomly in the field based on field observations and will be collected at a rate of approximately one for every 10 field samples.

### 9.1.3 Laboratory Quality Control (QC) Samples for Soil

A laboratory QC sample, also referred to as a MS/MSD, is not an extra sample; rather, it is a sample that requires additional QC analyses and therefore may require a larger sample volume. The chain-of-custody records for these samples will identify them as laboratory QC samples. The samples selected for laboratory QC will be selected at random. A minimum of one laboratory QC sample will be submitted per 20 samples (or one per delivery group), per matrix, to be analyzed for each analytical parameter. If the DQIs for analytical parameters are not achieved, further data review will be conducted to assess the impact on data quality.

Additional sample volume will be submitted for all lead and arsenic samples designated as laboratory QC samples and will be designated as MS/MSD samples on the chain-of-custody to the fixed-base laboratory.

## 9.2 Analytical and Data Package Requirements

It is required that all samples be analyzed in accordance with the U.S. EPA Method listed in Table 5-1. The laboratory is required to supply documentation to demonstrate that their data meet the requirements specified in the method. A preliminary data summary is expected within 20 working days after submission of samples for analysis. A full validation data package will be required five weeks after submission of samples. The laboratory will also provide all data electronically in a Microsoft Excel-compatible format or delimited text file.

Deliverables for this project must meet the guidelines in *Laboratory Documentation Requirements for Data Evaluation* (EPA Region IX R9/QA/00.4.1, March 2001). 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) for up to three significant figures for all samples, method blanks, MS/MSD, Laboratory Control Samples (LCS), duplicates, Performance Evaluation samples (if applicable), and field QC samples.
- QC summary sheets/forms that summarize the following:
  - MS/MSD/LCS recovery summary
  - Method/preparation blank summary
  - Initial and continuing calibration summary (including retention time windows)
  - Sample holding time and analytical sequence (i.e., extraction and analysis)
  - Calibration curves and correlation coefficients
  - Duplicate summary
  - Detection limit information
- Analyst bench records describing dilution, sample weight, percent moisture (solids), sample size, sample extraction and cleanup, final extract volumes, and amount injected.
- Standard preparation logs, including certificates of analysis for stock standards.
- Detailed explanation of the quantitation and identification procedure used for specific analyses, giving examples of calculations from the raw data.
- The final deliverable report consisting of sequentially numbered pages.

## 9.3 Data Management

Samples will be collected and described in a logbook, as discussed in Section 6.1.4. Samples will be kept secure in the custody of the sampler at all times; the sampler will ensure that all preservation parameters are being followed. All samples that are to be sent to the off site analytical laboratory will be collected and logged on chain-of-custody forms as discussed in

Section 8.4. A START member will only submit samples to the analytical laboratory with chain-of-custody documentation. All submitted samples will be in a properly custody-sealed container. Specifics are discussed in Section 8.3. The laboratories will note any evidence of tampering upon receipt.

All data summary reports and complete data packages will be archived by the project manager. The data validation reports and laboratory data summary reports will be included in the final report to be submitted to the EPA.

## 9.4 Data Validation

Data validation of all data will be performed by the START or their subcontractor in accordance with U.S. EPA Region IX Superfund Data Evaluation/Validation Guidance R9QA/006.1, December 2001.

The standard data quality review requirements of a Tier 2 validation of 100 percent of the data (as defined in the U.S. EPA document, *Requirements for Quality Assurance Project Plans*, March 2001) will satisfy the data quality requirements for this project. Upon completion of validation, data will be classified as one of the following: acceptable for use without qualifications, acceptable for use with qualifications, or unacceptable for use.

If during or after the evaluation of the project's analytical data it is found that the data contain excess QA/QC problems or if the data do not meet the DQI goals, then the independent reviewer may determine that additional data evaluation is necessary. Additional evaluation may include U.S. EPA Region IX Superfund Data Evaluation/Validation Guidance R9QA/006.1 for evaluation Tier 3.

To meet evaluation and project requirements, the following criteria will be evaluated during a Tier 2 evaluation:

- Data package completeness
- Laboratory QA/QC summaries
- Holding times
- Blank contamination
- Matrix related recoveries
- Field duplicates
- Random data checks
- Preservation and holding times
- Initial and continuing calibration
- Blank analyses
- Interference check samples

- Laboratory control samples
- Duplicate sample analysis
- Matrix spike sample analyses
- Sample serial dilution
- Field duplicate/replicate
- Overall assessment of data.

Upon completion of evaluation, an analytical data evaluation Tier 2 review report will be delivered to the project manager, and the data will be classified within the report as one of the following:

- acceptable for use without qualifications
- acceptable for use with qualifications
- unacceptable for use

The data with applicable qualifications will be attached to the report. Unacceptable data may be more thoroughly examined to determine whether corrective action could mitigate data usability.

## 9.5 Field Variances

As conditions in the field may vary, it may become necessary to implement minor modifications to this plan. When appropriate, the START QA Coordinator and U.S. EPA FOSC will be notified of the modifications and a verbal approval obtained before implementing the modifications. Modifications to the original plan will be recorded in site records and documented in the final report.

## 9.6 Assessment of Project Activities

### 9.6.1 Assessment Activities

The following assessment activities will be performed by the START:

- All project deliverables (SAP, Data Summaries, Data Validation Reports, Investigation Report) will be peer reviewed prior to submission 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 in the peer review process will be reported by the reviewer to the originator of the document, who will be responsible for corrective action.
- The QA Coordinator will review project documentation (logbooks, chain-of-custody forms, etc.) to ensure the SAP was followed and that sampling activities were adequately documented. The QA Coordinator will document deficiencies, and the PM will be responsible for corrective actions.

### 9.6.2 Project Status Reports to Management

It is standard procedure for the START PM to report to the U.S. EPA Task Monitor (TM) any issues, as they occur, that arise during the course of the project that could affect data quality, data use objectives, the project objectives, or project schedules.

As requested, the START will provide XRF results to the U.S. EPA TM daily and unvalidated data will be provided as the data are received from the laboratory.

### 9.6.3 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 by the START for evaluating the results obtained from the project.

Review of the DQO outputs and the sampling design will be conducted by the START QA Coordinator prior to sampling activities. The reviewer will submit comments to the START PM for action, comment, or clarification. This process will be iterative.

A preliminary data review will be conducted by the START. 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. When appropriate to the sample design and if specifically tasked to do so by the U.S. EPA TM, the START will select a statistical hypothesis test and identify assumptions underlying the test.

# 10 References

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# A Data Quality Objective Process Document

**Iron King Mine – Humboldt Smelter Removal**

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

**Contract: EP-S5-08-01**
**TDD No.: TO2-09-11-08-0005**
**Job No.: 002693.2155.01RF**

*In August 2011, the United States Environmental Protection Agency (U.S. EPA) Region IX Emergency Response Section's Superfund Technical Assessment and Response Team (START) Project Officer directed the Ecology and Environment, Inc. START to support a U.S. EPA-funded removal of contaminated soils at residential parcels in the town of Dewey-Humboldt, Arizona. To support the U.S. EPA's environmental data collection activities, the START has developed these project data quality objectives (DQOs), which will be used to develop the Iron King Mine – Humboldt Smelter Removal Sampling and Analysis Plan (SAP). These DQOs are included as Appendix B of the SAP.*

## 1. THE PROBLEM

**Background:**
Previous U.S. EPA investigations, including an assessment conducted by the START in 2010-2011, have identified elevated arsenic and lead concentrations in surface and near-surface soils at residential properties located between the Iron King Mine and the Humboldt Smelter. The START assessment report (August 2011) determined that 13 of the properties should undergo partial- or full-property removals of contaminated soil, to a depth of up to 2 feet below ground surface (bgs). The 13 properties are listed in Table 2-1 of the SAP.

**Conceptual Site Model:**

- The media of concern is surface- and near-surface soil.
- The contaminants of potential concern are arsenic and lead.
- The soil at the site was potentially contaminated with arsenic and lead due to wind dispersion from the mine and/or smelter and from possible train load-out operations from the smelter.
- The release of arsenic and lead at the site has impacted shallow soils at some residential properties.

**Exposure Scenario:**

Current Conditions

- Concerns based on current conditions include: 1) direct exposure of human and/or environmental receptors to arsenic and lead in soils.

Removal Action Conditions

- The conditions at the site during the removal action may pose an additional threat to human health and the environment. Direct exposure of human and/or environmental receptors to arsenic and lead-contaminated soils is of concern during a removal.

- Soils removed from the site may also pose a threat to human health during transportation and disposal.

Post Removal

Removal of arsenic- and lead-containing soils at the 13 properties will significantly alleviate the potential for human and/or environmental exposure to arsenic and lead.

**Planning Team:**

Mr. Craig Benson, U.S. EPA Federal On-Scene Coordinator (FOSC)
Mr. Howard Edwards, START Quality Assurance Officer
Mr. Michael Schwennesen, START Project Manager
Analytical Laboratory – TestAmerica Laboratory in Phoenix, Arizona.

**The Roles and Responsibilities for this investigation are as follows:**

- **Craig Benson, 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.
- **Howard Edwards, START Quality Assurance Officer**, will provide quality assurance oversight to ensure that planning and plan implementation are in accordance with U.S. EPA regional quality assurance/quality control (QA/QC) protocol. He will provide technical direction concerning QA/QC as needed to the U.S. EPA FOSC and the START project manager.
- **Michael Schwennesen, START Project Manager**, will coordinate with the planning team to develop objectives and complete an approved SAP. The START Project Manager will have the responsibility for implementation of the SAP, coordination of project tasks, coordination of field sampling, project management, and completion of all preliminary and final reporting.

**Available Resources:**

The current START budget for environmental data collection and reporting is $127,800, which includes activities related to the planning, sampling, laboratory analysis, data evaluation, and reporting for the Iron King Mine - Humboldt Smelter Removal (IKMHSR).

**Other Considerations and Constraints Related to Problem and Resources:**

- Removal activities will begin on September 12, 2011. START support will be required throughout the project which is expected to take up to two months.
- Fast-turnaround analytical results will be required so that removal and backfill operations are not impaired.

## 2. THE DECISION

**Primary and Secondary Study Questions:**

Primary Study Question #1: What is the lateral and vertical extent of arsenic and lead-contaminated soils in the area of concern (garden area) that exceed the site screening levels?

Secondary Study Question #1: Do soils in additional areas of concern at the site (as identified by site observations or aerial photographs) contain arsenic and lead at concentrations that exceed the site screening levels?

Primary Study Question #2: Does groundwater at the site contain arsenic and lead at concentrations that exceed the site screening levels?

**Actions that could Result from Resolution of the Study Questions:**

For Primary and Secondary Study Questions #1:

If it is resolved that the lateral and/or vertical extent of arsenic and lead contamination in the garden area has not been defined, then further assessment to delineate extent may be initiated.

If it is resolved that the lateral and/or vertical extent of arsenic and lead contamination in the garden area has been defined, then no further delineation will be required.

If the lateral and vertical extent of arsenic and lead contamination in the garden area is defined, the delineation will be used as a guide for planning future assessment or removal activities.

If it is resolved that the arsenic and lead concentrations in soil in a sampling location in a specific area of concern at the site do not exceed any screening level, then the information may be used to support a determination that no further action is needed for that area of the site.

If it is resolved that the soil in a sampling location in a specific area of concern at the site contains arsenic and lead at concentrations that exceed screening levels, then further assessment and/or actions may be warranted in that area of the site.

For Primary Study Question #2:

If it is resolved that arsenic and lead in groundwater does not exceed any screening level, then the information may be used to support a determination that no further action is needed.

If it is resolved that arsenic and lead in groundwater is present at concentrations that exceed screening levels, then further assessment may be warranted.

**Decision Statement(s):**

Soil analytical data will be used to evaluate the lateral and vertical extent of arsenic and lead at concentrations above screening levels in the garden area soils at the site. Soil analytical data will also be used to evaluate if arsenic and lead is present in soil at concentrations above screening levels in specific areas of concern at the site. Groundwater analytical data will be used to evaluate if arsenic and lead is present in groundwater at concentrations above screening levels at the site.

- The location and extent of soils at the site containing arsenic and lead at concentrations that exceed site screening levels will be determined in order to assist the U.S. EPA in establishing the need to conduct further assessment or actions.
- The presence of groundwater at the site containing arsenic and lead at concentrations that exceed site screening levels will be determined in order to assist the U.S. EPA in establishing the need to conduct further assessment.

## 3. DECISION INPUTS

**Sources of Information Currently Available:**

- Surface and shallow soil data collected during U.S. EPA/START December 2010 sampling event (see Appendix A of the SAP).

**New Environmental Data Required to Resolve the Decision Statements:**

- Definitive analytical data for arsenic and lead at the site (between 0 and 20 feet below ground surface [bgs], to a maximum of approximately 50 feet bgs).
- Physical site data such as observations of soil types beneath the site.
- Definitive analytical data for arsenic and lead in groundwater beneath the site.
- Geospatial (location) data for the area and sampling locations.

**Sources of Information to Resolve the Decision Statements:**

- Analytical data from proposed sampling.
- Global Positioning System (GPS) location data from proposed sampling.

**Information Needed to Establish Site Screening Level:**

Potential screening levels for COPCs may come from the following sources:

- U.S. EPA Region 9 RSLs for Residential Soil (November, 2010).
- California EPA Office of Environmental Health Hazard Assessment (OEHHA) maximum contaminant levels (MCLs)/Public Health Goals (PHGs).

**Measurement Methods**:

Collected soil and groundwater samples can be definitively analyzed to determine arsenic and lead concentrations by the U.S. EPA methods as follows:

- Arsenic and lead by U.S. EPA Method 314.0.

**Confirm that Appropriate (Analytical) Methods Exist to Provide the Necessary Data:**

All indicated definitive methods have sufficient sensitivity, accuracy, precision, and other quality parameters to generate necessary data. See Table 3-1 of the SAP for additional information.

## 4. DEFINE THE STUDY BOUNDARIES

**Specific Characteristics that Define Population Being Studied**:

- The spatial distribution of arsenic and lead in soils within the specified spatial and temporal boundaries.
- The arsenic and lead concentrations in soils within the specified spatial and temporal boundaries.
- The arsenic and lead concentrations in groundwater within the specific spatial and temporal boundaries.

**Spatial Boundaries:**
The investigation boundaries will be the property boundaries of the northwestern-most of the four 5-acre parcels (APN 0425-091-21-0-000), with potential extension of the spatial boundaries to include the other three 5-acre parcels depending on site observations. The boundary will encompass the specified area to a depth of approximately 50 feet bgs, the deepest depth at which first encountered groundwater is anticipated.

**Temporal Boundaries:**
The decisions will apply to determinations of risk associated with long-term direct exposure to contaminated soils as well as potential future migration to groundwater. However, the decision may also apply to short-term (acute) exposure during potential future removal activities.

Arsenic and leads are environmentally persistent, and arsenic and lead salts are readily soluble in water. Arsenic and lead is also a widespread contaminant in drinking water in the State of California.

The timeframe of the planned assessment is as follows:

- The SAP will be submitted to the U.S. EPA by March 14, 2011.
- Sample collection will take place beginning March 21, 2011.
- Preliminary analytical data will be reported to START approximately three weeks after 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.

**Practical Constraints on Data Collection:**

<u>Physical Constraints:</u>

- The two structures on the property may prevent delineation to the east and south of the area of concern.
- Geoprobe refusal in the subsurface will limit the vertical extent of sampling. Repeated sampling attempts at locations near refusal locations will proceed within practical time and effort constraints.
- Groundwater and vadose zone soil sampling may be inhibited if groundwater is first encountered at a depth difficult to attain or through a soil type difficult to penetrate using a Geoprobe®. Groundwater has been estimated by the RWQCB to occur at depths between 25 and 50 feet bgs. Soil type is unknown.

<u>Other Constraints on Data Collection</u>

- 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 prior to final reporting.

## 5. DECISION RULE

**Statistical Parameter:**
One goal of the assessment sampling is to generate a geographically distributed set of data points (which is not a statistical parameter). Each data point will be used to determine the contaminant concentration at that location. The data points will be used to locate contamination hot spots and may be used to represent the geographic distribution of contamination.

To meet additional sampling objectives, statistical analysis may be used to determine parameters such as the range of contaminant concentrations, average concentration, and contamination variability within the decision area. It will be necessary to consider an individual sampling data point as representing the contaminant concentration within a specific area.

**Site Screening Level:**

- For arsenic and lead in soil, the U.S. EPA Region 9 RSL for residential soil (November, 2010) will be used.
- For arsenic and lead in groundwater, the California EPA/OEHHA MCL/PHG will be used.

Refer to Table 5.1 for site soil and groundwater screening levels.

**Decision Rule:**
If the new data indicate that contaminant concentrations in soils and/or groundwater at the site are above the site screening levels, then decision-makers will decide whether further assessment and potential action are required in order to protect human health and/or the environment.

**Table 5.1**
**Potential Site Screening Levels for Soil and Groundwater**
**Mojave River Pyrotechnics Assessment**

E & E Project No.: 002693.2124.01RA TDD No.: TO2-09-10-12-0003

| Contaminants of Potential Concern | Site Screening Level | |
|---|---|---|
| | Soil (mg/kg) [1] | Groundwater (μg/L) [2] |
| Arsenic and lead/arsenic and lead salts | 55 | 6.0 |

[1] United States Environmental Protection Agency (U.S. EPA) Region 9 Regional Screening Levels for Residential Soil (November, 2010)
[2] Arsenic and lead: California EPA/Office of Environmental Health Hazard Assessment Maximum Contaminant Level (MCL)/Public Health Goal
mg/kg – milligrams per kilogram μg/L – micrograms per liter
N/A – Not Available

2011 ecology & environment, inc.

## 6. LIMITS ON DECISION ERRORS

**Range of the Parameter(s) of Interest:**
For all investigation areas and parameters, the range of interest for a COPC is from ½ the site screening level to anything above the site screening levels. Quantitatively precise and accurate determinations of contaminant concentrations that are significantly above (i.e., >100 times) the site screening level are not necessary.

Based upon previous investigations, soils containing arsenic and lead are expected to be present at the site at concentrations above site screening levels.

**Baseline Condition *(The Null Hypothesis)*:**
The contaminant concentrations in soil and/or groundwater are equal to or greater than the site screening levels.

**Alternative Condition *(The Alternative Hypothesis)*:**
The contaminant concentrations in soil and/or groundwater are less than site screening levels.

**Decision Error**
A discussion of decision error and decision error goals is presented in Tables 6-1 and 6-2.

**TABLE 6-1 DECISION ERRORS**
**Soil and Groundwater**
**Mojave River Pyrotechnics Assessment**

E & E Project No.: 002693.2124.01RA TDD No.: TO2-09-10-12-0003

| | | |
|---|---|---|
| ***Decision Error*** | Deciding that an area is contaminated and requires restrictions, additional investigation, and mitigation when the site is not contaminated. | Deciding that an area is not contaminated and requires no restrictions, additional investigations or mitigation when the site is contaminated. |
| ***True Nature of Decision Error*** | The sample concentrations are either not representative or are biased high. | The sample concentrations are either not representative or are biased low. |
| ***The Consequence of Error*** | 1) Development of the site will have restrictions and will undergo additional investigation or additional mitigating activities. These situations would cost additional resources of time, money, and manpower and could negatively impact the environment. This could limit use of the site. | 1) Site occupants could be directly exposed to contaminants.<br>2) The COPCs in contaminated soil could potentially migrate throughout the area or migrate vertically to impact groundwater.<br>3) The COPCs in contaminated groundwater could continue to migrate and could potentially impact drinking water.<br>3) The contaminants could become more exposed and more accessible if the site is in use. |
| ***Which Decision Error Has More Severe Consequences Near the Screening Level?*** | **LESS SEVERE**<br>To human health, but with appreciable economic consequences. | **MORE SEVERE**<br>Since the contaminated soil may pose risks to human health and/or the environment. |
| ***Error Type Based on Consequences*** | **False Acceptance Decisions**<br>A decision that the area is contaminated when it is not. | **False Rejection Decisions**<br>A decision that the area is not contaminated when it is. |

**Definitions**
False Acceptance Decisions = A false acceptance decision error occurs when the null hypothesis is not rejected when it is false.
False Rejection Decisions = A false rejection decision error occurs when the null hypothesis is rejected when it is true.

Because a judgmental sampling approach will be utilized for groundwater sampling and for a portion of the soil sampling, decision error limit goals were determined only for the systematic soil sampling in the garden area.

**TABLE 6-2 DECISION ERROR LIMIT GOALS**
**Soil – Garden Area**
**Mojave River Pyrotechnics Assessment**

E & E Project No.: 002693.2124.01RA — TDD No.: TO2-09-10-12-0003

| True Average Concentration of Area (% of Screening Level [SL]) | Decision Error | Typical Decision Error Probability Goals (Based on Professional Judgment) | Type of Decision Error |
|---|---|---|---|
| <75 % | A decision that a portion of the site is contaminated when it is not. | Less than 5 % | False Acceptance |
| 75 to <100 % SL | A decision that a portion of the site is contaminated when it is not. | Gray Area [1] | False Acceptance |
| 100 to 150 % SL | A decision that a portion of the site is not contaminated when it is. | 10 % [2] | False Rejection |
| > 150 % | A decision that a portion of the site is not contaminated when it is. | less than 1% | False Rejection |

**The goals in this table are based on professional judgment as relevant to the Soil Assessment.**

[1] Gray Area is where relatively large decision errors are acceptable.

[2] Note that relatively large decision errors are expected when the true contaminant concentrations are between 100 and 150 % of the screening level. Decreasing the probability is not possible since sampling and analytical uncertainties and biases cannot be eliminated.

## 7. OPTIMIZED DESIGN FOR OBTAINING DATA

**General:**
All activities and documentation related to the project should proceed under a Quality Management Plan. 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 QA/QC requirements for selected analytical methods.

**Decision Error Minimization:**

Average Concentrations
In order to minimize a decision error related to data uncertainty, the decision-maker should consider statistical evaluations of the data prior to making decisions.

Data from Individual Sample Locations
The decision-maker should consider data uncertainty when making decisions based upon sampling data and associated estimated values based upon a single location. An individual data value reported below the site screening level may potentially be biased low, while a data value reported above the site screening level may potentially be biased high. The probability of decision errors increases at COPC concentrations around the site screening level due to both data uncertainty and data bias.

For any reported values near the method detection limit, the uncertainty of any given value is even greater. Thus the probability of decision error is greatly increased at COPC concentrations near detection limits. The uncertainty for estimated data (i.e., data based on extrapolations and interpolations) is typically greater than for actual data. Therefore, the probability of decision errors is greatly increased for extrapolated data.

Due to the nature of the deposition of contamination, it is reasonable to assume that data from any individual sample locations on this site can represent a larger area. However, there are insufficient data to determine the confidence of any single sampling location. Thus the decision-maker should acknowledge that discrete data points could potentially not be representative of any greater area.

Contamination Distribution Map
Data from sampling locations can be used to create a contamination distribution map. The mapped contaminant concentrations indicated within an area should generally be based upon 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 concentrations 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 upon the map.

Search Grid Size
Decision-makers should consider the sizes and probability of missing a contamination hot spot when evaluating sampling grid data.

Decision Error Limits
There are limited contaminant data available for the soils and groundwater at this site. Therefore, a sampling design constructed specifically to meet the decision error limits discussed in Step 6 is not possible. Data generated from this investigation may be used to determine whether decision error goals have been achieved.

**Specific Design Optimization:**
Based upon the project's goals and objectives, the Planning Team considered the following design elements as necessary to achieve the DQOs:

- The collection of soil samples for arsenic and lead analysis.
- The collection of groundwater samples for arsenic and lead analysis.
- Systematic soil sampling within the garden area.
- Biased judgmental soil sampling at individual locations of concern in other portions of the site selected based on visual observations.
- Judgmental groundwater sampling at locations distributed within the garden area.
- Generation of data that will indicate the geographical distribution of contamination (GPS data).

The objectives of the sampling are: 1) to evaluate arsenic and lead concentrations in soils within the garden area at the site; 2) to evaluate the lateral and vertical extent of arsenic and lead concentrations that exceed the screening level in soil within the garden area; 3) to evaluate arsenic and lead concentrations in soils at areas of concern in other portions of the site selected based on visual observations of historical aerial photographs; and 4) to evaluate arsenic and lead concentrations in groundwater beneath the garden area at the site.

The primary sampling area is the garden area located in the northwest corner of the northwest residential parcel of the site (APN 0425-091-21-0-000). During the December 2010 sampling, the garden area was the location of the surface and shallow subsurface soil samples in which elevated arsenic and lead concentrations were detected. Based on review of historical aerial photographs, additional sample areas were identified to the rear of this parcel as potential historical storage or unauthorized disposal areas. A subsurface geophysical survey will be conducted in the garden area and the potential historical storage areas prior to sampling to determine whether any anomalous subsurface features are present. Additionally, during the proposed March 2011 sampling event, the other three parcels that make up the site will be evaluated visually to identify any potential areas of concern. Potential areas of concern identified in the other three parcels may be selected for targeted geophysical surveys and potential subsequent soil sampling; however, a sampling plan has not been established as part of this SAP for the three remaining parcels.

In consultation with the U.S. EPA, a grid sampling design combined with judgmental sampling was selected to meet the specified DQOs. A rectangular grid of 20 soil boring locations was situated to cover the entire garden area, including the perimeters. Visual Sample Plan, Version 6.0 (Battelle Memorial Institute 2010) (VSP) was used to determine that the specified grid will detect a circular hotspot with a radius of at least 27 feet.

Three additional judgmental boring locations were selected, in consultation with the U.S. EPA, for locations in the southern half of the northwestern parcel. Based on review of historical aerial photographs, the northwestern and southeastern of the three biased sample locations are situated at either end of a visible pathway or trail that may have been used to traverse historical storage or disposal areas. The third biased sample location is located in an area that historical aerial photographs show to have been fenced at one time, possibly indicating a storage or disposal area. Proposed sampling locations are presented in Figure 4-1 of the SAP.

Four vertical soil samples per each of the 23 boring locations will be collected at 1 foot bgs (6 – 12 inches bgs), 3 feet bgs, 6 feet bgs, and 10 feet bgs. Based on field observations, up to five sample locations in the garden area may be selected for additional sampling at 15 and 20 feet bgs. At three boring locations in the garden area grid, situated at the northwestern and southwestern corners and in the center of the eastern perimeter, groundwater samples will be collected. A fourth boring location may be added on the north side of Poplar Street, for collection of an additional groundwater sample. At these borings, soil samples will be collected to 20 feet bgs at the intervals described above; below 20 feet bgs, soil samples will be collected at 10-foot intervals to first encountered groundwater and will also be collected in the vadose zone immediately above first encountered groundwater. Groundwater is estimated to occur between 25 and 50 feet bgs.

An estimated 117 systematic and judgmental soil samples are proposed within the gridded garden area and at the three biased sample locations. Three groundwater samples are proposed within the garden area. Sample locations at the other three parcels that make up the site or across Poplar Street will not be collected without prior direction from the FOSC.

The following methods of soil and groundwater sampling may be used at the site:

- A Geoprobe® with Macrocore or Largebore sampling device will use direct push technology to advance the soil boring to the boring termination depth. During boring advancement, the Geoprobe® will collect soil cores in a polyethylene terephthalate glycol (PETG) sample liner in discrete intervals encompassing the target sampling depth. Soils will be transferred from the sample sleeve at the appropriate target depth to the appropriate container for transportation to the laboratory.
- A hand auger may be used to advance the boring to the desired depth in areas suspected of potential underground obstructions. After the hand auger is used to advance to the target sampling depth, the soils will be transferred from the auger to the appropriate sample containers.
- At the three boring locations selected for groundwater sampling, the Geoprobe® will be advanced to first encountered groundwater. Soils will be collected and observed during boring advancement to characterize lithology and to identify when groundwater is reached based on soil saturation. The boring will be terminated approximately 5 to 10 feet into groundwater. After withdrawing the Geoprobe® rods, a temporary groundwater well will be constructed using 3/4-inch diameter PVC casing riser connected to 5 to 10 feet of 0.010-inch slot PVC screen. A grab groundwater sample will be collected by lowering a bailer within the temporary well to the water level or by using tubing and valve to create a passive pumping system. The water sample will be transferred from the bailer or tubing to the appropriate sample container.

All samples will be placed in coolers and chilled with ice for storage and shipping. Duplicates, equipment blanks, and other appropriate QA/QC samples will be collected and are specified in the SAP. Data review, independent of the laboratory, will 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.

If the initial sampling location is inaccessible or refusal is encountered, the boring will be moved several feet and a second attempt will be made. If a boring location was moved to an area that was not subject to a geophysical survey to identify subsurface features, the borehole will be hand augered to a depth of approximately 3 to 5 feet bgs prior to sampling using the Geoprobe®. The field sampling team will proceed to collect samples at a specific location within practical time and effort constraints.

**Analysis:**
All soil and groundwater samples collected will be analyzed for arsenic and lead by the following

definitive method:

- Arsenic and lead by U.S. EPA Method 314.0.

# B Site Specific Health and Safety Plan

## Title and Approval Sheet

# U.S. EPA Region IX
# Emergency and Rapid Response Services
## Iron King Mine-Humboldt Smelter Site
## Dewey-Humboldt, Arizona

Health and Safety Plan
August 2011
Contract No. EP-W-07-022, ERRS IX
EPA Task Order No. 022-9098
EQ Project No. 030262.0098

Environmental Quality Management, Inc.
6825 216th Street SW, Suite J
Lynnwood, Washington, 98036

Approved: ______________________ Date: 9/12/11 11-3-11
On-Scene Coordinator, USEPA Region 9

Approved: Gary Wofford Date: 6 SEPT 11
ERRS Response Manager

Approved: ______________________ Date: 9/1/11
Program Manager

Approved: ______________________ Date: 9/12/11
START Representative

## A. SITE INFORMATION, ROLES AND RESPONSIBILITIES

| | |
|---|
| **Site Name:**<br>Iron King Removal |
| **Site Address:**<br>Dewey-Humboldt, Arizona (34° 31′ 57.00″ N 112° 15′ 08.80″ W |
| **Date of Activities:** September 12-October 7, 2011 |
| **Participants:** Ξ USEPA Ξ START Ξ ERRS PST Other |

**Table A-1**
**Site Roles/Responsibilities**

| SiteRole/Responsibility | Agency / Entity | Name | Title |
|---|---|---|---|
| USEPA-Lead | USEPA | Craig Benson | FOSC |
| START Project Manager | E&E | Mike Schwennesen | |
| START Safety Officer | E&E | Chris Myers | |
| ERRS Response Manager | EQM, Inc. | Gary Wofford | |
| ERRS Safety Officer | EQM, Inc. | Gary Wofford | |
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## B. SITE CHARACTERIZATION

**Site Description:** The Iron King Mine – Humboldt Smelter site is located in Dewey-Humboldt, Yavapai County, Arizona. The site is a community (typically termed the "In-Town Area") that is located between the Iron King Mine and the Humboldt Smelter. Three waterways (Chaparral Gulch, Galena Gulch, and Agua Fria River) transect the site. The Iron King Mine (IKM) property is approximately 153 acres in size. It is located west of Highway 69, bordered by the Chaparral Gulch and residences to the north; Highway 69 to the east; Galena Gulch to the south; and undeveloped land to the west. The IKM is a former lead, gold, silver, and zinc mine, and it has associated tailings piles and sediment ponds. The principal feature of the 85-acre portion of the Iron King Mine area of interest is a large (more than 50 acres) tailings pile, which contains high concentrations of arsenic and lead. The tailings are subject to off-site migration mainly via air particulate migration and surface water transport. At a residential property adjacent to the IKM exists an additional estimated 20,000 cubic yards of tailings deposited in a creek channel ("Small Tailings Pile").

The Humboldt Smelter (HS) property is located less than one mile east of the Iron King Mine property, on the east side of Highway 69. The approximately 189-acre smelter property is bounded by residences to the north and west; the Agua Fria River to the east; and Chaparral Gulch to the south. The Humboldt Smelter area of interest includes tailings and slag deposit areas and an approximately 23-acre ash pile. The ash pile material is subject to off-site migration mainly via air particulate migration and surface water transport.

map:

The area is: 9 predominately commercial 9 predominately residential Ξ mixed commercial/residential 9 rural

**Site History**: Various environmental assessments and remedial investigations have been conducted at the mine, smelter, and site since about the late 1980s and the IKM-HS area is currently listed as a Superfund site on the National Priorities List. Based on soil sampling performed as part of the remedial investigations, portions of the site are known to have soils with elevated lead and arsenic concentrations. In the In-town Area, lead was detected at concentrations up to 18,100 milligrams per kilogram (mg/kg) and arsenic was detected at concentrations up to 817 mg/kg. START conducted assessment soil sampling in March and June 2011. Results from the START sampling supported the results of previous investigations in documenting elevated concentrations of lead (maximum 4,100 mg/kg) and arsenic (maximum 1,900 mg/kg). The EPA's Emergency Response Section (ERS) is conducting a soil removal action in the In-Town Area.

**Scope of Work**: The Scope of Work for this project includes the following:

As part of the overall removal action at the site, the following primary tasks will be completed:

- Dust suppression at the smelter site through application of a soil sealant product to the approximately 10 acres of exposed ash (conducted by ERRS);
- Contaminated soil removal at 14 residential properties (ERRS will conduct the excavation, with confirmation soil sampling and air monitoring/sampling conducted by START);
- Relocation of the Small Tailings Pile to the main IKM tailings pile with application of soil sealant (conducted by ERRS, with soil sampling and air monitoring/sampling conducted by START);
- Creek restoration after removal of the Small Tailings Pile (conducted by ERRS, with air monitoring/sampling conducted by START).

During the main activities, START will also provide technical oversight and documentation support.

The individual activities that are required to complete the scope of work are divided into numbered tasks. Table B-1 provides a description of each numbered task.

| Table B-1<br>Project Tasks and Task Descriptions | |
|---|---|
| **Task Number** | **Task Description** |
| 1 | Mobilization, Site Preparation, and Demobilization |
| 2 | Dust suppression of smelter ash through application of soil sealant ("gorilla snot") |
| 3 | Contaminated soil excavation/removal |
| 4 | Relocation of the Small Tailings Pile followed by application of soil sealant |
| 5 | Creek channel restoration |
| 6 | Air Monitoring (health and safety) and air sampling (documentation of off-site migration of contaminants) during removal operations |
| 7 | Soil sampling as required to document residual contaminant concentrations after clean up |
| 8 | Decontamination of sampling/removal equipment as required. |
| 9 | Site documentation/oversight of removal activities |

## C. EVALUATION AND HAZARD CONTROL

This section identifies and describes safety and health hazards associated with site work. The hazards associated with each task, by site location are identified in the following table(s). Based on the best available knowledge of how that task will be performed, the likelihood of exposure to the hazards identified at that location specified and control measures implemented to protect employees from the hazard. Engineering controls, work practices, personal protective equipment, or a combination of these shall be implemented in accordance with 29 CFR 1910.120(g) to protect employees from exposure to health hazards.

| Overall Hazard Summary | | |
|---|---|---|
| **Hazard** (low, med, high) | **Task (s)** | **Discussion** |
| Low - Med | 1 | Heavy equipment/traffic awareness; weather extremes; electrocution prevention |
| Low - Med | 2 | Heavy equipment awareness; weather extremes |
| Med | 3, 4 | Contaminants in dust; heavy equipment/traffic awareness; weather extremes |
| Low - Med | 5 | Heavy equipment awareness; weather extremes |
| Low - Med | 6 | Contaminants in dust; heavy equipment awareness; weather extremes |
| Low | 7 | Contaminants in dust; heavy equipment awareness; weather extremes |
| Low | 8 | Heavy equipment awareness; weather extremes |
| Med | 9 | Contaminants in dust; heavy equipment awareness; weather extremes |

| Overall Control Measures | | |
|---|---|---|
| **Hazard** | **PPE** | **Discussion** |
| Low | Level D | Steel toed/shanked boots; gloves; hard hat, tyvek coveralls if required |
| Medium | Level D (air monitoring will be conducted to ensure Level D PPE is appropriate) | Steel toed/shanked boots; gloves; hard hat, tyvek coveralls if required |
| | | |
| | | |
| | | |
| | | |

| Job Hazard Analysis (JHA) | | | |
|---|---|---|---|
| **JHA Number** | **Task** | **Location Where Task Performed** | |
| 1 | Mobilization, Site Preparation, and Demobilization | IKM-HS Site | |
| **Date JHA conducted:** 9/12/11-10/07/11 | | **Date(s) JHA updated:** | |
| **Biological Hazards** | | | |
| **Name of Biological Hazard** | **Characteristics** | **Concentration** | **Exposure Potential during Task** |
| Desert creatures (insects, spiders, snakes, rodents, Gila monster)/Hantavirus | Ξ Infectious/Pathogenic<br>Ξ Toxic | NA | 9 High Ξ Low<br>9 Medium 9 Unknown |
| **Chemical Hazards** | | | |
| **Chemical Name or Type** | **Characteristics** | **State/Concentration** | **Exposure Potential during Task** |
| Lead, arsenic | 9 Flammable / Ignitable<br>9 Corrosive<br>Ξ Poison / Acutely Toxic<br>9 Air/Water Reactive<br>Ξ Carcinogenic<br>9 Explosive/Shock Sensitive<br>9 Volatile | 9 Gas/ Vapor<br>Ξ Solid<br>9 Liquid | 9 High Ξ Low<br>9 Medium 9 Unknown |
| See Table D-1 for a summary of Chemical information. Chemical Evaluation Sheet or Material Safety Data Sheets (MSDS) are located in Appendix A for known chemical hazards. | | | |
| **Physical Hazards** | | | |
| **Type of Physical Hazard** | | | **Exposure Potential during Task** |
| 9 Overhead 9 Below Grade X Trip/Fall<br>9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant<br>X Noise X Heat Stress X Cold Stress X Other – electrocution, traffic, heavy equipment operation, muscle strain | | | 9 High 9 Low<br>Ξ Medium 9 Unknown |
| 9 Ionizing Radiation<br>9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| | | | |
| 9 Confined Space (Hazards associated with permit required confined space (PRCS) entries will be addressed in separate document prepared by the contractor making the PRCS entry. | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| **Control Measures** | | | |
| **Engineering Controls:** Limit set up operations to “clean” areas. | | | |

| | | |
|---|---|---|
| **Work Practices:** (describe those work practices specific to this task or that differ from the general work practices described in Section G)<br><br>Limit set up operations to non-contaminated areas. Use qualified electrician during site set up. Use proper lifting techniques when lifting heavy equipment and bending. Use buddy system when lifting. Use mechanical devices for lifting greater than 60 pounds when possible. Exercise caution around moving vehicles. Use traffic spotter when loading and unloading equipment. Document site conditions from upwind. | | |
| **PPE** D: steel toed/shanked work boots, work gloves, tyvek coveralls if required, hard hat | | |
| **Group** | **PPE Level** | **Modifications Allowed** |
| USEPA | D | |
| START | D | |
| ERRS | D | |
| | | |

<table>
<tr><th colspan="4">Job Hazard Analysis (JHA)</th></tr>
<tr><th>JHA Number</th><th>Task</th><th colspan="2">Location Where Task Performed</th></tr>
<tr><td>2</td><td>Dust suppression of smelter ash through application of soil sealant</td><td colspan="2">Humboldt Smelter</td></tr>
<tr><td colspan="2">Date JHA conducted: 9/12/11-10/07/11</td><td colspan="2">Date(s) JHA updated:</td></tr>
<tr><th colspan="4">Biological Hazards</th></tr>
<tr><td>Name of Biological Hazard</td><td>Characteristics</td><td>Concentration</td><td>Exposure Potential during Task</td></tr>
<tr><td>Desert creatures (insects, spiders, snakes, rodents, Gila monster)/Hantavirus</td><td>Ξ Infectious/Pathogenic<br>Ξ Toxic</td><td>NA</td><td>9 High Ξ Low<br>9 Medium 9 Unknown</td></tr>
<tr><th colspan="4">Chemical Hazards</th></tr>
<tr><td>Chemical Name or Type</td><td>Characteristics</td><td>State/Concentration</td><td>Exposure Potential during Task</td></tr>
<tr><td>Lead, arsenic</td><td>9 Flammable / Ignitable<br>9 Corrosive<br>Ξ Poison / Acutely Toxic<br>9 Air/Water Reactive<br>Ξ Carcinogenic<br>9 Explosive/Shock Sensitive<br>9 Volatile</td><td>9 Gas/ Vapor<br>Ξ Solid<br>9 Liquid</td><td>9 High Ξ Low<br>9 Medium 9 Unknown</td></tr>
<tr><td colspan="4">See Table D-1 for a summary of Chemical information. Chemical Evaluation Sheet or Material Safety Data Sheets (MSDS) are located in Appendix A for known chemical hazards.</td></tr>
<tr><th colspan="4">Physical Hazards</th></tr>
<tr><td colspan="3">Type of Physical Hazard</td><td>Exposure Potential during Task</td></tr>
<tr><td colspan="3">9 Overhead 9 Below Grade X Trip/Fall<br>9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant<br>X Noise X Heat Stress X Cold Stress X Other – heavy equipment operation</td><td>9 High 9 Low<br>Ξ Medium 9 Unknown</td></tr>
<tr><td colspan="3">9 Ionizing Radiation<br>9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons</td><td>9 High Ξ Low<br>9 Medium 9 Unknown</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="3">9 Confined Space (Hazards associated with permit required confined space (PRCS) entries will be addressed in separate document prepared by the contractor making the PRCS entry.</td><td>9 High Ξ Low<br>9 Medium 9 Unknown</td></tr>
<tr><th colspan="4">Control Measures</th></tr>
<tr><td colspan="4">Engineering Controls: Work upwind of soil sealant application if possible.</td></tr>
</table>

| | | |
|---|---|---|
| **Work Practices:** (describe those work practices specific to this task or that differ from the general work practices described in Section G)<br><br>Exercise caution around moving vehicles and heavy equipment (make eye contact). Use traffic spotter when loading and unloading equipment. Document site conditions from upwind. | | |
| **PPE** D: steel toed/shanked work/nitrile boots, work gloves, tyvek coveralls if required, hard hat | | |
| **Group** | **PPE Level** | **Modifications Allowed** |
| USEPA | D | |
| START | D | |
| ERRS | D | |
| | | |

| Job Hazard Analysis (JHA) | | | |
|---|---|---|---|
| **JHA Number** | **Task** | **Location Where Task Performed** | |
| 3 | Contaminated soil excavation/removal | IKM-HS site residential properties | |
| **Date JHA conducted:** 9/12/11-10/07/11 | | **Date(s) JHA updated:** | |
| **Biological Hazards** | | | |
| **Name of Biological Hazard** | **Characteristics** | **Concentration** | **Exposure Potential during Task** |
| Desert creatures (insects, spiders, snakes, rodents, Gila monster)/Hantavirus | Ξ Infectious/Pathogenic<br>Ξ Toxic | NA | 9 High Ξ Low<br>9 Medium 9 Unknown |
| **Chemical Hazards** | | | |
| **Chemical Name or Type** | **Characteristics** | **State/Concentration** | **Exposure Potential during Task** |
| Lead, arsenic | 9 Flammable / Ignitable<br>9 Corrosive<br>Ξ Poison / Acutely Toxic<br>9 Air/Water Reactive<br>Ξ Carcinogenic<br>9 Explosive/Shock Sensitive<br>9 Volatile | 9 Gas/ Vapor<br>Ξ Solid<br>9 Liquid | 9 High 9 Low<br>Ξ Medium 9 Unknown |
| See Table D-1 for a summary of Chemical information. Chemical Evaluation Sheet or Material Safety Data Sheets (MSDS) are located in Appendix A for known chemical hazards. | | | |
| **Physical Hazards** | | | |
| **Type of Physical Hazard** | | | **Exposure Potential during Task** |
| 9 Overhead 9 Below Grade X Trip/Fall<br>9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant<br>X Noise X Heat Stress X Cold Stress X Other – traffic, heavy equipment operation | | | 9 High 9 Low<br>Ξ Medium 9 Unknown |
| 9 Ionizing Radiation<br>9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| | | | |
| 9 Confined Space (Hazards associated with permit required confined space (PRCS) entries will be addressed in separate document prepared by the contractor making the PRCS entry. | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| **Control Measures** | | | |
| **Engineering Controls:** Perform air monitoring to assure proper PPE is utilized. Use a water truck to keep soils wet and to control dust levels. | | | |

| | | |
|---|---|---|
| **Work Practices:** (describe those work practices specific to this task or that differ from the general work practices described in Section G)<br><br>Exercise caution around moving vehicles and heavy equipment (make eye contact). Use traffic spotter when loading and unloading equipment. Document site conditions from upwind. | | |
| **PPE** D: steel toed/shanked work/nitrile boots, work gloves, tyvek coveralls if required, hard hat | | |
| **Group** | **PPE Level** | **Modifications Allowed** |
| USEPA | D | |
| START | D | |
| ERRS | D | |
| | | |

| Job Hazard Analysis (JHA) | | | |
|---|---|---|---|
| **JHA Number** | **Task** | **Location Where Task Performed** | |
| 4 | Relocation of the Small Tailings Pile followed by application of soil sealant | OFS-002/IKM site | |
| **Date JHA conducted:** 9/12/11-10/07/11 | | **Date(s) JHA updated:** | |
| **Biological Hazards** | | | |
| **Name of Biological Hazard** | **Characteristics** | **Concentration** | **Exposure Potential during Task** |
| Desert creatures (insects, spiders, snakes, rodents, Gila monster)/Hantavirus | Ξ Infectious/Pathogenic<br>Ξ Toxic | NA | 9 High Ξ Low<br>9 Medium 9 Unknown |
| **Chemical Hazards** | | | |
| **Chemical Name or Type** | **Characteristics** | **State/Concentration** | **Exposure Potential during Task** |
| Lead, arsenic | 9 Flammable / Ignitable<br>9 Corrosive<br>Ξ Poison / Acutely Toxic<br>9 Air/Water Reactive<br>Ξ Carcinogenic<br>9 Explosive/Shock Sensitive<br>9 Volatile | 9 Gas/ Vapor<br>Ξ Solid<br>9 Liquid | 9 High 9 Low<br>Ξ Medium 9 Unknown |
| See Table D-1 for a summary of Chemical information. Chemical Evaluation Sheet or Material Safety Data Sheets (MSDS) are located in Appendix A for known chemical hazards. | | | |
| **Physical Hazards** | | | |
| **Type of Physical Hazard** | | | **Exposure Potential during Task** |
| 9 Overhead 9 Below Grade X Trip/Fall<br>9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant<br>X Noise X Heat Stress X Cold Stress X Other – traffic, heavy equipment operation | | | 9 High 9 Low<br>Ξ Medium 9 Unknown |
| 9 Ionizing Radiation<br>9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| | | | |
| 9 Confined Space (Hazards associated with permit required confined space (PRCS) entries will be addressed in separate document prepared by the contractor making the PRCS entry. | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| **Control Measures** | | | |
| **Engineering Controls:** Perform air monitoring to assure proper PPE is utilized. Use a water truck to keep soils wet and to control dust levels. Work upwind of soil sealant application if possible. | | | |

| | | |
|---|---|---|
| **Work Practices:** (describe those work practices specific to this task or that differ from the general work practices described in Section G)<br><br>Exercise caution around moving vehicles and heavy equipment (make eye contact). Use traffic spotter when loading and unloading equipment. Document site conditions from upwind. | | |
| **PPE** D: steel toed/shanked work/nitrile boots, work gloves, tyvek coveralls if required, hard hat | | |
| **Group** | **PPE Level** | **Modifications Allowed** |
| USEPA | D | |
| START | D | |
| ERRS | D | |
| | | |

<table>
<tr><th colspan="4">Job Hazard Analysis (JHA)</th></tr>
<tr><th>JHA Number</th><th>Task</th><th colspan="2">Location Where Task Performed</th></tr>
<tr><td>5</td><td>Creek channel restoration</td><td colspan="2">OFS-002 (residential property with Small Tailings Pile)</td></tr>
<tr><td colspan="2">Date JHA conducted: 9/12/11-10/07/11</td><td colspan="2">Date(s) JHA updated:</td></tr>
<tr><th colspan="4">Biological Hazards</th></tr>
<tr><td>Name of Biological Hazard</td><td>Characteristics</td><td>Concentration</td><td>Exposure Potential during Task</td></tr>
<tr><td>Desert creatures (insects, spiders, snakes, rodents, Gila monster)/Hantavirus</td><td>Ξ Infectious/Pathogenic<br>Ξ Toxic</td><td>NA</td><td>9 High Ξ Low<br>9 Medium 9 Unknown</td></tr>
<tr><th colspan="4">Chemical Hazards</th></tr>
<tr><td>Chemical Name or Type</td><td>Characteristics</td><td>State/Concentration</td><td>Exposure Potential during Task</td></tr>
<tr><td>Lead, arsenic</td><td>9 Flammable / Ignitable<br>9 Corrosive<br>Ξ Poison / Acutely Toxic<br>9 Air/Water Reactive<br>Ξ Carcinogenic<br>9 Explosive/Shock Sensitive<br>9 Volatile</td><td>9 Gas/ Vapor<br>Ξ Solid<br>9 Liquid</td><td>9 High Ξ Low<br>9 Medium 9 Unknown</td></tr>
<tr><td colspan="4">See Table D-1 for a summary of Chemical information. Chemical Evaluation Sheet or Material Safety Data Sheets (MSDS) are located in Appendix A for known chemical hazards.</td></tr>
<tr><th colspan="4">Physical Hazards</th></tr>
<tr><td colspan="3">Type of Physical Hazard</td><td>Exposure Potential during Task</td></tr>
<tr><td colspan="3">9 Overhead 9 Below Grade X Trip/Fall<br>9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant<br>X Noise X Heat Stress X Cold Stress X Other – heavy equipment operation</td><td>9 High 9 Low<br>Ξ Medium 9 Unknown</td></tr>
<tr><td colspan="3">9 Ionizing Radiation<br>9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons</td><td>9 High Ξ Low<br>9 Medium 9 Unknown</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="3">9 Confined Space (Hazards associated with permit required confined space (PRCS) entries will be addressed in separate document prepared by the contractor making the PRCS entry.</td><td>9 High Ξ Low<br>9 Medium 9 Unknown</td></tr>
<tr><th colspan="4">Control Measures</th></tr>
<tr><td colspan="4">Engineering Controls: Perform air monitoring to assure proper PPE is utilized.</td></tr>
</table>

| | | |
|---|---|---|
| **Work Practices:** (describe those work practices specific to this task or that differ from the general work practices described in Section G)<br><br>Exercise caution around moving vehicles and heavy equipment (make eye contact). Use traffic spotter when loading and unloading equipment. Document site conditions from upwind. | | |
| **PPE** D: steel toed/shanked work boots, work gloves, tyvek coveralls if required, hard hat | | |
| **Group** | **PPE Level** | **Modifications Allowed** |
| USEPA | D | |
| START | D | |
| ERRS | D | |
| | | |

| Job Hazard Analysis (JHA) | | | |
|---|---|---|---|
| **JHA Number** | **Task** | **Location Where Task Performed** | |
| 6 | Air monitoring/air sampling | Throughout site | |
| **Date JHA conducted:** 9/12/11-10/07/11 | | **Date(s) JHA updated:** | |
| **Biological Hazards** | | | |
| **Name of Biological Hazard** | **Characteristics** | **Concentration** | **Exposure Potential during Task** |
| Desert creatures (insects, spiders, snakes, rodents, Gila monster)/Hantavirus | Ξ Infectious/Pathogenic<br>Ξ Toxic | NA | 9 High Ξ Low<br>9 Medium 9 Unknown |
| **Chemical Hazards** | | | |
| **Chemical Name or Type** | **Characteristics** | **State/Concentration** | **Exposure Potential during Task** |
| Lead, arsenic | 9 Flammable / Ignitable<br>9 Corrosive<br>Ξ Poison / Acutely Toxic<br>9 Air/Water Reactive<br>Ξ Carcinogenic<br>9 Explosive/Shock Sensitive<br>9 Volatile | 9 Gas/ Vapor<br>Ξ Solid<br>9 Liquid | 9 High 9 Low<br>Ξ Medium 9 Unknown |
| See Table D-1 for a summary of Chemical information. Chemical Evaluation Sheet or Material Safety Data Sheets (MSDS) are located in Appendix A for known chemical hazards. | | | |
| **Physical Hazards** | | | |
| **Type of Physical Hazard** | | | **Exposure Potential during Task** |
| 9 Overhead 9 Below Grade X Trip/Fall<br>9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant<br>X Noise X Heat Stress X Cold Stress X Other – heavy equipment operation | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| 9 Ionizing Radiation<br>9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| | | | |
| 9 Confined Space (Hazards associated with permit required confined space (PRCS) entries will be addressed in separate document prepared by the contractor making the PRCS entry. | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| **Control Measures** | | | |
| **Engineering Controls:** Perform air monitoring to assure proper PPE is utilized. | | | |

| | | |
|---|---|---|
| **Work Practices:** (describe those work practices specific to this task or that differ from the general work practices described in Section G)<br><br>Exercise caution around moving vehicles and heavy equipment (make eye contact). | | |
| **PPE** D: steel toed/shanked work boots, work gloves, tyvek coveralls if required, hard hat | | |
| **Group** | **PPE Level** | **Modifications Allowed** |
| USEPA | D | |
| START | D | |
| ERRS | D | |
| | | |

<table>
<tr><th colspan="4">Job Hazard Analysis (JHA)</th></tr>
<tr><td>JHA Number</td><td>Task</td><td colspan="2">Location Where Task Performed</td></tr>
<tr><td>7</td><td>Soil sampling</td><td colspan="2">Soil removal areas of site</td></tr>
<tr><td colspan="2">Date JHA conducted: 9/12/11-10/07/11</td><td colspan="2">Date(s) JHA updated:</td></tr>
<tr><th colspan="4">Biological Hazards</th></tr>
<tr><td>Name of Biological Hazard</td><td>Characteristics</td><td>Concentration</td><td>Exposure Potential during Task</td></tr>
<tr><td>Desert creatures (insects, spiders, snakes, rodents, Gila monster)/Hantavirus</td><td>Ξ Infectious/Pathogenic<br>Ξ Toxic</td><td>NA</td><td>9 High Ξ Low<br>9 Medium 9 Unknown</td></tr>
<tr><th colspan="4">Chemical Hazards</th></tr>
<tr><td>Chemical Name or Type</td><td>Characteristics</td><td>State/Concentration</td><td>Exposure Potential during Task</td></tr>
<tr><td>Lead, arsenic</td><td>9 Flammable / Ignitable<br>9 Corrosive<br>Ξ Poison / Acutely Toxic<br>9 Air/Water Reactive<br>Ξ Carcinogenic<br>9 Explosive/Shock Sensitive<br>9 Volatile</td><td>9 Gas/ Vapor<br>Ξ Solid<br>9 Liquid</td><td>9 High Ξ Low<br>9 Medium 9 Unknown</td></tr>
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<tr><th colspan="4">Control Measures</th></tr>
<tr><td colspan="4">Engineering Controls: Perform air monitoring to assure proper PPE is utilized.</td></tr>
</table>

| | | |
|---|---|---|
| **Work Practices:** (describe those work practices specific to this task or that differ from the general work practices described in Section G)<br><br>Exercise caution around moving vehicles and heavy equipment (make eye contact). | | |
| **PPE** D: steel toed/shanked work boots, work gloves, tyvek coveralls if required, hard hat | | |
| **Group** | **PPE Level** | **Modifications Allowed** |
| USEPA | D | |
| START | D | |
| ERRS | D | |
| | | |

| Job Hazard Analysis (JHA) | | | |
|---|---|---|---|
| **JHA Number** | **Task** | **Location Where Task Performed** | |
| 8 | Decontamination of sampling/ removal equipment as required | IKM-HS site | |
| **Date JHA conducted:** 9/12/11-10/07/11 | | **Date(s) JHA updated:** | |
| **Biological Hazards** | | | |
| **Name of Biological Hazard** | **Characteristics** | **Concentration** | **Exposure Potential during Task** |
| Desert creatures (insects, spiders, snakes, rodents, Gila monster)/Hantavirus | Ξ Infectious/Pathogenic<br>Ξ Toxic | NA | 9 High Ξ Low<br>9 Medium 9 Unknown |
| **Chemical Hazards** | | | |
| **Chemical Name or Type** | **Characteristics** | **State/Concentration** | **Exposure Potential during Task** |
| Lead, arsenic | 9 Flammable / Ignitable<br>9 Corrosive<br>Ξ Poison / Acutely Toxic<br>9 Air/Water Reactive<br>Ξ Carcinogenic<br>9 Explosive/Shock Sensitive<br>9 Volatile | 9 Gas/ Vapor<br>Ξ Solid<br>9 Liquid | 9 High Ξ Low<br>9 Medium 9 Unknown |
| See Table D-1 for a summary of Chemical information. Chemical Evaluation Sheet or Material Safety Data Sheets (MSDS) are located in Appendix A for known chemical hazards. | | | |
| **Physical Hazards** | | | |
| **Type of Physical Hazard** | | | **Exposure Potential during Task** |
| 9 Overhead 9 Below Grade X Trip/Fall<br>9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant<br>X Noise X Heat Stress X Cold Stress X Other – heavy equipment operation | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| 9 Ionizing Radiation<br>9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| | | | |
| 9 Confined Space (Hazards associated with permit required confined space (PRCS) entries will be addressed in separate document prepared by the contractor making the PRCS entry. | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| **Control Measures** | | | |
| **Engineering Controls:** Limit set up to hot zone/contaminant reduction zone. | | | |

| | | |
|---|---|---|
| **Work Practices:** (describe those work practices specific to this task or that differ from the general work practices described in Section G)<br><br>Exercise caution around moving vehicles and heavy equipment (make eye contact). Use traffic spotter when loading and unloading equipment. Document site conditions from upwind. | | |
| **PPE** D: steel toed/shanked work boots, work gloves, tyvek coveralls if required, hard hat | | |
| **Group** | **PPE Level** | **Modifications Allowed** |
| USEPA | D | |
| START | D | |
| ERRS | D | |
| | | |

| Job Hazard Analysis (JHA) | | | |
|---|---|---|---|
| **JHA Number** | **Task** | **Location Where Task Performed** | |
| 9 | Site documentation/ oversight of removal activities | IKM-HS site | |
| **Date JHA conducted:** 9/12/11-10/07/11 | | **Date(s) JHA updated:** | |
| **Biological Hazards** | | | |
| **Name of Biological Hazard** | **Characteristics** | **Concentration** | **Exposure Potential during Task** |
| Desert creatures (insects, spiders, snakes, rodents, Gila monster)/Hantavirus | Ξ Infectious/Pathogenic<br>Ξ Toxic | NA | 9 High Ξ Low<br>9 Medium 9 Unknown |
| **Chemical Hazards** | | | |
| **Chemical Name or Type** | **Characteristics** | **State/Concentration** | **Exposure Potential during Task** |
| Lead, arsenic | 9 Flammable / Ignitable<br>9 Corrosive<br>Ξ Poison / Acutely Toxic<br>9 Air/Water Reactive<br>Ξ Carcinogenic<br>9 Explosive/Shock Sensitive<br>9 Volatile | 9 Gas/ Vapor<br>Ξ Solid<br>9 Liquid | 9 High 9 Low<br>Ξ Medium 9 Unknown |
| See Table D-1 for a summary of Chemical information. Chemical Evaluation Sheet or Material Safety Data Sheets (MSDS) are located in Appendix A for known chemical hazards. | | | |
| **Physical Hazards** | | | |
| **Type of Physical Hazard** | | | **Exposure Potential during Task** |
| 9 Overhead 9 Below Grade X Trip/Fall<br>9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant<br>X Noise X Heat Stress X Cold Stress X Other – heavy equipment operation | | | 9 High 9 Low<br>Ξ Medium 9 Unknown |
| 9 Ionizing Radiation<br>9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| | | | |
| 9 Confined Space (Hazards associated with permit required confined space (PRCS) entries will be addressed in separate document prepared by the contractor making the PRCS entry. | | | 9 High Ξ Low<br>9 Medium 9 Unknown |
| **Control Measures** | | | |
| **Engineering Controls:** Perform air monitoring to assure proper PPE is utilized. Limit work to “clean” areas when possible. | | | |

| | | |
|---|---|---|
| **Work Practices:** (describe those work practices specific to this task or that differ from the general work practices described in Section G)<br><br>Exercise caution around moving vehicles and heavy equipment (make eye contact). Document site conditions from upwind. | | |
| **PPE** D: steel toed/shanked work boots, work gloves, tyvek coveralls if required, hard hat | | |
| **Group** | **PPE Level** | **Modifications Allowed** |
| USEPA | D | |
| START | D | |
| ERRS | D | |
| | | |

## D. CHEMICAL HAZARDS

**Table D-1**
**Chemical Compound Information Summary**

| Compound | Exposure Limits | | | IDLH Level | Route(s) of Exposure | Acute Symptoms | Odor Threshold/ Description |
|---|---|---|---|---|---|---|---|
| | PEL | REL | TLV | | | | |
| Arsenic* | 0.010 mg/m$^3$ | 0.002 mg/m$^3$ Ceiling (15 minute) | 0.01 mg/m$^3$ | 5 mg/m$^3$ | Inhalation, ingestion, absorption, skin or eye contact | Ulceration of septum, dermatitis, GI disturbances | None |
| Lead | 0.050 mg/m$^3$ | 0.050 mg/m$^3$ | 0.05 mg/m$^3$ | 100 mg/m$^3$ | Inhalation, ingestion, skin or eye contact | Lassitude, irritated eyes | None |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Note: Use an asterisk (*) to indicate known or suspected carcinogens.

## E. ACTION LEVELS AND HEALTH AND SAFETY MONITORING

*Delete information for biological agents not of concern at the site.*

| Table E-1<br>Site-Specific Action Levels | | | | |
|---|---|---|---|---|
| **Contaminant** | **Level** | **Action** | **Level** | **Action** |
| Arsenic (OFS-002 property only) | 2.53 $mg/m^3$ (dust concentration) | Cease operations, apply engineering controls | | |
| Total dust | 2.5 $mg/m^3$ | Evaluate necessity of additional engineering controls | 5 $mg/m^3$ | Cease operations, apply engineering controls |

| Table E-2<br>General Action Levels | | | | |
|---|---|---|---|---|
| **Contaminant** | **Level** | **Action** | **Level** | **Action** |
| **Oxygen** | 19.5% - 22% | Continue work in Level D or C | < 19.5% or > 22% | Upgrade to Level B or A |
| **Lower Explosive Limit (LEL)** | 10 to 25% of LEL | Continuous monitoring | > 25% of LEL | Evacuate immediately |
| **Particulates** | ≥ 5 mg/m3 (assume all dust is respirable dust) | Upgrade to Level C | | |
| **Radiation** | Above background but <1 mR/hr | Continue monitoring | ≥1 mR/hr | Withdraw, contact Health Physicist and reassess work plan |
| **Unknown Organic Vapors/Gases** | Background to 1 part per million (ppm) | Level D with continuous monitoring | > 5 ppm to ≤ 500 ppm | Level B |
| | 1 ppm to ≤ 5 ppm | Level C with continuous monitoring | >500 ppm | Level A |
| **Other:** | | | | |

## F. 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.

**Table F-1**
**Decontamination Procedures:**

| **Type** | **Responsible Entity** |
|---|---|
| **Personnel:**PPE will be removed in the order and manner described in the *Guidelines for Removal of Protective Clothing* RAG.<br><br>Disposable PPE will be directed to the proper waste stream. Contaminated spots identified on nondisposable PPE, including respirators and hard hats, will be decontaminated using controlled dry or damp methods (e.g. towelettes) Respirators may also be directed to the respirator washing station for full decontamination.<br><br>Contaminated areas on the skin or body will be decontaminated using controlled dry or damp methods (e.g. towelettes). All contamination incidents on the skin or body will be documented in a Personnel Decontamination Form. | EPA/ERRS/START |
| **Equipment/Instruments:** Equipment/instruments will be washed with soap (alconox) and rinsed with water. Dedicated contaminated items will be disposed of. | ERRS/START |
| **Emergency Decon: Non Life Threatening:** Remove PPE, wash with soap and water and transport to hospital<br>**Life Threatening:** Remove PPE and transport to hospital | All |
| **Waste Management:** Waste will be disposed of in accordance with applicable regulations by ERRS | ERRS |

## G. SITE CONTROL

Draw site map indicating work zones.

**Buddy System:** All on-site personnel shall comply with the buddy system. The buddy system will be maintained on a line-of-sight basis.

**Work Practices and Site Control Measures Common to All Site Tasks**

**1.**The exclusion zone and contamination reduction zone (CRZ) will be clearly marked and access to it restricted to those personnel directly involved with the response operations.
**2.**Entry and exit corridors leading to the CRZ will be clearly marked.
**3.**Exclusion and CRZ zone entry and egress protocols will be established prior to any entry to these zones.
**4.**Prior to entering the exclusion zone and CRZ, personnel will know their specific tasks for the entry.
**5.**Personnel will enter and exit the exclusion zone only through designated corridors, which are located in and traverse the CRZ, unless emergency exiting of the facility is required.

**6.Communications:**

**On-Site Radio Frequencies:** Not used on this site.

**Cell Phone #:** Craig Benson, EPA OSC: 562-889-1630
Gary Wofford, ERRS: 714-269-5979__________
Mike Schwennesen, START: 760-689-8000
**Hand Signals:** Use appropriately

**Illumination:** All work will be conducted during daytime operational period unless sufficient artificial lighting in compliance with 29 CFR 1910.120(m) has been provided.

**Sanitation:** All work sites will be in compliance with the requirements pursuant to 29 CFR 1910.120(n).

## H. TRAINING/MEDICAL SURVEILLANCE

**Check all that apply**:

| **Table H-1 Personnel Training and Surveillance Requirements** | | | | |
|---|---|---|---|---|
| **Regulation** | USEPA | START | ERRS | Other |
| 29 CFR 1910.120(e)(3)(i): General Site Worker - 40 hr | X | X | X | |
| 29 CFR 1910.120(e)(3)(ii): Occasional Worker - 24 hr | | | | |
| 29 CFR 1910.120(e)(3)(iii): Workers in Area <PEL - 24 hr | | | | |
| 29 CFR 1910.120(e)(4): Management & Supervisors - 40/8 hr | X | X | X | |
| 29 CFR 1910.120(e)(7): Emergency Response | | | | |
| 29 CFR 1910.120(e)(8): Refresher - 8 hr | X | X | X | |
| First Responder Awareness | | | | |
| First Responder Operational - 8 hr | | | | |
| Hazmat Technician - 24 hr | | | | |
| Hazmat Specialist- 24 hr | | | | |
| On-Scene Commander - 24 hr | | | | |
| 29 CFR 1910.134: Resp. Std. | | | | |
| 29 CFR 1910.146: PRCS | | | | |
| 29 CFR 1910.120(f): Medical Surveillance Participation | X | X | X | |
| 8-Hour General Radiation Training | | | | |
| Radiation Exposure Surveillance - External Dosimetry (TLD Badge and/or electronic dosimeters) | | | | |

## I. EMERGENCY RESPONSE PLAN

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.

### Section I.1 Emergency Responsibilities

**Section I.1.1 All Personnel:** All personnel shall be alert to the possibility of an on-site emergency; report potential or actual emergency situations directly to supervision or to the FOSC, SSO and RSO; When practicable, the lead Federal official on-site will make the decision to declare a site emergency and notify appropriate emergency resources, as necessary.

**Section I.1.2 Entry Team Leader:** The team leader will determine the emergency actions to be performed by site personnel and will direct these actions. The team leader also will ensure that applicable incidents are reported to appropriate project personnel and the FOSC. The FOSC will determine what other government agency notifications are required.

**Section I.1.3 SSO:** The SSO will recommend health/safety and protective measures appropriate to the emergency. The SSO is authorized to terminate all activities deemed to be unsafe. In the case of an emergency, the SSO shall call 911 or designated someone to call 911.

**Section I.1.4 RSO:** The RSO is responsible for all radiation safety issues. If emergency decontamination is required, the RSO shall supervise.

**Section I.1.5 FOSC:** The FOSC has overall responsibility for all emergency operations. The FOSC shall interface with all rescue personnel.

**On-Site Emergency Signal:** Three long horn blasts

**On-Site Meeting Location:** EPA/ERRS/START office trailer

**Emergency Egress Route Off-Site:** See Map to Hospital

**Off-Site Meeting Location:** TBD at first tailgate safety meeting

**Emergency Decontamination Procedures:** Remove PPE and transport to hospital

| **Company/Resource** | **Name Contact** | **Telephone Numbers** |
|---|---|---|
| USEPA | Region Response Center<br>Harry Allen, ERS Chief<br><br>OSC:<br>Craig Benson | (800) 300-2193<br>(415) 972-3063 (Office)<br>(415) 218-7406 (Cell)<br><br>(562) 889-1630 (Cell) |
| START | Cindy McLeod<br><br>Sara Dwight | (415) 238-3379 (Cell)<br>(510) 654-6250 (Home)<br>(415) 264-8246 (Cell) |
| ERRS | RM: Gary Wofford | (714) 269-5979 |
| Hospital (Route Map Appendix B) | Yavapai Regional Medical Center-East, 7700 East Florentine Road, Prescott Valley, AZ 86314 | (928) 445-2700 |
| Poison Control Center | | 1-800-222-1222 |
| Police | | 911 |
| Fire | | 911 |
| Site | USEPA: Craig Benson<br><br>START: Mike Schwennesen<br>ERRS: Gary Wofford | (562) 889-1630 (Cell)<br><br>(760) 689-8000<br>(714) 269-5979 |

**Participant Acknowledgment Sheet**

| **Name** | **Organization** | **Date** |
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# Appendix A: Chemical Hazard Sheets

# Arsenic (inorganic compounds, as As)

**Synonyms & Trade Names** Arsenic metal: Arsenia
Other synonyms vary depending upon the specific As compound. [Note: OSHA considers "Inorganic Arsenic" to mean copper acetoarsenite and all inorganic compounds containing arsenic except ARSINE.]

| | | |
|---|---|---|
| **CAS No.** 7440-38-2 (metal) | **RTECS No.** CG0525000 (metal) (/niosh-rtecs/CG802C8.html) | **DOT ID & Guide** 1558 152 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=152) (metal)<br>1562 152 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=152) (dust) |
| **Formula** As (metal) | **Conversion** | **IDLH** Ca [5 mg/m$^3$ (as As)]<br>See: 7440382 (/niosh/idlh/7440382.html) |

| | |
|---|---|
| Exposure Limits<br>**NIOSH REL** : Ca C 0.002 mg/m$^3$ [15-minute] See Appendix A (nengapdxa.html)<br>**OSHA PEL** : [1910.1018] TWA 0.010 mg/m$^3$ | **Measurement Methods**<br>**NIOSH** 7300 (/niosh/docs/2003-154/pdfs/7300.pdf) , 7301 (/niosh/docs/2003-154/pdfs/7301.pdf) , 7303 (/niosh/docs/2003-154/pdfs/7303.pdf) , 7900 (/niosh/docs/2003-154/pdfs/7900.pdf) , 9102 (/niosh/docs/2003-154/pdfs/9102.pdf) ;<br>**OSHA** ID105 (http://www.osha.gov/dts/sltc/methods/inorganic/id105/id105.html)<br>See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) |

**Physical Description** Metal: Silver-gray or tin-white, brittle, odorless solid.

| | | | | | |
|---|---|---|---|---|---|
| **MW:** 74.9 | **BP:** Sublimes | MLT: 1135°F (Sublimes) | **Sol:** Insoluble | **VP:** 0 mmHg (approx) | **IP:** NA |
| **Sp.Gr:** 5.73 (metal) | **Fl.P:** NA | **UEL:** NA | **LEL:** NA | | |

Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame.

**Incompatibilities & Reactivities** Strong oxidizers, bromine azide [Note: Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.]

**Exposure Routes** inhalation, skin absorption, skin and/or eye contact, ingestion

**Symptoms** Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen]

**Target Organs** Liver, kidneys, skin, lungs, lymphatic system

**Cancer Site** [lung & lymphatic cancer]

**Personal Protection/Sanitation** (See protection codes (protect.html) )
**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** When contaminated/Daily
**Remove:** When wet or contaminated
**Change:** Daily
**Provide:** Eyewash, Quick drench

**First Aid** (See procedures (firstaid.html) )
**Eye:** Irrigate immediately
**Skin:** Soap wash immediately
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately

**Respirator Recommendations**
(See Appendix E) (nengapdxe.html)

**NIOSH**

**At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister having an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0013 (/niosh/ipcsneng/neng0013.html) See MEDICAL TESTS: 0017 (/niosh/docs/2005-110/nmed0017.html)

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Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People. Saving Money through Prevention.

Search the Pocket Guide

SEARCH

Enter search terms separated by spaces.

# Lead

**Synonyms & Trade Names** Lead metal, Plumbum

| | | |
|---|---|---|
| **CAS No.** 7439-92-1 | **RTECS No.** OF7525000 (/niosh-rtecs/OF72D288.html) | **DOT ID & Guide** |
| **Formula** Pb | **Conversion** | **IDLH** 100 mg/m$^3$ (as Pb) See: 7439921 (/niosh/idlh/7439921.html) |

## Exposure Limits

**NIOSH REL** *: TWA (8-hour) 0.050 mg/m$^3$ See Appendix C (nengapdxc.html) [*Note: The REL also applies to other lead compounds (as Pb) -- see Appendix C.]

**OSHA PEL** *: [1910.1025] TWA 0.050 mg/m$^3$ See Appendix C (nengapdxc.html) [*Note: The PEL also applies to other lead compounds (as Pb) -- see Appendix C.]

**Measurement Methods**

**NIOSH** 7082 (/niosh/docs/2003-154/pdfs/7082.pdf), 7105 (/niosh/docs/2003-154/pdfs/7105.pdf), 7300 (/niosh/docs/2003-154/pdfs/7300.pdf), 7301 (/niosh/docs/2003-154/pdfs/7301.pdf), 7303 (/niosh/docs/2003-154/pdfs/7303.pdf), 7700 (/niosh/docs/2003-154/pdfs/7700.pdf), 7701 (/niosh/docs/2003-154/pdfs/7701.pdf), 7702 (/niosh/docs/2003-154/pdfs/7702.pdf), 9100 (/niosh/docs/2003-154/pdfs/9100.pdf), 9102 (/niosh/docs/2003-154/pdfs/9102.pdf), 9105 (/niosh/docs/2003-154/pdfs/9105.pdf);
**OSHA** ID121 (http://www.osha.gov/dts/sltc/methods/inorganic/id121/id121.html), ID125G (http://www.osha.gov/dts/sltc/methods/inorganic/id125g/id125g.html), ID206 (http://www.osha.gov/dts/sltc/methods/inorganic/id206/id206.html)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html)

**Physical Description** A heavy, ductile, soft, gray solid.

| | | | | | |
|---|---|---|---|---|---|
| **MW:** 207.2 | **BP:** 3164°F | MLT: 621°F | **Sol:** Insoluble | **VP:** 0 mmHg (approx) | **IP:** NA |
| **Sp.Gr:** 11.34 | **Fl.P:** NA | **UEL:** NA | **LEL:** NA | | |

Noncombustible Solid in bulk form.

**Incompatibilities & Reactivities** Strong oxidizers, hydrogen peroxide, acids

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension

**Target Organs** Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue

**Personal Protection/Sanitation** (See protection codes (protect.html) )
**Skin:** Prevent skin contact
**Eyes:** Prevent eye contact
**Wash skin:** Daily
**Remove:** When wet or contaminated
**Change:** Daily

**First Aid** (See procedures (firstaid.html) )
**Eye:** Irrigate immediately
**Skin:** Soap flush promptly
**Breathing:** Respiratory support
**Swallow:** Medical attention immediately

**Respirator Recommendations**
(See Appendix E) (nengapdxe.html)
**NIOSH/OSHA**

**Up to 0.5 mg/m3**:
(APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

**Up to 1.25 mg/m3**:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.

**Up to 2.5 mg/m3**:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 50 mg/m3**:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

**Up to 100 mg/m3**:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:**
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:**
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0052 (/niosh/ipcsneng/neng0052.html) See MEDICAL TESTS: 0127 (/niosh/docs/2005-110/nmed0127.html)

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## HEAT STRESS PREVENTION AND TREATMENT

Elevated temperatures are potentially hazardous, especially when work is conducted without appropriate precautions. The following sections describe heat stress prevention and the recognition and treatment of heat emergencies.

**Effects of Heat**

A predictable amount of heat is generated as a result of normal oxidation processes within the body. If heat is liberated rapidly, the body cools to a point at which the production of heat is accelerated, and the excess heat brings the body temperature back to normal.

Interference with the elimination of heat leads to its accumulation and to the elevation of body temperature. This condition produces a vicious cycle in which certain body processes accelerate and generate additional heat. Afterward, the body must eliminate not only the heat that is normally generated but also the additional quantities of heat.

Most body heat is brought to the surface by the bloodstream and escapes to cooler surroundings by conduction and radiation. If moving air or a breeze strikes the body, additional heat is lost by convection. When the temperature of the surrounding air becomes equal to or rises above the body temperature, all the heat must be lost by vaporization of the moisture or sweat from skin surfaces. As the air becomes more humid (contains more moisture), vaporization from the skin decreases. Weather conditions including high temperatures (90 to 100 degrees F), high humidity, and little or no breeze cause the retention of body heat. Such conditions or a succession of such days (a heat wave) increase the chances of a medical emergency due to heat.

**Preventing Emergencies Due to Heat**

When working in situations where the ambient temperatures and humidity are high, and especially in situations where protection levels A, B, or C are required, the site safety officer should:

- Ensure that all employees drink plenty of fluids (Gatorade or its equivalent);
- Ensure that frequent breaks are scheduled so overheating does not occur; and
- Revise work schedules, when necessary, to take advantage of the cooler parts of the day (i.e., 5:00 a.m. to 11:00 a.m. and 6:00 p.m. to nightfall).

When protective clothing is required, the suggested guidelines correlating ambient temperature and maximum wearing time per excursion are:

| Ambient Temperature | Maximum Wearing Time per Excursion |
|---|---|
| Above 90 degrees F | 15 minutes |
| 85 to 90 degrees F | 30 minutes |
| 80 to 85 degrees F | 60 minutes |
| 70 to 80 degrees F | 90 minutes |
| 60 to 70 degrees F | 120 minutes |
| 50 to 60 degrees F | 180 minutes |

One method of measuring the effectiveness of an employee's rest-recovery regime is by monitoring the heart rate. The "Brouha guideline" is one such method and is performed as follows:

- Count the pulse rate for the **last** 30 seconds of the first minute of a 3-minute period, the **last** 30 seconds of the second minute, and the **last** 30 seconds of the third minute; and

- Double each result to yield beats per minute.

If the recovery pulse rate during the last 30 seconds of the first minute is 110 beats/minute or less, and the deceleration between the first, second, and third minutes is **at least** 10 beats/minute, then the work-recovery regime is acceptable. If the employee's rate is above the rate specified, a longer rest period will be required, accompanied by an increased intake of fluids.

**Heat Emergencies**

**Heat Cramps.** Heat cramps usually affect people who work in hot environments and perspire a great deal. Loss of salt from the body causes very painful cramps in leg and abdominal muscles. Heat cramps may also result from drinking iced water or other drinks either too quickly or in too large a quantity. The symptoms of heat cramps are:

- Painful muscle cramps in legs and abdomen;

- Faintness; and

- Profuse perspiration.

To provide emergency care for heat cramps, move the patient to a cool place. Give him or her sips of liquids such as Gatorade or its equivalent. Apply manual pressure to the cramped muscle. Move the patient to a hospital if there is any indication of a more serious problem.

**Heat Exhaustion.** Heat exhaustion also may occur in individuals working in hot environments and may be associated with heat cramps. Heat exhaustion is caused by the pooling of blood in the vessels of the skin. The heat is transported from the interior of the body to the surface by the blood. The skin vessels become dilated and a large amount of blood is pooled in the skin. This condition, plus the blood that is pooled in the lower extremities when in an upright position, may lead to an inadequate return of blood to the heart and eventual physical collapse. The symptoms of heat exhaustion are:

- Weak pulse;

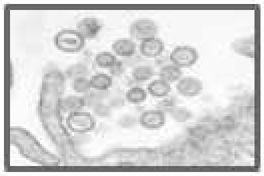
- Rapid and usually shallow breathing;
- Generalized weakness;
- Pale, clammy skin;
- Profuse perspiration;
- Dizziness/faintness; and
- Unconsciousness.

To provide emergency care for heat exhaustion, move the patient to a cool place and remove as much clothing as possible. Have the patient drink cool water, Gatorade, or its equivalent. If possible, fan the patient continually to remove heat by convection, but do not allow chilling or overcooling. Treat the patient for shock and move him or her to a medical facility if there is any indication of a more serious problem.

**Heat Stroke.** Heat stroke is a profound disturbance of the heat-regulating mechanism and is associated with high fever and collapse. It is a serious threat to life and carries a 20% mortality rate. Sometimes this condition results in convulsions, unconsciousness, and even death. Direct exposure to sun, poor air circulation, poor physical condition, and advanced age (over 40) increase the chance of heat stroke. Alcoholics are extremely susceptible. The symptoms of heat stroke are:

- Sudden onset;
- Dry, hot, and flushed skin;
- Dilated pupils;
- Early loss of consciousness;
- Full and fast pulse;
- Deep breathing at first, followed by shallow or faint breathing;
- Muscle twitching, growing into convulsions; and
- Body temperature reaching 105 to 106 degrees F or higher.

When providing emergency care for heat stroke, remember that it is a life-threatening emergency. Transportation to a medical facility should not be delayed. Move the patient to a cool environment, if possible, and remove as much clothing as possible. Ensure an open airway. Reduce body temperature promptly by dousing the body with water or, preferably, by wrapping the patient in a wet sheet. If cold packs are available, place them under the arms, around the neck, at the ankles, or any place where blood vessels that lie close to the skin can be cooled. Protect the patient from injury during convulsions.



National Center for Infectious Diseases
Special Pathogens Branch

# All About Hantaviruses



## General Information
**For general interest readers, students, and others**
**Printer-Friendly Version**

Back to General Information Index

**Tracking a Mystery Disease: A Brief History of Hantavirus Pulmonary Syndrome**
When did we first hear about hantavirus? What has happened since the first cases made national headlines? Learn about how researchers from many different institutions joined together to hunt down the source of the deadly illness.

**How Is the Virus That Causes HPS Transmitted? The Rodent Connection**
Rodents, particularly the deer mouse and cotton rat, are the ultimate source of the disease. Learn how people get the virus from them!

**Who Is at Risk of Getting HPS, and Why?**
Find out who gets the disease and why. What does being "at risk" mean?

**What are the Symptoms of HPS?**
What signs and symptoms are important to know? What symptoms aren't?

**How Do I Prevent HPS?**
Prevention is your best bet for dealing with HPS. That means keeping rodents out of homes and workplaces, keeping away from rodents when camping or hiking, and cleaning up safely if you do find rodents. Our prevention pages have complete tips and instructions for all kinds of people, and all kinds of problems and concerns.

**Treating Hantavirus Pulmonary Syndrome**
There is no miracle drug to cure HPS. Instead, patients should get immediate intensive care. What does this involve?

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## Tracking a Mystery Disease:
## The Detailed Story of Hantavirus Pulmonary Syndrome

### The "First" Outbreak

In May 1993, an outbreak of an unexplained pulmonary illness occurred in the southwestern United States, in an area shared by Arizona, New Mexico, Colorado and Utah known as "The Four Corners." A young, physically fit Navajo man suffering from shortness of breath was rushed to a hospital in New

Mexico and died very rapidly.

While reviewing the results of the case, medical personnel discovered that the young man's fiancee had died a few days before after showing similar symptoms, a piece of information that proved key to discovering the disease. As Dr. James Cheek of the Indian Health Service (IHS) noted, "I think if it hadn't been for that initial pair of people that became sick within a week of each other, we never would have discovered the illness at all."

An investigation combing the entire Four Corners region was launched by the New Mexico Office of Medical Investigations (OMI) to find any other people who had a similar case history. Within a few hours, Dr. Bruce Tempest of IHS, working with OMI, had located five young, healthy people who had all died after acute respiratory failure.

A series of laboratory tests had failed to identify any of the deaths as caused by a known disease, such as bubonic plague. At this point, the CDC Special Pathogens Branch was notified. CDC, the state health departments of New Mexico, Colorado and Utah, the Indian Health Service, the Navajo Nation, and the University of New Mexico all joined together to confront the outbreak.

During the next few weeks, as additional cases of the disease were reported in the Four Corners area, physicians and other scientific experts worked intensively to narrow down the list of possible causes. The particular mixture of symptoms and clinical findings pointed researchers away from possible causes, such as exposure to a herbicide or a new type of influenza, and toward some type of virus. Samples of tissue from patients who had gotten the disease were sent to CDC for exhaustive analysis. Virologists at CDC used several tests, including new methods to pinpoint virus genes at the molecular level, and were able to link the pulmonary syndrome with a virus, in particular a previously unknown type of hantavirus.

**Researchers Launch Investigations to Pin Down the Carrier of the New Virus**

Researchers knew that all other known hantaviruses were transmitted to people by rodents, such as mice and rats. Therefore, an important part of their mission was to trap as many different species of rodents living in the Four Corners region as possible to find the particular type of rodent that carried the virus. From June through mid-August of 1993, all types of rodents were trapped inside and outside homes where people who had hantavirus pulmonary syndrome had lived, as well as in piñon groves and summer sheep camps where they had worked. Additional rodents were trapped for comparison in and around nearby households as well. Taking a calculated risk, researchers decided not to wear protective clothing or masks during the trapping process. "We didn't want to go in wearing respirators, scaring...everybody," John Sarisky, an Indian Health Service environmental disease specialist said. However, when the almost 1,700 rodents trapped were dissected to prepare samples for analysis at CDC, protective clothing and respirators were worn.

Among rodents trapped, the deer mouse (*Peromyscus maniculatus*) was found to be the main host to a previously unknown type of hantavirus. Since the deer mouse often lives near people in rural and semi-rural areas—in barns and outbuildings, woodpiles, and inside people's homes—researchers suspected that the deer mouse might be transmitting the virus to humans. About 30% of the deer mice tested showed evidence of infection with hantavirus. Tests also showed that several other types of rodents were infected, although in lesser numbers.

The next step was to pin down the connection between the infected deer mice and households where people who had gotten the disease lived. Therefore, investigators launched a case-control investigation.

They compared "case" households, where people who had gotten the disease lived, with nearby "control" households. Control households were similar to those where the case-patients lived, except for one factor: no one in the control households had gotten the disease.

The results? First, investigators trapped more rodents in case households than in control households, so more rodents may have been living in close contact with people in case households. Second, people in case households were more likely than those in control households to do cleaning around the house or to plant in or hand-plow soil outdoors in fields or gardens. However, it was unclear if the risk for contracting HPS was due to performing these tasks, or with entering closed-up rooms or closets to get tools needed for these tasks.

In November 1993, the specific hantavirus that caused the Four Corners outbreak was isolated. The Special Pathogens Branch at CDC used tissue from a deer mouse that had been trapped near the New Mexico home of a person who had gotten the disease and grew the virus from it in the laboratory. Shortly afterwards and independently, the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) also grew the virus, from a person in New Mexico who had gotten the disease as well as from a mouse trapped in California.

The new virus was called Muerto Canyon virus—later changed to Sin Nombre virus (SNV)—and the new disease caused by the virus was named hantavirus pulmonary syndrome, or HPS.

The isolation of the virus in a matter of months was remarkable. This success was based on close cooperation of all the agencies and individuals involved in investigating the outbreak, years of basic research on other hantaviruses that had been conducted at CDC and USAMRIID, and on the continuing development of modern molecular virologic tests. To put the rapid isolation of the Sin Nombre virus in perspective, it took several decades for the first hantavirus discovered, the Hantaan virus, to be isolated.

**HPS Not Really a New Disease**

As part of the effort to locate the source of the virus, researchers located and examined stored samples of lung tissue from people who had died of unexplained lung disease. Some of these samples showed evidence of previous infection with Sin Nombre virus—indicating that the disease had existed before the "first" known outbreak—it simply had not been recognized!

Other early cases of HPS have been discovered by examining samples of tissue belonging to people who had died of unexplained adult respiratory distress syndrome. By this method, the earliest known case of HPS that has been confirmed has been the case of a 38-year-old Utah man in 1959.

Interestingly, while HPS was not known to the epidemiologic and medical communities, there is evidence that it was recognized elsewhere. The Navajo Indians, a number of whom contracted HPS during the 1993 outbreak, recognize a similar disease in their medical traditions, and actually associate its occurrence with mice. As strikingly, Navajo medical beliefs concur with public health recommendations for preventing the disease.

**Why Did the Outbreak Occur in the Four Corners Area?**

But why this sudden cluster of cases? The key answer to this question is that, during this period, there were suddenly many more mice than usual. The Four Corners area had been in a drought for several years. Then, in early 1993, heavy snows and rainfall helped drought-stricken plants and animals to revive and grow in larger-than-usual numbers. The area's deer mice had plenty to eat, and as a result they reproduced so rapidly that there were ten times more mice in May 1993 than there had been in May of 1992. With so many mice, it was more likely that mice and humans would come into contact with one another, and thus more likely that the hantavirus carried by the mice would be transmitted to humans.

### Person-to-Person Spread of HPS Decided Unlikely

"Although person-to-person spread [of HPS] has not been documented with any of the other known hantaviruses, we were concerned [during this outbreak] because we were dealing with a new agent," said Charles Vitek, a CDC medical investigator.

Researchers and clinicians investigating the ongoing outbreak were not the only groups concerned about the disease. Shortly after the first few HPS patients died and it became clear that a new disease was affecting people in the area, and that no one knew how it was transmitted, the news media began extensive reporting on the outbreak. Widespread concern among the public ensued.

Unfortunately, the first victims of the outbreak were Navajo. News reports focused on this fact, and the misperception grew that the unknown disease was somehow linked to Navajos. As a consequence, Navajos found themselves at the center of intense media attention and the objects of the some people's fears.

By later in the summer of 1993, the media frenzy had quieted somewhat, and the source of the disease was pinpointed. Researchers determined that, like other hantaviruses, the virus that causes HPS is not transmitted from person to person the way other infections, such as the common cold, may be.

To date, no cases of HPS have been reported in the United States in which the virus was transmitted from one person to another. In fact, in a study of health care workers who were exposed to either patients or specimens infected with related types of hantaviruses (which cause a different disease in humans), none of the workers showed evidence of infection or illness.

### HPS Since the First Outbreak

After the initial outbreak, the medical community nationwide was asked to report any cases of illness with symptoms similar to those of HPS that could not be explained by any other cause. As a result, additional cases have been reported.

Since 1993, researchers have discovered that there is not just one hantavirus that causes HPS, but several. In June 1993, a Louisiana bridge inspector who had not traveled to the Four Corners area developed HPS. An investigation was begun. The patient's tissues were tested for the presence of antibodies to hantavirus. The results led to the discovery of another hantavirus, named Bayou virus, which was linked to a carrier, the rice rat (*Oryzomys palustris*). In late 1993, a 33-year-old Florida man came down with HPS symptoms; he later recovered. This person also had not traveled to the Four Corners area. A similar investigation revealed yet another hantavirus, named the Black Creek Canal virus, and its carrier, the cotton rat (*Sigmodon hispidus*). Another case occurred in New York. This time, the Sin Nombre-like virus was named New York-1, and the white-footed mouse, *Peromyscus leucopus*, was implicated as the carrier.

More recently, cases of HPS stemming from related hantaviruses have been documented in Argentina, Brazil, Canada, Chile, Paraguay, and Uruguay, making HPS a pan-hemispheric disease.

**References**

Information for this page was developed using the CDC video *Preventing Hantavirus Disease* and resource articles listed in the bibliography.

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## How Is Hantavirus Transmitted?

In the United States, deer mice (along with cotton rats and rice rats in the southeastern states and the white-footed mouse in the Northeast) carry hantaviruses that cause hantavirus pulmonary syndrome. Learn more about the rodent carriers of HPS.

Rodents shed the virus in their urine, droppings, and saliva. The virus is mainly transmitted to people whenthey breathe in air contaminated with the virus.

When fresh rodent urine, droppings or nesting materials are stirred up, tiny droplets containing the virus get into the air. This process is known as "aerosolization."

There are several other ways rodents may spread hantavirus to people:

- If a rodent with the virus bites someone, the virus may be spread to that person-but this type of transmission is rare.
- Researchers believe that people may be able to get the virus if they touch something that has been contaminated with rodent urine, droppings, or saliva, and then touch their nose or mouth.
- Researchers also suspect people can become sick if they eat food contaminated by urine, droppings, or saliva from an infected rodent.

### Can You Get Hantavirus from Another Person?

The types of hantavirus that cause HPS in the United States cannot be transmitted from one person to another. For example, you cannot get the virus from touching or kissing a person who has HPS or from a health care worker who has treated someone with the disease. You also cannot get the virus from a blood transfusion in which the blood came from a person who became ill with HPS and survived.

### Can You Get Hantavirus from Animals Other Than Rodents, or from Insects? What About Pets?

No-the hantaviruses that cause HPS in the United States are not known to be transmitted by any types of animals other than certain species of rodents. You cannot get hantavirus from farm animals, such as cows, chickens, or sheep, or from insects, such as mosquitoes. Dogs and cats are not known to carry hantavirus; however, they may bring infected rodents into contact with people if they catch such animals and carry them home. Guinea pigs, hamsters, gerbils, and rodents from pet stores are not known to carry hantavirus.

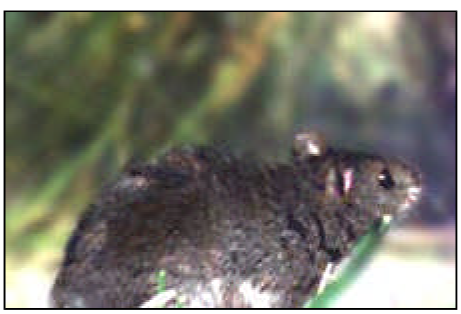
## Here are the Rodents That Carry the Types of Hantavirus Which Cause HPS in the United States:

*deer mouse*

**The Deer Mouse** (*Peromyscus maniculatus*) is a deceptively cute animal, with big eyes and big ears. Its head and body are normally about 2 - 3 inches long, and the tail adds another 2 - 3 inches in length. You may see it in a variety of colors, from gray to reddish brown, depending on its age. The underbelly is always white and the tail has sharply defined white sides. The deer mouse is found almost everywhere in North America. Usually, the deer mouse likes woodlands, but also turns up in desert areas.

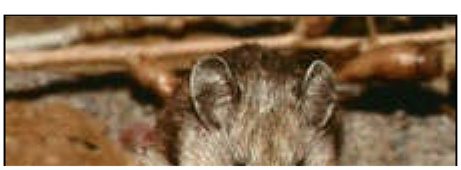
*cotton rat*

**The Cotton Rat** (*Sigmodon hispidus*), which you'll find in the southeastern United States (and way down into Central and South America), has a bigger body than the deer mouse—head and body about 5 - 7 inches, and another 3 - 4 inches for the tail. The hair is longer and coarser, of a grayish brown color, even grayish black. The cotton rat prefers overgrown areas with shrubs and tall grasses.



*rice rat*

**The Rice Rat** (*Oryzomys palustris*) is slightly smaller than the cotton rat, having a head and body 5 - 6 inches long, plus a very long, 4- to 7-inch tail. Rice rats sport short, soft, grayish brown fur on top, and gray or tawny underbellies. Their feet are whitish. As you might expect from the name, this rat likes marshy areas and is semiaquatic. It's found in the southeastern United States and in Central America.



*white-footed mouse*

**The White-footed Mouse** (*Peromyscus leucopus*) is hard to distinguish from the deer mouse. The head and body together are about four inches long. Note that its tail is normally shorter than its body (about 2 - 4 inches long). Topside, its fur ranges from pale brown to reddish brown, while its underside and feet are white. The white-footed mouse is found through southern New England, the Mid-Atlantic and southern states, the midwestern and western states, and Mexico. It prefers wooded and brushy areas, although sometimes it will live in more open ground.

Both the deer mouse and the cotton rat usually live in rural areas, but can also be found in cities when conditions are right, such as easy availability of food, water and shelter. (Remember this point when it comes to "discouraging" rodents, which is discussed under "How Do I Prevent HPS").

**Other Rodents May Also Carry Hantavirus**
Other rodents carry strains of hantavirus that cause HPS, but they have not yet been identified. In addition, other rodent species may play host to other types of hantaviruses that cause a different type of infection, hemorrhagic fever with renal syndrome, or HFRS. See "hantavirus" for more information.

It is wise, therefore, to avoid close contact with rodents in general.

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## Transmission Details: So How Does "Aerosolization" Really Work?

For a hantavirus to cause HPS, the virus must travel from the rodents that carry it to a person. A common way this happens is when a person breathes in the hantavirus from the air.

Let's create an imaginary scenario and go through the process step by step. Say you have a storage room in your home that you hardly ever enter. You keep old furniture there, old newspapers and magazines, and so on. At some point, a group of deer mice find their way into the room, looking for places to build nests. They found their way into the room through a crack—deer mice can squeeze through holes as small as a shirt button! Some mice chew through the fabric of an old armchair and build a nest inside it. Other mice shred bits of magazines and build nests under the shredded pieces.

A few of these mice are infected with the hantavirus. The infected mice don't show any signs of being sick. In fact, the virus does not seem to make them ill at all; it simply lives in their bodies. However, the virus is shed continuously from them: into the droppings and urine they leave around the room, and into their saliva, which dries on anything they have chewed, such as nesting material. Out in the environment like this, the virus can live for several days.

Meanwhile, you decide to clean up your storage room. You go inside, spend a few minutes moving boxes and furniture. The mice hear you coming and scurry away, leaving a trail of fresh urine! Because you find mouse droppings and some of the furniture stuffing the mice have used as nesting material, you get a broom and sweep up the mess. As you move around and sweep, tiny particles of fresh urine, droppings and saliva, with the virus in them, get kicked up into the air. This is the aerosolization. It is these tiny particles that you breathe in—and this is the beginning of becoming sick with HPS.

Because the virus is spread when virus-containing particles are stirred up into the air, an essential HPS tactic in areas showing signs of rodents is to avoid actions that raise dust and to carefully wet the area down with disinfectant. The less chance the virus has to get into the air, the less chance it will be breathed in!

## Who Is at Risk of Getting HPS, and Why?

Anyone who comes into contact with rodents that carry hantavirus is at risk of HPS. Rodent infestation in and around the home remains the primary risk for hantavirus exposure. Even healthy individuals are at risk for HPS infection if exposed to the virus.

### What Kind of Activities Are Risky?

Any activity that puts you in contact with rodent droppings, urine, saliva, or nesting materials can place you at risk for infection. Hantavirus is spread when virus-containing particles from rodent urine, droppings, or saliva are stirred into the air. It is important to avoid actions that raise dust, such as sweeping or vacuuming. Infection occurs when you breathe in virus particles.

**Opening and Cleaning Previously Unused Buildings**
Opening or cleaning cabins, sheds, and outbuildings, including barns, garages and storage facilities, that have been closed during the winter is a potential risk for hantavirus infections, especially in rural settings.

**Housecleaning Activities**
Cleaning in and around your own home can put you at risk if rodents have made it their home too. Many homes can expect to shelter rodents, especially as the weather turns cold. Please see our prevention information on how to properly clean rodent-infested areas.

**Work-related Exposure**
Construction, utility and pest control workers can be exposed when they work in crawl spaces, under houses, or in vacant buildings that may have a rodent population.

**Campers and Hikers**
Campers and hikers can also be exposed when they use infested trail shelters or camp in other rodent habitats.

The chance of being exposed to hantavirus is greatest when people work, play, or live in closed spaces where rodents are actively living. However, recent research results show that many people who have become ill with HPS were infected with the disease after continued contact with rodents and/or their droppings. In addition, many people who have contracted HPS reported that they had not seen rodents or their droppings before becoming ill. Therefore, if you live in an area where the carrier rodents, such as the deer mouse, are known to live, take sensible precautions-even if you do not see rodents or their droppings.

## What Are The Symptoms of HPS?

**Early symptoms**

Early symptoms include fatigue, fever and muscle aches, especially in the large muscle groups-thighs, hips, back, and sometimes shoulders. These symptoms are universal.

There may also be headaches, dizziness, chills, and abdominal problems, such as nausea, vomiting, diarrhea, and abdominal pain. About half of all HPS patients experience these symptoms.

**Late symptoms**

Four to 10 days after the initial phase of illness, the late symptoms of HPS appear. These include coughing and shortness of breath, with the sensation of, as one survivor put it, a "...tight band around my chest and a pillow over my face" as the lungs fill with fluid.

**Uncommon symptoms**

Earache, sore throat, runny nose, and rash are very uncommon symptoms of HPS.

**How long after contracting the virus do symptoms appear?**

Due to the small number of HPS cases, the "incubation time" is not positively known. However, on the basis of limited information, it appears that symptoms may develop between 1 and 5 weeks after exposure to urine, droppings, or saliva of infected rodents.

Another important point to remember from the data that the CDC Special Pathogens Branch keeps on all reported cases of HPS, is that it appears many people who have become ill were in a situation where they did not see rodents or rodent droppings. Other people have had frequent contact with rodents and their droppings before becoming ill. This apparent inconsistency makes it very difficult to pin down the precise time when the virus was transmitted.

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## How Do I Prevent HPS?

Eliminate or minimize contact with rodents in your home, workplace, or campsite. If rodents don't find that where you are is a good place for them to be, then you're less likely to come into contact with them. Seal up holes and gaps in your home or garage. Place traps in and around your home to decrease rodent infestation. Clean up any easy-to-get food.

Recent research results show that many people who became ill with HPS developed the disease after having been in frequent contact with rodents and/or their droppings around a home or a workplace. On the other hand, many people who became ill reported that they had not seen rodents or rodent droppings at all. Therefore, if you live in an area where the carrier rodents are known to live, try to keep your home, vacation place, workplace, or campsite clean.

## Prevention Indoors and Outdoors

**Indoors:**

- Keep a clean home, especially kitchen (wash dishes, clean counters and floor, keep food covered in rodent-proof containers).
- Keep a tight-fitting lid on garbage, discard uneaten pet food at the end of the day.
- Set and keep spring-loaded rodent traps. Set traps near baseboards because rodents tend to run along walls and in tight spaces rather than out in the open.
- Set Environmental Protection Agency-approved rodenticide with bait under plywood or plastic shelter along baseboards. These are sometimes known as "covered bait stations." Remember to follow product use instructions carefully, since rodenticides are poisonous to pets and people, too.
- Seal all entry holes 1/4 inch wide or wider with lath screen or lath metal, cement, wire screening or other patching materials, inside and out.

  If bubonic plague is a problem in your area, spray flea killer or spread flea powder in the area before setting traps. This is important. If you control rodents but do not control fleas as well, you may increase the risk of infection with bubonic plague, since fleas will leave rodents once the rodents die and will seek out other food sources, including humans.

**Outdoors:**

- Clear brush, grass and junk from around house foundations to eliminate a source of nesting materials.
- Use metal flashing around the base of wooden, earthen or adobe homes to provide a strong metal barrier. Install so that the flashing reaches 12 inches above the ground and six inches down into the ground.
- Elevate hay, woodpiles and garbage cans to eliminate possible nesting sites. If possible, locate them 100 feet or more from your house.
- Trap rodents outside, too. Poisons or rodenticides may be used as well, but be sure to keep them out of the reach of children or pets.
- Encourage the presence of natural predators, such as non-poisonous snakes, owls and hawks.
- Remember, getting rid of all rodents isn't feasible, but with ongoing effort you can keep the population very low.

## Some Common Signs of Rodent Infestation

**Remember that not all types of rodents carry hantavirus. Neither common house mice nor common rats have been associated with HPS in humans, for example. Yet because it can be tough to tell just what kind of rodents you have, play it safe -- clean up the infestation and rodent-proof your home or workplace.**

Here are some common signs that you may have a rodent problem.

**Rodent Droppings**

This is one of the most reliable signs that you have a rodent problem. You may find droppings in places where you store your food or your pet/animal food, such as in cupboards and drawers or in bins. Because mice like to run in places that offer them some protection from predators, you may find droppings in cupboards or under the sink, along walls, or on top of wall studs or beams. Mice will leave droppings near their nests as well (see below). Storage rooms, sheds, barns, or cabins loaded with boxes, bags, old furniture, and other objects make anideal home for rodents, so you may find droppings there, even inside boxes and other containers.

Workplaces can also make good rodent homes. Warehouses, restaurants, and the like are obvious places to look because food may be plentiful there. However, rodents can infest office buildings, too. Once again, look for droppings in protected places, such as closets, storage rooms, or inside boxes.

**Signs of Rodent Nests**

Rodents tend to build their nests from materials that are soft, fuzzy, or warm. Among common rodent nest materials are shredded paper, bunches of dry grass or small twigs, fabric, andfurniture stuffing. Rodents will nest wherever safety from enemies can be found close enough to food and water, and they prefer places that are relatively quiet. Inside buildings, here are some places to look:

- inside cabinets
- under or inside dressers
- in and among boxes
- behind and inside machinery and appliances (kitchen appliances such as stoves or refrigerator drip pans; water coolers; and electric motor cases or computer cases)
- inside upholstered furniture
- inside double walls or the space between floors and ceilings.

**Food Boxes, Containers, or Food Itself That Appears To Be Nibbled**

Look for droppings nearby. Rodents can chew through plastic, so plastic bags do not make safe food storage containers.

**Signs of Rodent "Feeding Stations"**

These are semi-hidden spots where rodents eat food they have collected. At these stations, rodents may leave larger-than-normal amounts of droppings/urine, plus remnants of a variety of foods (such as nut shells), bits of plastic or paper, and cockroach carcasses.

**You Find Evidence of Gnawing**

To get to food, rodents will gnaw on almost anything that is softer than the enamel of their teeth. This includes such things as wood, paper board, cloth sacks, and materials even harder than these. Because rodents' teeth grow continuously, they must gnaw to keep them short. That may help to explain why chair legs or similar surfaces show gnawed spots or tooth marks in rodent-infested places.

**You Notice an Odd, Stale Smell**

In closed-up rooms infested by rodents, you will commonly smell an unusual, musky odor.

**You See a Mouse in Your House**

Rodents are normally active at night, and generally avoid humans. If you have rodents, unless the infestation is large, you may never see one.

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## Clean Up Infested Areas, Using Safety Precautions:

Put on latex rubber gloves before cleaning up.

**Do not** stir up dust by sweeping up or vacuuming up droppings, urine or nesting materials.

Instead, thoroughly wet contaminated areas with detergent or liquid to deactivate the virus. Most general purpose disinfectants and household detergents are effective. However, a hypochlorite solution prepared by mixing 1 and 1/2 cups of household bleach in 1 gallon of water may be used in place of commercial disinfectant. When using the chlorine solution, avoid spilling the mixture on clothing or other items that may be damaged.

Once everything is wet, take up contaminated materials with a damp towel, then mop or sponge the area with disinfectant.

Spray dead rodents with disinfectant, then double-bag along with all cleaning materials and bury or burn—or throw out in appropriate waste disposal system. If burning or burying isn't feasible, contact your local or state health department about other disposal methods.

Finally, disinfect gloves *before taking them off* with disinfectant or soap and water. After taking off the clean gloves, thoroughly wash hands with soap and warm water.

When going into cabins or outbuildings (or work areas) that have been closed for awhile, open them up and air out before cleaning.

### Hantaviruses and Disinfectants

Hantaviruses are surrounded by a lipid (fatty) envelope, so they are somewhat fragile. The lipid envelope can be destroyed and the virus killed by fat solvents, such as alcohol, ordinary disinfectants and household bleach. That is why one of the most important ways to prevent transmitting the disease is to carefully wet down dead rodents and areas where rodents have been with disinfectant and/or bleach. When you do this, you are killing the virus itself and reducing the chance that the virus will get into the air.

Strength and Quantity of Hypochlorite Solutions (Bleach)
Special Pathogens Branch recommends a 10% bleach solution be used to inactivate hantaviruses.

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## Special Precautions for Homes of Persons with Confirmed Hantavirus Infection or Buildings with Heavy Rodent Infestations

Special precautions should be used for cleaning homes or buildings with heavy rodent infestations in areas where HPS has been reported. If you are attempting to deal with such an infestation, it is recommended that you contact the responsible local, state, or federal public health agency for guidance.

The special precautions may also apply to vacant dwellings that have attracted numbers of rodents while unoccupied and to dwellings and other structures that have been occupied by persons with confirmed hantavirus infection.

Workers who are either hired specifically to perform the clean-up or asked to do so as part of their work activities should receive a thorough orientation from the responsible health agency about hantavirus transmission and should be trained to perform the required activities safely.

### Precautions To Be Used:

- Persons involved in the clean-up should wear coveralls (disposable, if possible), rubber boots or disposable shoe covers, rubber or plastic gloves, protective goggles, and an appropriate respiratory protection device, such as a half-mask air-purifying (or negative-pressure) respirator with a high-efficiency particulate air (HEPA) filter or a powered air-purifying respirator (PAPR) with HEPA filters.

  Please note: the HEPA classification recently has been discontinued. Please read "Update On the Nomenclature and Use of Respirators as a Precaution for Hantavirus Infection, February, 1999" for details.

- Personal protective gear should be decontaminated upon removal at the end of the day. If the coveralls are not disposable, they should be laundered on site. If no laundry facilities are available, the coveralls should be immersed in liquid disinfectant until they can be washed.
- All potentially infective waste material (including respirator filters) from clean-up operations that cannot be burned or deep buried on site should be double bagged in appropriate plastic bags. The bagged material should then be labeled as infectious (if it is to be transported) and disposed of in accordance with local requirements for infectious waste.
- Workers who develop symptoms suggestive of HPS within 45 days of the last potential exposure should immediately seek medical attention. The physician should contact local health authorities promptly if hantavirus-associated illness is suspected. A blood sample should be obtained and forwarded with the baseline serum through the state health department to CDC for hantavirus antibody testing.

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## Precautions for Workers in Affected Areas Who are Regularly Exposed to Rodents

Persons who frequently handle or are exposed to rodents (e.g., mammalogists, pest-control workers) in the affected area are probably at higher risk for hantavirus infection than the general public because of their frequency of exposure. Therefore, enhanced precautions are warranted to protect them against hantavirus infection.

**Precautions To Be Used**:

- Workers in potentially high-risk settings should be informed about the symptoms of the disease and be given detailed guidance on prevention measures.
- Workers who develop a febrile or respiratory illness within 45 days of the last potential exposure should immediately seek medical attention and inform the attending physician of the potential occupational risk of hantavirus infection. The physician should contact local health authorities promptly if hantavirus-associated illness is suspected. A blood sample should be obtained and forwarded with the baseline serum through the state health department to CDC for hantavirus antibody testing.
- Workers should wear a half-face air-purifying (or negative-pressure) respirator or PAPR equipped with HEPA filters when removing rodents from traps or handling rodents in the affected area. (Please note: the HEPA classification recently has been discontinued. Under the new classification system, the N-100 filter type is recommended. Read the Federal Occupational Safety and Health Administration (OSHA) directive online, at "OSHA Directives: CPL 2-0.120 - Inspection procedures for the Respiratory Protection Standard".), at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=2275
- Respirators (including positive-pressure types) are not considered protective if facial hair interferes with the face seal, since proper fit cannot be assured. Respirator use practices should be in accord with a comprehensive user program and should be supervised by a knowledgeable person.
- Workers should wear rubber or plastic gloves when handling rodents or handling traps containing rodents. Gloves should be washed and disinfected before removing them, as described above.
- Traps contaminated by rodent urine or feces or in which a rodent was captured should be disinfected with a commercial disinfectant or bleach solution. Dispose of dead rodents as described in the section on Eliminating Rodents inside the Home.
- Persons removing organs or obtaining blood from rodents in affected areas should contact the Special Pathogens Branch, Division of Viral and Rickettsial Diseases, National Center for Infectious Diseases, Centers for Disease Control and Prevention, [telephone (404) 639-1115] for detailed safety precautions.

**Precautions for Other Occupational Groups Who Have Potential Rodent Contact**

Insufficient information is available at this time to allow general recommendations regarding risks or precautions for persons in the affected areas who work in occupations with unpredictable or incidental contact with rodents or their habitations. Examples of such occupations include telephone installers, maintenance workers, plumbers, electricians, and certain construction workers. Workers in these jobs may have to enter various buildings, crawl spaces, or other sites that may be rodent infested. Recommendations for such circumstances must be made on a case-by-case basis after the specific working environment has been assessed and state or local health departments have been consulted.

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## Precautions for Campers and Hikers in the Affected Areas

There is no evidence to suggest that travel into areas where HPS has been reported should be restricted. Most usual tourist activities pose little or no risk that travelers will be exposed to rodents or their urine and/or droppings.

However, persons who do outdoor activities such as camping or hiking in areas where the disease has been reported should take precautions to reduce the likelihood of their exposure to potentially infectious materials.

**Useful Precautions:**

- Avoid coming into contact with rodents and rodent burrows or disturbing dens (such as pack rat nests).
- Air out, then disinfect cabins or shelters before using them. These places often shelter rodents.
- Do not pitch tents or place sleeping bags in areas in proximity to rodent droppings or burrows or near areas that may shelter rodents or provide food for them (e.g., garbage dumps or woodpiles).
- If possible, do not sleep on the bare ground. In shelters, use a cot with the sleeping surface at least 12 inches above the ground. Use tents with floors or a ground cloth if sleeping in the open air.
- Keep food in rodent-proof containers!
- Promptly bury (or--preferably--burn followed by burying, when in accordance with local requirements) all garbage and trash, or discard in covered trash containers.
- Use only bottled water or water that has been disinfected by filtration, boiling, chlorination, or iodination for drinking, cooking, washing dishes, and brushing teeth.
- And last but not least, do not play with or handle any rodents that show up at the camping or hiking site, even if they appear friendly.

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## Update On the Nomenclature and Use of Respirators as a Precaution for Hantavirus Infection
## February, 1999

The CDC **Interim Recommendations for Risk Reduction for Hantavirus Infection**(1) describe precautions for persons who are involved in the cleanup of homes of confirmed cases of hantavirus infection or of areas with heavy rodent infestation and for workers in affected areas who are regularly exposed to rodents. Among these precautions is the wearing of one of the following types of respirators (2) equipped with a high-efficiency particulate air (HEPA) filter:

a) half-mask air-purifying (or negative-pressure) respirator

Recent changes in the nomenclature and certification of the type of filters used in these respirators include the **discontinuation of the HEPA designation** and the designation of new classes of filters. As shown on the chart below, the N-100 (99.97) is equivalent to the previous HEPA filter.

**Use of an N-100 filter should provide the same protection as the HEPA filter. Due to the nature of the virus, no studies have been able to test the**

b) powered air-purifying respirator (PAPR)

**efficacy of either the HEPA or N-100 filters in protecting against HPS transmission. Available evidence suggests that HPS is transmitted by inspiring small (less than 5 micron) viral particles in aerosols which the N-100 is the most effective in removing.**

**Cautions:** As described in CDC **Interim Recommendations for Risk Reduction for Hantavirus Infection**, all negative-pressure respirators are fit-dependent. Anything that interferes with the respirator's face seal, such as facial hair, will allow ambient air to bypass the filter medium in the respirator(3). Ideally, users should be fit-tested with the same make, model, style, and size of respirator that will be actually used. Respirator practices should follow a comprehensive user program and be supervised by a knowledgeable person.

**New Classes of Filters for Respiratory Protection Devices(4)**

| *New classes of filters ††* | | | *Characteristics* |
|---|---|---|---|
| | | **Equivalent to HEPA** | |
| N-95 | N-99 | **N-100 (99.97)** | Not resistant to oil |
| R-95 | R-99 | **R-100 (99.97)** | Resistant to oil |
| P-95 | P-99 | **P-100 (99.97)** | Oil Proof |

*†† number indicates % efficiency in removing monodispersed particles 0.3 micrometers in diameter.*

Authority for testing and certifying these respirators has been given exclusively to NIOSH. For additional information:

- contact the Industrial Hygiene Section, Office of Health & Safety, CDC at 404 639-3112.
- Read the NIOSH directive online, at "OSHA Directives: CPL 2-0.120 - Inspection procedures for the Respiratory Protection Standard", at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=2275

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(1) *MMWR* Recommendations and Reports, July 30, 1993; 42 [RR-11]: 1-13)

(2) All of these respirators can be purchased from commercial suppliers of laboratory safety equipment. The items displayed here are intended to show the general design of the respirator and do not constitute endorsement of any particular brand of respirator.

(3) *MMWR* 47(40): 1045-1049, demonstrates importance of fit testing for all negative-pressure respirators.

(4) As described in NIOSH 42, CFR 84.

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## What Is the Treatment for HPS?

At the present time, there is no specific treatment or "cure" for hantavirus infection. However, we do know that if the infected individuals are recognized early and are taken to an intensive care unit, some patients may do better. In intensive care, patients are intubated and given oxygen therapy to help them through the period of severe respiratory distress.

The earlier the patient is brought in to intensive care, the better. If a patient is experiencing full distress, it is less likely the treatment will be effective.

Therefore, if you have been around rodents and have symptoms of fever, deep muscle aches and severe shortness of breath, see your doctor *immediately*. Be sure to tell your doctor that you have been around rodents—this will alert your physician to look closely for any rodent-carried disease such as HPS.

Back to General Information Index

All About Hantaviruses Home | General Information | Technical Information | Contact Us

CDC Home | Search | Health Topics A-Z

This page last reviewed Thursday, April 28, 2005

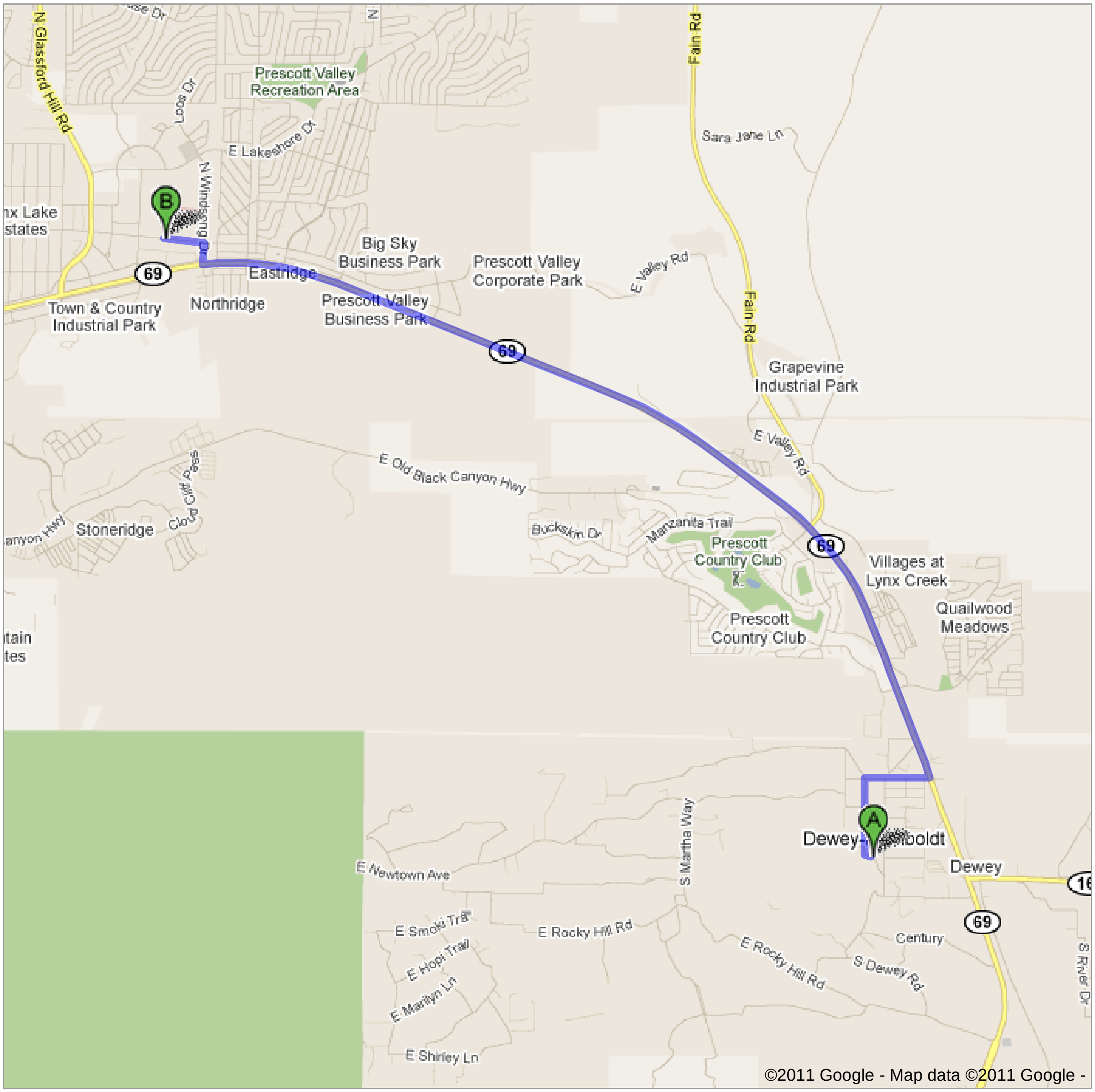
Infectious Disease Pathology Activity
Division of Viral and Rickettsial Diseases
National Center for Infectious Diseases
Centers for Disease Control and Prevention
U.S. Department of Health and Human Services

## Appendix B: Hospital Map/Route to Hospital

Google maps

**Directions to 7700 E Florentine Rd, Prescott Valley, AZ 86314**
**7.3 mi** – about **13 mins**

Route to Hospital
Yavapai Regional Medical Center - East



Dewey-Humboldt, AZ

| | | |
|---|---|---|
| 1. | Head **northwest** on **Antelope Dr/E Deer Path Rd** toward **Yavapai Dr**<br>Continue to follow Antelope Dr<br>About 2 mins | go 0.5 mi<br>total 0.5 mi |
| 2. | Take the 3rd right onto **Kachina Pl**<br>About 1 min | go 0.4 mi<br>total 0.9 mi |
| 3. | Take the 1st left onto **AZ-69 N**<br>About 9 mins | go 6.0 mi<br>total 6.9 mi |
| 4. | Turn right at **N Windsong Dr** | go 0.1 mi<br>total 7.1 mi |
| 5. | Turn left at **E Florentine Rd**<br>Destination will be on the right<br>About 1 min | go 0.3 mi<br>total 7.3 mi |

7700 E Florentine Rd, Prescott Valley, AZ 86314

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.



Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.

# C Standard Operating Procedures

## 1.0 SCOPE AND APPLICATION

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

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

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

## 2.0 METHOD SUMMARY

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

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

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

## 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

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

## 5.0 EQUIPMENT

Soil sampling equipment includes the following:

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

## 6.0 REAGENTS

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

## 7.0 PROCEDURES

### 7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies required.

2. Obtain necessary sampling and monitoring equipment.

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

4. Prepare schedules and coordinate with staff, client, and regulatory agencies, if appropriate.

5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.

6. Use stakes, flagging, or buoys to identify and mark all sampling locations. Specific site factors, including extent and nature of contaminant, should be considered when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared by the property owner or the On-Scene-Coordinator (OSC) prior to soil sampling; and utility clearance should always be confirmed before beginning work.

### 7.2 Sample Collection

#### 7.2.1 Surface Soil Samples

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

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

The following procedure is used to collect surface soil samples:

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

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

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

7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

7.2.3 Sampling with a Trier

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

7.2.5 Test Pit/Trench Excavation

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

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

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

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

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

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

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

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

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

## 8.0 CALCULATIONS

This section is not applicable to this SOP.

## 9.0 QUALITY ASSURANCE/QUALITY CONTROL

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

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

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

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

## 10.0 DATA VALIDATION

This section is not applicable to this SOP.

## 11.0 HEALTH AND SAFETY

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

## 12.0 REFERENCES

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

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

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

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

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

APPENDIX A
Figures
SOP #2012
February 2000

FIGURE 1. Sampling Augers

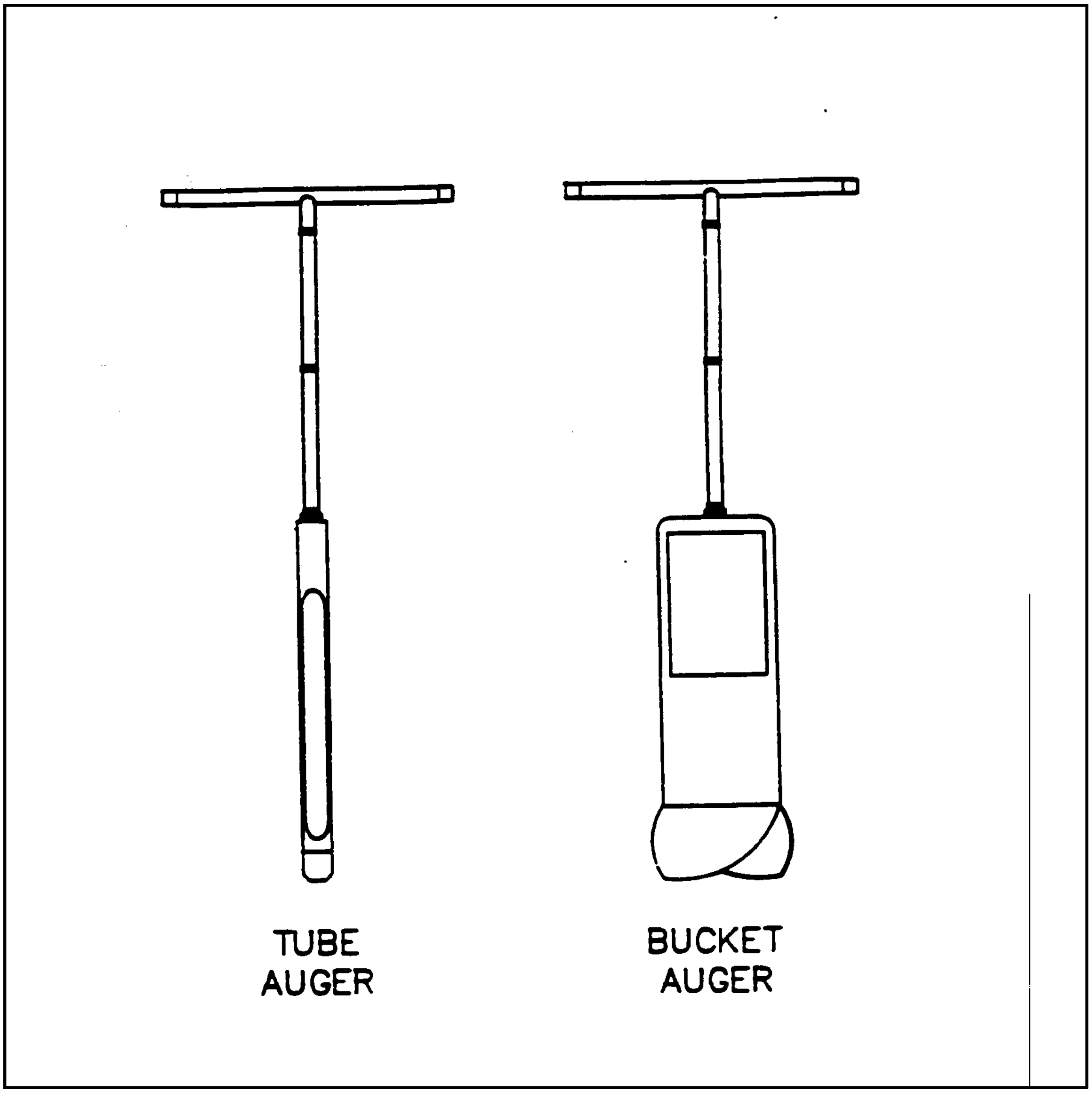
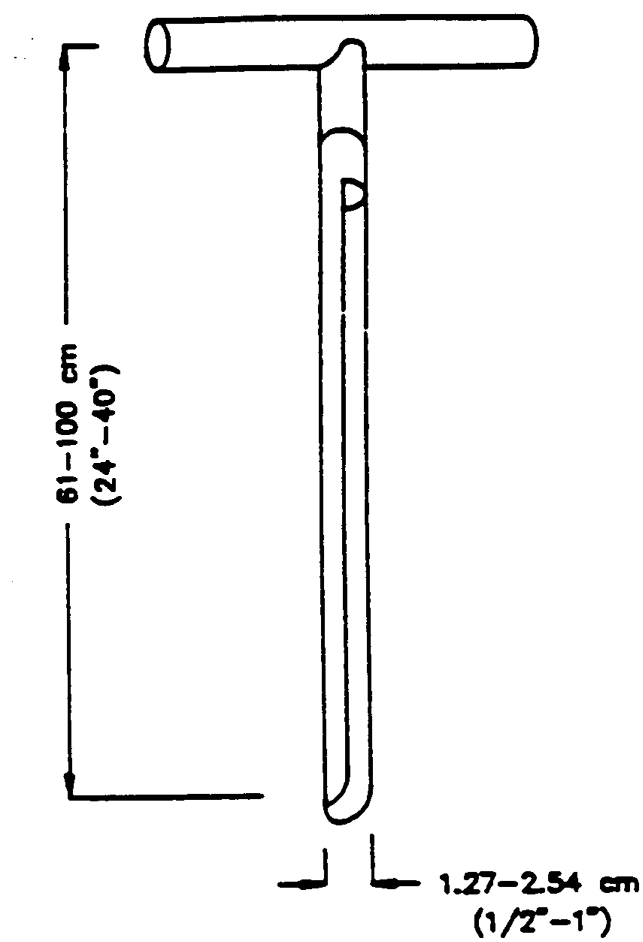


FIGURE 2. Sampling Trier



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|---|---|
| **Title:** | **SOIL SAMPLING** |
| **Category:** | ENV 3.13 |
| **Revised:** | August 1997 |

**STANDARD OPERATING PROCEDURE**

# SOIL SAMPLING



**ecology and environment, inc.**
368 Pleasant View Drive / Lancaster, New York 14086 / (716) 684-8060

| | | | |
|---|---|---|---|
| **TITLE:** | **SOIL SAMPLING** | | |
| **CATEGORY:** | ENV 3.13 | **REVISED:** | August 1997 |

# TABLE OF CONTENTS

Appendix

# LIST OF TABLES

# LIST OF FIGURES

Figure | Page

# 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).

# 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 bedrock | 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. |

**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

- 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

**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 procedures 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.

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.

**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[a] | 3 | 3 | 2 |
| Identify Sources | 1 | 4 | 2 | 2[a] | 3 | 2 | 3 |
| Delineate Extent of Contamination | 4 | 3 | 3 | 1[b] | 1 | 1 | 1 |
| Evaluate Treatment and Disposal Options | 3 | 3 | 1 | 2 | 2 | 4 | 2 |
| Confirm Cleanup | 4 | 1[c] | 3 | 1[b] | 1 | 1 | 1[c] |

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).

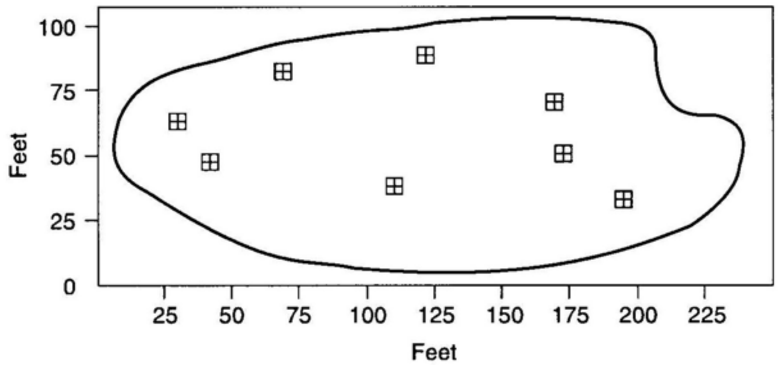



**Figure 8-1 Random Sampling****

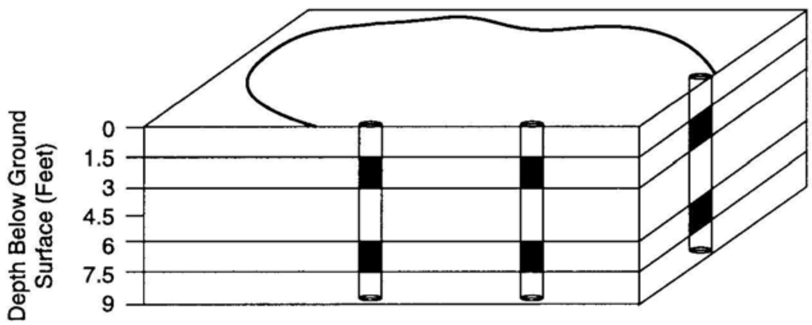



**Figure 8-2 Stratified Random Sampling**

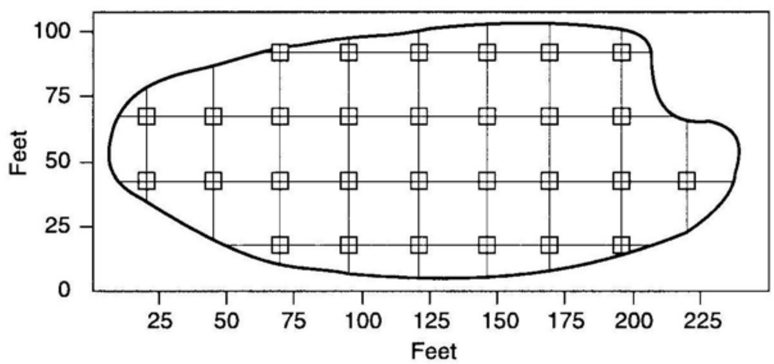
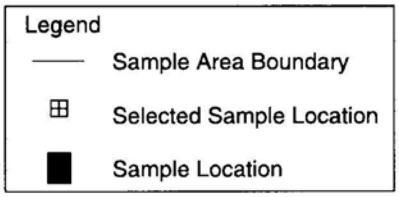



**Figure 8-3 Systematic Grid Sampling****

** After EPA, February 1989



### 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).

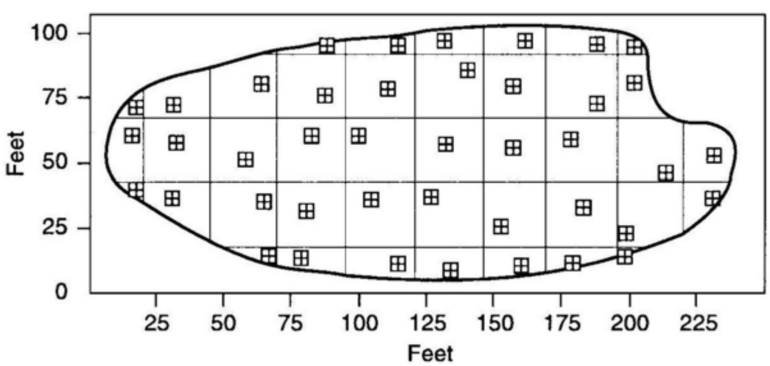



**Figure 8-4 Systematic Random Sampling**

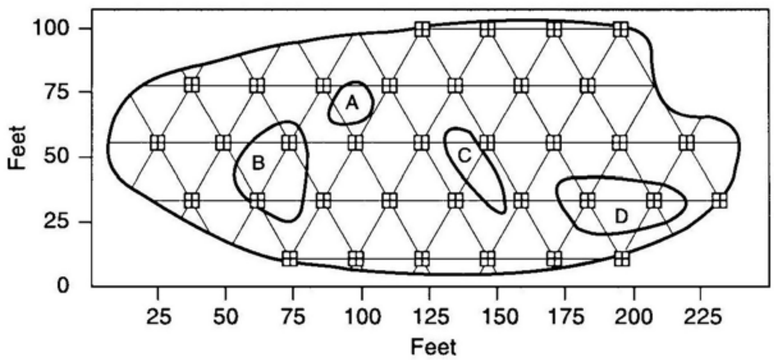



**Figure 8-5 Search Sampling**

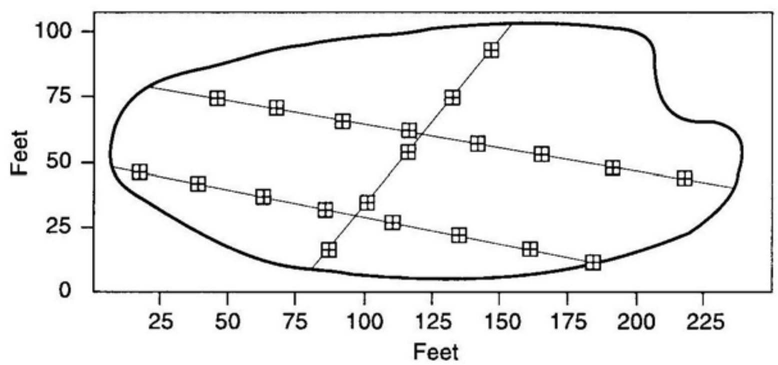
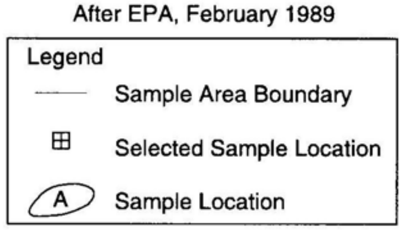



**Figure 8-6 Transect Sampling**

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 suffice 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 satisfactory 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 dill 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.

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).

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).

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.

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 |
| **SW-846** | | | | | | | | |
| VOA[e] | 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 HC1 until pH <2 and cool to 4° (ice in cooler) |
| Semi-VOA (BNAs)[e] | 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[d,e] | 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[d,e] | 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[c] | 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 $HNO_3$ until pH <2 and cool to 4°C (ice in cooler) |
| Cyanide[c] | 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[a] | 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)[a] | 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 $H_2SO_4$ 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 $H_2SO_4$ until pH <2 and cool to 4°C (ice in cooler) |

## 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[e] | 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 $H_2SO_4$ until pH <2 and cool to 4°C (ice in cooler) |
| **EPA-CLP** | | | | | | | | |
| VOA[e] | 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 HC1 until pH <2 and cool to 4°C (ice in cooler) |
| Semi-VOA (BNAs)[e] | 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[d,e] | 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[d,e] | 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[c] | 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 $HNO_3$ to pH <2 and cool to 4°C (ice in cooler) |
| Cyanide[c] | 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) |
| **NYSDEC-CLP** | | | | | | | | |
| VOA[e] | 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 HC1 until pH <2 and cool to 4°C (ice in cooler) |
| Semi-VOA (BNAs)[e] | 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) |

## 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[d,e] | 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[d,e] | 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[c] | 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 $HNO_3$ to pH <2 and cool to 4°C (ice in cooler) |
| Cyanide[c] | 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) |
| **EPA Water and Waste** | | | | | | | | |
| 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.

[a] 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.
[b] Holding time for GC/MS analysis is 7 days if samples are not preserved.
[c] Maximum holding time for mercury is 28 days from time sampled.
[d] 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.
[e] Extra containers required for MS/MSD.

Key:

NA = Not applicable.

### 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

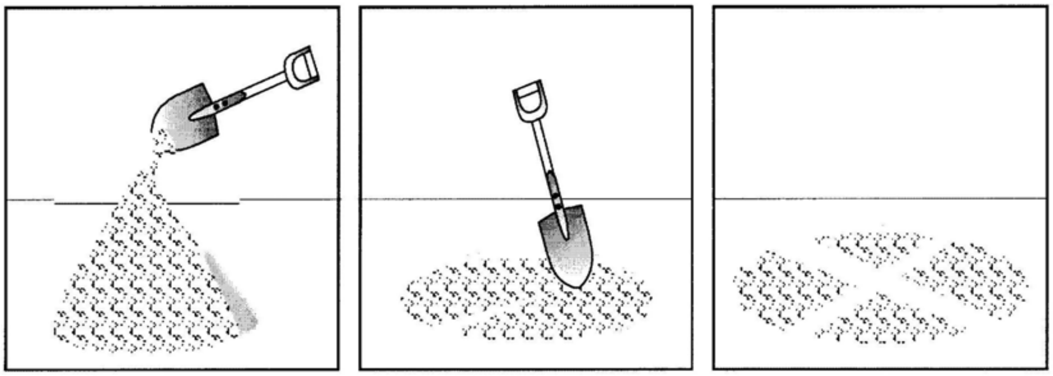
Organize field notes into a report format and transfer logging information to appropriate forms.

# 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.



**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.

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.

## 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.

### 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.

ASTM D 1586-84, Penetration Test and Split Barrel Sampling of Soils.

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

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

Ecology and Environment, Inc., 1990, *Standard Operating Procedures*: "Equipment Decontamination," and "Sample Packaging and Shipping."

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.

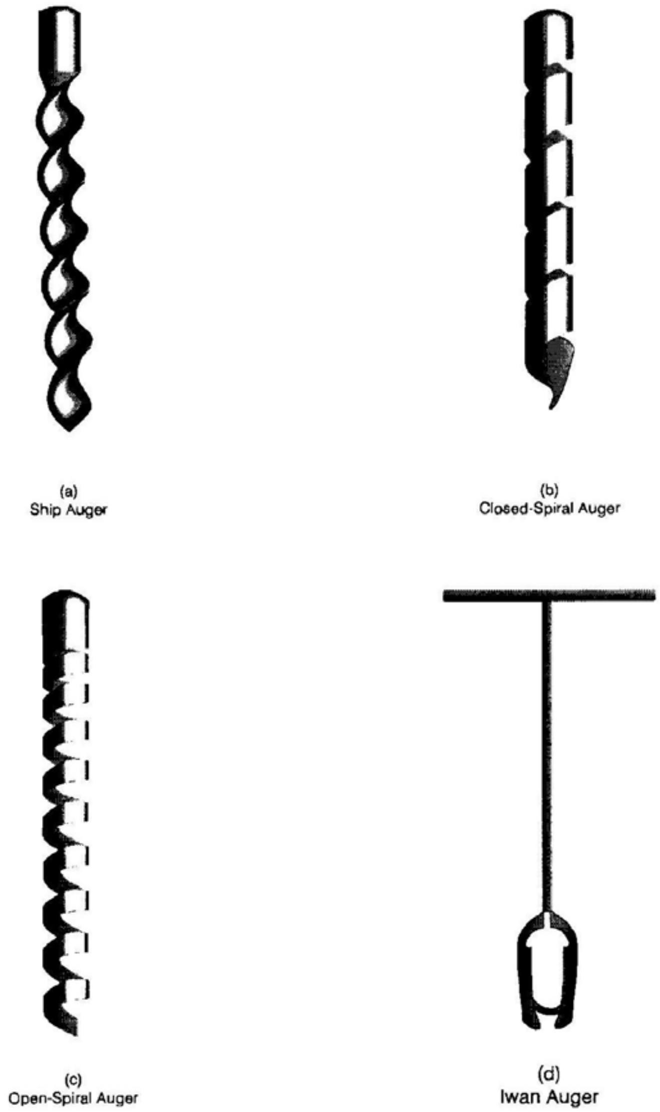
__________, 1991, *Removal Program Representative Sampling Guidance: Volume I – Soil*, (Interim Final), EPA-9360.4-10.

__________, 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.

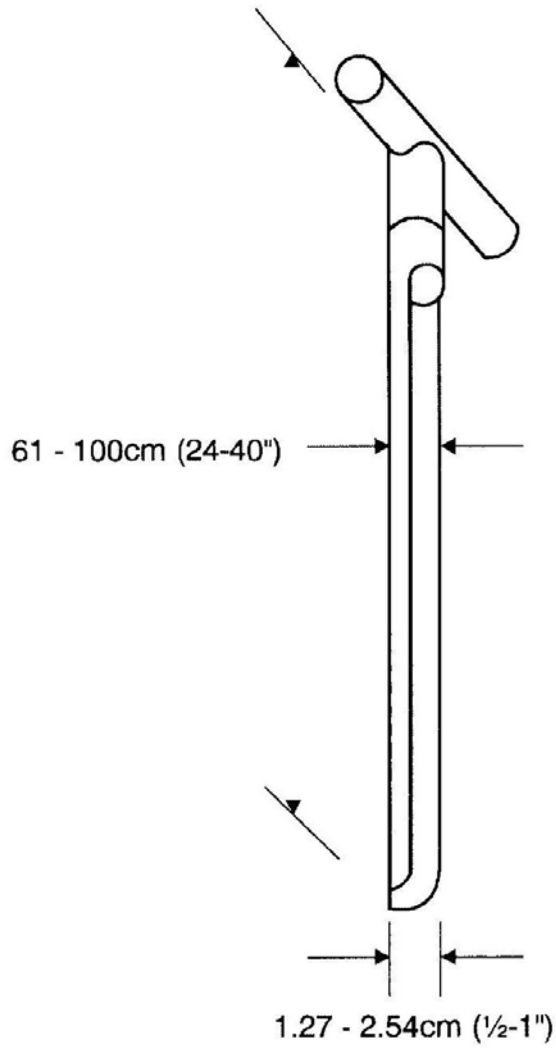
__________, February 1989, *Methods for Evaluating the Attainment of Cleanup Standards: Volume I, Soils and Solid Media*, EPA/230/02-89/042.

## A SAMPLING AUGERS

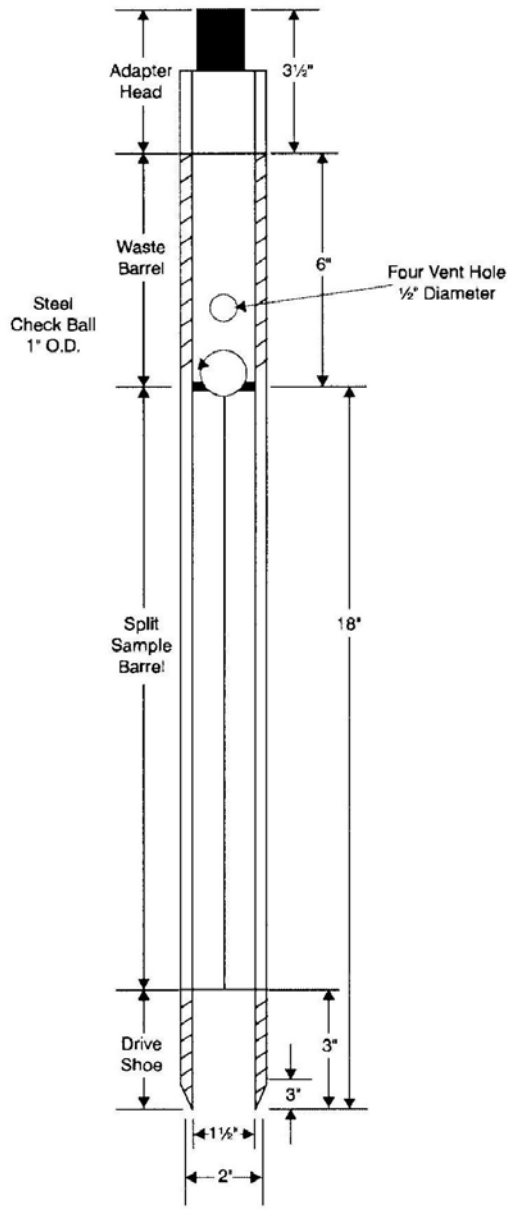
**A. Sampling Augers**



### B SAMPLING TRIER



## C SPLIT-SPOON SAMPLER



| | |
|---|---|
| **Title:** | **SAMPLING EQUIPMENT DECONTAMINATION** |
| **Category:** | ENV 3.15 |
| **Revised:** | March 1999 |

**STANDARD OPERATING PROCEDURE**

# SAMPLING EQUIPMENT DECONTAMINATION



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# TABLE OF CONTENTS

# LIST OF TABLES

# 1. Scope and Application

The purpose of this procedure is to provide a description of methods for preventing or reducing cross-contamination and general guidelines for designing and selecting decontamination procedures for use at potential hazardous waste sites. The decontamination procedures chosen will prevent introduction and cross-contamination of suspected contaminants in environmental samples, and will protect the health and safety of site personnel.

# 2. Method Summary

Removing or neutralizing contaminants that have accumulated on personnel and equipment ensures protection of personnel from permeating substances, reduces/eliminates transfer of contaminants to clean areas, prevents the mixing of incompatible substances, and minimizes the likelihood of sample contamination.

Cross-contamination can be removed by physical decontamination procedures. The abrasive and non-abrasive methods include the use of brushes, high pressure water, air and wet blasting, and high pressure Freon cleaning. These methods should be followed by a wash/rinse process using appropriate cleaning solutions. A general protocol for cleaning with solutions is as follows:

1. Physical removal.
2. Non-phosphate detergent plus tap water.
3. Tap water.
4. 10% nitric acid.
5. Distilled/deionized water rinse.
6. Solvent rinse.
7. Total air dry.
8. Triple rinse with distilled/deionized water.

This procedure can be expanded to include additional or alternate solvent rinses that will remove specified target compounds if required by site-specific work plans (WP) or as directed by a particular client.

# 3. Interferences

The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte-free distilled/deionized water. Distilled water available from local grocery stores and pharmacies is generally not acceptable for final decontamination rinses. Contaminant-free deionized water is available from commercial vendors and may be shipped directly to the site or your hotel.

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

# 4. Equipment/Apparatus

The following are standard materials and equipment used as a part of the decontamination process:

- Appropriate protective clothing;
- Air purifying respirator (APR);
- Field log book;
- Non-phosphate detergent;
- Selected high purity, contaminant-free solvents;
- Long-handled brushes;
- Drop cloths (plastic sheeting);
- Trash containers;
- Paper towels;
- Galvanized tubs or equivalent (e.g., baby pools);
- Tap water;
- Contaminant-free distilled/deionized water;
- Metal/plastic container for storage and disposal of contaminated wash solutions;
- Pressurized sprayers, $H_2O$;
- Pressurized sprayers, solvents;
- Trash bags;
- Aluminum foil;
- Sample containers;

- Safety glasses or splash shield; and
- Emergency eyewash bottle.

# 5. Reagents

There are no reagents used in this procedure aside from decontamination solutions used for the equipment. The type of decontamination solution to be used shall depend upon the type and degree of contamination present and as specified in the project/site-specific Quality Assurance Project Plan (QAPP).

In general, the following solvents are utilized for decontamination purposes:

- 10% nitric acid wash ( reagent grade nitric acid diluted with deionized/distilled water – 1 part acid to 10 parts water)[a];
- Acetone (pesticide grade)[b] ;
- Hexane (pesticide grade)[b];
- Methanol; and
- Methylene chloride[b].

[a] Only if sample is to be analyzed for trace metals.
[b] Only if sample is to be analyzed for organics requiring specific or specialized decontamination procedures. These solvents must be kept away from samples in order to avoid contamination by decon solvents.

# 6. Procedures

Decontamination is the process of removing or neutralizing contaminants that have accumulated on both personnel and equipment. Specific procedures in each case are designed accordingly and may be identified in either the Health and Safety Plan (HSP), WP, QAPP, or all three.

As part of the HSP, a personnel decontamination plan should be developed and set up before any personnel or equipment enters the areas of potential contamination. Decontamination procedures for equipment will be specified in the WP and the associated QAPP. These plans should include:

- Number and layout of decontamination stations;
- Decontamination equipment needed (see Section 4);

- Appropriate decontamination methods;
- Procedures to prevent contamination of clean areas;
- Methods and procedures to minimize worker contact with contaminants during removal of protective clothing;
- Methods and procedures to prevent cross-contamination of samples and maintain sample integrity and sample custody; and
- Methods for disposal of contaminated clothing, equipment, and solutions.

Revisions to these plans may be necessary for health and safety when the types of protective clothing, site conditions, or on-site hazards are reassessed based on new information.

### Prevention of Contamination

Several procedures can be established to minimize contact with waste and the potential for contamination. For example:

- Employing work practices that minimize contact with hazardous substances (e.g., avoid areas of obvious contamination, avoid touching potentially hazardous substances);
- Use of remote sampling, handling, and container-opening techniques;
- Covering monitoring and sampling equipment with plastic or other protective material;
- Use of disposable outer garments and disposable sampling equipment with proper containment of these disposable items;
- Use of disposable towels to clean the outer surfaces of sample bottles before and after sample collection; and
- Encasing the source of contaminants with plastic sheeting or overpacks.

Proper procedures for dressing prior to entrance into contaminated areas will minimize the potential for contaminants to bypass the protective clothing. Generally, all fasteners (zippers, buttons, snaps, etc.) should be used, gloves and boots tucked under or over sleeves and pant legs, and all junctures taped (see the Health and Safety Plan for these procedures).

### Decontamination Methods

All personnel, samples, and equipment leaving the contaminated area of a site must be decontaminated to remove any chemicals or infectious organisms that may have adhered to them. Various decontamination methods will either physically remove, inactivate by chemical detoxification/disinfection/sterilization, or remove contaminants by both physical and chemical means.

In many cases, gross contamination can be removed by physical means. The physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods.

## 6.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The following reviews the available abrasive methods.

### Mechanical

Mechanical methods include using brushes with metal, nylon, or natural bristles. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushing, and degree of brush contact. Material may also be removed by using appropriate tools to scrape, pry, or otherwise remove adhered materials.

### Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, and time of air blasting dictate cleaning efficiency. The method's disadvantages are its inability to control the exact amount of material removed and its large amount of waste generated.

### Wet Blasting

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

## 6.2 Non-abrasive Cleaning Methods

Non-abrasive cleaning methods work by either dissolution or by forcing the contaminant off a surface with pressure. In general, less of the equipment surface is removed using non-abrasive methods.

### High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and high-pressure hose. Operating pressure usually ranges from 340 to 680 psi, which relates to flow rates of 20 to 140 lpm.

### Steam Cleaning

This method uses water delivered at high pressure and high temperature in order to remove accumulated solids and/or oils.

### Ultra-High-Pressure Water

This system produces a water jet from 1,000 to 4,000 atm. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 m/sec. (1,000 atm) to 900 m/sec. (4,000 atm). Additives can be used to enhance the cleaning action, if approved by the QAPP for the project.

### High-Pressure Freon Cleaning

Freon cleaning is a very effective method for cleaning cloth, rubber, plastic, and external/internal metal surfaces. Freon 113 (trichlorotriflorethane) is dense, chemically stable, relatively non-toxic, and leaves no residue. The vapor is easily removed from the air by activated charcoal. A high pressure (1,000 atm) jet of liquid Freon 113 is directed onto the surface to be cleaned. The Freon can be collected in a sump, filtered, and reused.

Physical removal of gross contamination should be followed by a wash/rinse process using cleaning solutions. One or more of the following methods utilize cleaning solutions.

### Dissolving

Removal of surface contaminants can be accomplished by chemically dissolving them, although the solvent must be compatible with the equipment and protective clothing. Organic solvents include alcohols, ethers, ketones, aromatics, straight-chain alkanes, and common petroleum products. Halogenated solvents are generally incompatible with protective clothing and are toxic. Table 1 provides a general guide to the solubility of contaminant categories in four types of solvents.

### Surfactants

Surfactants reduce adhesion forces between contaminants and the surface being cleaned and prevents reposition of the contaminants. Non-phosphate detergents dissolved in tap water is an acceptable surfactant solution.

### Rinsing

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

### Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment and personal protective clothing.

## 6.3 Field Sampling Equipment Cleaning Procedures

The following steps for equipment cleaning should be followed for general field sampling activities.

1. Physical removal (abrasive or non-abrasive methods).
2. Scrub with non-phosphate detergent plus tap water.
3. Tap water rinse.
4. 10% nitric acid (required during sampling for inorganics only).
5. Distilled/deionized water rinse.
6. Solvent rinse (required during sampling for organics only).
7. Total air dry (required during sampling for organics only).
8. Triple rinse with distilled/deionized water.

Table 1 lists solvent rinses which may be required for elimination of particular chemicals. After each solvent rinse, the equipment should be air-dried and triple-rinsed with distilled/deionized water.

Solvent rinses are not necessarily required when organics are not a contaminant of concern. Similarly, an acid rinse is not necessarily required if analysis does not include inorganics.

NOTE: Reference the appropriate analytical procedure for specific decontamination solutions required for adequate removal of the contaminants of concern.

Sampling equipment that requires the use of plastic or teflon tubing should be disassembled, cleaned, and the tubing replaced with clean tubing, if necessary, before commencement of sampling or between sampling locations.

**Table 1 Decontamination Solvents**

| Solvent | Soluble Contaminants |
|---|---|
| Water | Low-chain compounds<br>Salts<br>Some organic acids and other polar compounds |
| Dilute Bases<br>For example:<br>■ detergent<br>■ soap | Acidic compounds<br>Phenol<br>Thiols<br>Some nitro and sulfonic compounds |
| Organic Solvents:<br>For example:<br>■ alcohols (methanol)<br>■ ethers<br>■ ketones<br>■ aromatics<br>■ straight-chain alkanes (e.g., hexane)<br>■ common petroleum products (e.g., fuel oil, kerosene) | Nonpolar compounds (e.g., some organic compounds) |

WARNING: Some organic solvents can permeate and/or degrade the protective clothing.

# 7. Quality Assurance/Quality Control

QA/QC samples are intended to provide information concerning possible cross-contamination during collection, handling, preparation, and packing of samples from field locations for subsequent review and interpretation. A field blank (rinsate blank) provides an additional check on possible sources of contamination from ambient air and from sampling instruments used to collect and transfer samples into sample containers.

A field blank (rinsate blank) consists of a sample of analyte-free water passed through/over a precleaned/decontaminated sampling device and placed in a clean area to attempt to simulate a worst-case condition regarding ambient air contributions to sample contamination.

Field blanks should be collected at a rate of one per day per sample matrix even if samples are not shipped that day. The field blanks should return to the lab with the trip blanks originally sent to the field and be packed with their associated matrix.

The field blank places a mechanism of control on equipment decontamination, sample handling, storage, and shipment procedures. It is also indicative of ambient conditions and/or equipment conditions that may affect the quality of the samples.

Holding times for field blanks analyzed by CLP methods begin when the blank is received in the laboratory (as documented on the chain of parameters and associated analytical methods).

Holding times for samples and blanks analyzed by SW-846 or the 600 and 500 series begins at the time of sample collection.

# 8. Health and Safety

Decontamination can pose hazards under certain circumstances even though performed to protect health and safety. Hazardous substances may be incompatible with decontamination methods (i.e., the method may react with contaminants to produce heat, explosion, or toxic products). Decontamination methods may be incompatible with clothing or equipment (e.g., some solvents can permeate and/or degrade protective clothing). Also, a direct health hazard to workers can be posed from chemical decontamination solutions that may be hazardous if inhaled or may be flammable.

The decontamination solutions must be determined to be compatible before use. Any method that permeates, degrades, or damages personal protective equipment should not be used. If decontamination methods do pose a direct health hazard, measures should be taken to protect personnel or modified to eliminate the hazard.

All site-specific safety procedures should be followed for the cleaning operation. At a minimum, the following precautions should be taken:

1. Safety glasses with splash shields or goggles, neoprene gloves, and laboratory apron should be worn.

2. All solvent rinsing operations should be conducted under a fume hood or in open air.

3. No eating, smoking, drinking, chewing, or any hand-to-mouth contact is permitted.

# 9. References

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

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

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

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

# C Laboratory Data Sheets

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

4625 East Cotton Center Blvd. Ste 189, Phoenix, AZ 85040 (602) 437-3340 Fax:(602) 454-9303

Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUI0975

Sampled: 09/15/11
Received: 09/16/11

# TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI0975-01 (1KMHSR-OFS-148-001-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0581 | 5.0 | 180 | 0.996 | 9/16/2011 | 9/18/2011 | |
| Lead | EPA 6010B | 11I0581 | 5.0 | 760 | 0.996 | 9/16/2011 | 9/18/2011 | |
| **Sample ID: PUI0975-02 (1KMHSR-OFS-148-002-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0581 | 5.0 | 200 | 0.988 | 9/16/2011 | 9/18/2011 | |
| Lead | EPA 6010B | 11I0581 | 5.0 | 850 | 0.988 | 9/16/2011 | 9/18/2011 | |
| **Sample ID: PUI0975-03 (1KMHSR-OFS-148-003-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0581 | 5.0 | 29 | 0.968 | 9/16/2011 | 9/18/2011 | |
| Lead | EPA 6010B | 11I0581 | 5.0 | 67 | 0.968 | 9/16/2011 | 9/18/2011 | |
| **Sample ID: PUI0975-04 (1KMHSR-OFS-148-005-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0581 | 5.0 | 21 | 0.969 | 9/16/2011 | 9/18/2011 | |
| Lead | EPA 6010B | 11I0581 | 5.0 | 61 | 0.969 | 9/16/2011 | 9/18/2011 | |
| **Sample ID: PUI0975-05 (1KMHSR-OFS-111-001-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0581 | 5.0 | 170 | 0.996 | 9/16/2011 | 9/18/2011 | |
| Lead | EPA 6010B | 11I0581 | 5.0 | 460 | 0.996 | 9/16/2011 | 9/18/2011 | |

BLIND DUPLICATES TO LAB
RS 10/3/12

1/12/12

TestAmerica Phoenix

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Ecology and Environment - Lakewood
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Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUJ1827

Sampled: 10/29/11
Received: 10/29/11

# INORGANICS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUJ1827-04 (1KMHSR-OFS-002-004-072 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Cyanide | SW 9010C/9014 | 11K0029 | 0.40 | 1.9 J | 0.979 | 11/1/2011 | 11/1/2011 | BLIND DUPLICATES TO LAB VS 1/29/12 |
| **Sample ID: PUJ1827-05 (1KMHSR-OFS-002-005-072 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Cyanide | SW 9010C/9014 | 11K0029 | 0.40 | 2.6 J | 1.01 | 11/1/2011 | 11/1/2011 | |

[signature] 1/25/12

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Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUK0708

Sampled: 11/09/11
Received: 11/09/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUK0708-01 (IKMHSR-OFS-002-014-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11K0374 | 5.0 | 67 J | 0.996 | 11/9/2011 | 11/11/2011 | BLIND DUPLICATES TO LAB |
| Lead | EPA 6010B | 11K0374 | 5.0 | 65 | 0.996 | 11/9/2011 | 11/11/2011 | |
| **Sample ID: PUK0708-02 (IKMHSR-OFS-002-015-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11K0374 | 5.0 | 70 J | 0.998 | 11/9/2011 | 11/11/2011 | rs 1/29/12 |
| Lead | EPA 6010B | 11K0374 | 5.0 | 60 | 0.998 | 11/9/2011 | 11/11/2011 | |
| **Sample ID: PUK0708-03 (IKMHSR-OFS-002-016-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11K0374 | 5.0 | 50 J | 0.997 | 11/9/2011 | 11/11/2011 | |
| Lead | EPA 6010B | 11K0374 | 5.0 | 32 | 0.997 | 11/9/2011 | 11/11/2011 | |

1/25/12

TestAmerica Phoenix

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Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUK0813

Sampled: 11/10/11
Received: 11/11/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUK0813-01 (IKMHSR-OFS-002-017-002 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11K0454 | 5.0 | **200** J | 0.975 | 11/11/2011 | 11/14/2011 | |
| **Lead** | EPA 6010B | 11K0454 | 5.0 | **160** | 0.975 | 11/11/2011 | 11/14/2011 | |
| **Sample ID: PUK0813-02 (IKMHSR-OFS-002-018-002 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11K0454 | 5.0 | **22** J | 0.958 | 11/11/2011 | 11/14/2011 | |
| **Lead** | EPA 6010B | 11K0454 | 5.0 | **9.1** | 0.958 | 11/11/2011 | 11/14/2011 | |
| **Sample ID: PUK0813-03 (IKMHSR-OFS-002-019-002 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11K0454 | 5.0 | **56** J | 0.994 | 11/11/2011 | 11/14/2011 | |
| **Lead** | EPA 6010B | 11K0454 | 5.0 | **47** | 0.994 | 11/11/2011 | 11/14/2011 | |

1/25/12

**TestAmerica Phoenix**

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Project Manager

7 of 138

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUJ1827

Sampled: 10/29/11
Received: 10/29/11

# TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUJ1827-01 (1KMHSR-OFS-002-001-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J1199 | 5.0 | 24 | 0.988 | 10/31/2011 | 11/4/2011 | |
| Lead | EPA 6010B | 11J1199 | 5.0 | 11 | 0.988 | 10/31/2011 | 11/1/2011 | |
| **Sample ID: PUJ1827-02 (1KMHSR-OFS-002-002-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J1199 | 5.0 | 25 | 0.967 | 10/31/2011 | 11/4/2011 | |
| Lead | EPA 6010B | 11J1199 | 5.0 | 12 | 0.967 | 10/31/2011 | 11/1/2011 | |
| **Sample ID: PUJ1827-03 (1KMHSR-OFS-002-003-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J1199 | 5.0 | 25 | 0.991 | 10/31/2011 | 11/4/2011 | |
| Lead | EPA 6010B | 11J1199 | 5.0 | 36 | 0.991 | 10/31/2011 | 11/1/2011 | |
| **Sample ID: PUJ1827-04 (1KMHSR-OFS-002-004-072 - Soil)** BLIND DUPLICATE w/ 002-005-072 MS 1-29-12 | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Antimony | EPA 6010B | 11J1199 | 5.0 | 40 J | 1 | 10/31/2011 | 11/4/2011 | |
| Arsenic | EPA 6010B | 11J1199 | 50 | 5000 | 10 | 10/31/2011 | 11/17/2011 | D2 |
| Barium | EPA 6010B | 11J1199 | 5.0 | 26 | 1 | 10/31/2011 | 11/1/2011 | |
| Beryllium | EPA 6010B | 11J1199 | 0.50 | ND | 1 | 10/31/2011 | 11/1/2011 | |
| Cadmium | EPA 6010B | 11J1199 | 0.50 | 120 | 1 | 10/31/2011 | 11/1/2011 | |
| Chromium | EPA 6010B | 11J1199 | 2.0 | 13 | 1 | 10/31/2011 | 11/1/2011 | |
| Cobalt | EPA 6010B | 11J1199 | 2.0 | 18 | 1 | 10/31/2011 | 11/1/2011 | |
| Copper | EPA 6010B | 11J1199 | 5.0 | 800 | 1 | 10/31/2011 | 11/1/2011 | |
| Lead | EPA 6010B | 11J1199 | 5.0 | 5100 | 1 | 10/31/2011 | 11/1/2011 | |
| Mercury | EPA 7471A | 11J1213 | 2.0 | 17 | 19.1 | 11/1/2011 | 11/1/2011 | B7, D2 |
| Molybdenum | EPA 6010B | 11J1199 | 2.0 | 5.2 | 1 | 10/31/2011 | 11/1/2011 | |
| Nickel | EPA 6010B | 11J1199 | 2.0 | 14 | 1 | 10/31/2011 | 11/1/2011 | |
| Selenium | EPA 6010B | 11J1199 | 5.0 | 31 | 1 | 10/31/2011 | 11/1/2011 | |
| Silver | EPA 6010B | 11J1199 | 2.5 | 36 | 1 | 10/31/2011 | 11/1/2011 | |
| Thallium | EPA 6010B | 11J1199 | 5.0 | ND | 1 | 10/31/2011 | 11/1/2011 | |
| Vanadium | EPA 6010B | 11J1199 | 1.0 | 29 | 1 | 10/31/2011 | 11/1/2011 | |
| Zinc | EPA 6010B | 11J1199 | 1000 | 48000 | 100 | 10/31/2011 | 11/4/2011 | D2 |

1/25/12

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THE LEADER IN ENVIRONMENTAL TESTING

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUJ1827

Sampled: 10/29/11
Received: 10/29/11

# TOTAL METALS

Sample ID: PUJ1827-05 (1KMHSR-OFS-002-005-072 - Soil) BLIND DUPLICATE W/ 002-004-072 ·S 1-29-12

Reporting Units: mg/kg

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| Antimony | EPA 6010B | 11J1199 | 5.0 | 38 J | 0.977 | 10/31/2011 | 11/4/2011 | |
| Arsenic | EPA 6010B | 11J1199 | 50 | 5300 | 9.77 | 10/31/2011 | 11/17/2011 | D2 |
| Barium | EPA 6010B | 11J1199 | 5.0 | 32 | 0.977 | 10/31/2011 | 11/1/2011 | |
| Beryllium | EPA 6010B | 11J1199 | 0.50 | ND | 0.977 | 10/31/2011 | 11/1/2011 | |
| Cadmium | EPA 6010B | 11J1199 | 0.50 | 120 | 0.977 | 10/31/2011 | 11/1/2011 | |
| Chromium | EPA 6010B | 11J1199 | 2.0 | 15 | 0.977 | 10/31/2011 | 11/1/2011 | |
| Cobalt | EPA 6010B | 11J1199 | 2.0 | 19 | 0.977 | 10/31/2011 | 11/1/2011 | |
| Copper | EPA 6010B | 11J1199 | 5.0 | 950 | 0.977 | 10/31/2011 | 11/1/2011 | |
| Lead | EPA 6010B | 11J1199 | 5.0 | 5300 | 0.977 | 10/31/2011 | 11/1/2011 | |
| Mercury | EPA 7471A | 11J1213 | 2.0 | 10 | 21.2 | 11/1/2011 | 11/1/2011 | B7, M4 |
| Molybdenum | EPA 6010B | 11J1199 | 2.0 | 5.5 | 0.977 | 10/31/2011 | 11/1/2011 | |
| Nickel | EPA 6010B | 11J1199 | 2.0 | 14 | 0.977 | 10/31/2011 | 11/1/2011 | |
| Selenium | EPA 6010B | 11J1199 | 5.0 | 29 | 0.977 | 10/31/2011 | 11/1/2011 | |
| Silver | EPA 6010B | 11J1199 | 2.5 | 35 | 0.977 | 10/31/2011 | 11/1/2011 | |
| Thallium | EPA 6010B | 11J1199 | 5.0 | ND | 0.977 | 10/31/2011 | 11/1/2011 | |
| Vanadium | EPA 6010B | 11J1199 | 1.0 | 33 | 0.977 | 10/31/2011 | 11/1/2011 | |
| Zinc | EPA 6010B | 11J1199 | 1000 | 44000 | 97.7 | 10/31/2011 | 11/4/2011 | D2 |

1/25/12

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mindy Song

Project ID: T02-09-11-08-0005

Report Number: PUI1581

Sampled: 09/26/11
Received: 09/27/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI1581-01 (IKMHSR-OFS-111-009-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0976 | 5.0 | **160** | 0.996 | 9/27/2011 | 9/28/2011 | M3 |
| Lead | EPA 6010B | 11I0976 | 5.0 | **610** | 0.996 | 9/27/2011 | 9/28/2011 | M3 |
| **Sample ID: PUI1581-02 (IKMHSR-OFS-111-006-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0976 | 5.0 | **120** | 1 | 9/27/2011 | 9/28/2011 | |
| Lead | EPA 6010B | 11I0976 | 5.0 | **390** | 1 | 9/27/2011 | 9/28/2011 | |
| **Sample ID: PUI1581-03 (IKMHSR-OFS-306-003-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0976 | 5.0 | **29** | 0.997 | 9/27/2011 | 9/28/2011 | |
| Lead | EPA 6010B | 11I0976 | 5.0 | **59** | 0.997 | 9/27/2011 | 9/28/2011 | |
| **Sample ID: PUI1581-04 (IKMHSR-OFS-306-004-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0976 | 5.0 | **52** | 0.996 | 9/27/2011 | 9/28/2011 | |
| Lead | EPA 6010B | 11I0976 | 5.0 | **180** | 0.996 | 9/27/2011 | 9/28/2011 | |

1/20/12

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUI1139

Sampled: 09/19/11
Received: 09/20/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI1139-01 (1KMHSR-OFS-111-002-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0710 | 5.0 | 84 | 0.997 | 9/20/2011 | 9/21/2011 | |
| Lead | EPA 6010B | 11I0710 | 5.0 | 460 | 0.997 | 9/20/2011 | 9/21/2011 | |
| **Sample ID: PUI1139-02 (1KMHSR-OFS-111-003-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0710 | 5.0 | 160 | 0.995 | 9/20/2011 | 9/21/2011 | |
| Lead | EPA 6010B | 11I0710 | 5.0 | 620 | 0.995 | 9/20/2011 | 9/21/2011 | |
| **Sample ID: PUI1139-03 (1KMHSR-OFS-111-004-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0710 | 5.0 | 180 | 0.997 | 9/20/2011 | 9/21/2011 | |
| Lead | EPA 6010B | 11I0710 | 5.0 | 880 | 0.997 | 9/20/2011 | 9/21/2011 | |
| **Sample ID: PUI1139-04 (1KMHSR-OFS-111-005-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0710 | 5.0 | 190 | 0.997 | 9/20/2011 | 9/21/2011 | |
| Lead | EPA 6010B | 11I0710 | 5.0 | 820 | 0.997 | 9/20/2011 | 9/21/2011 | |

1/12/12

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mindy Song

Project ID: T02-09-11-08-0005

Report Number: PUJ0935

Sampled: 10/07/11-10/13/11
Received: 10/14/11

# TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUJ0935-01 (IKMHSR-OFS-118-003-002 - Soil)** | | | | Sampled: 10/07/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0706 | 5.0 | 250 | 0.998 | 10/18/2011 | 10/19/2011 | |
| Lead | EPA 6010B | 11J0706 | 5.0 | 820 J | 0.998 | 10/18/2011 | 10/19/2011 | |
| **Sample ID: PUJ0935-02 (IKMHSR-OFS-118-004-002 - Soil)** | | | | Sampled: 10/07/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0706 | 5.0 | 98 | 0.998 | 10/18/2011 | 10/19/2011 | BLIND DUPLICATES TO LAB MS 1-24-12 |
| Lead | EPA 6010B | 11J0706 | 5.0 | 620 J | 0.998 | 10/18/2011 | 10/19/2011 | |
| **Sample ID: PUJ0935-03 (IKMHSR-OFS-118-005-002 - Soil)** | | | | Sampled: 10/07/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0706 | 5.0 | 74 | 0.999 | 10/18/2011 | 10/19/2011 | M1 |
| Lead | EPA 6010B | 11J0706 | 5.0 | 470 J | 0.999 | 10/18/2011 | 10/19/2011 | M2 |
| **Sample ID: PUJ0935-04 (IKMHSR-OFS-133-001-002 - Soil)** | | | | Sampled: 10/11/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0706 | 5.0 | 320 | 0.999 | 10/18/2011 | 10/19/2011 | |
| Lead | EPA 6010B | 11J0706 | 5.0 | 1000 J | 0.999 | 10/18/2011 | 10/19/2011 | |
| **Sample ID: PUJ0935-05 (IKMHSR-OFS-133-003-002 - Soil)** | | | | Sampled: 10/12/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0706 | 5.0 | 240 | 1 | 10/18/2011 | 10/19/2011 | |
| Lead | EPA 6010B | 11J0706 | 5.0 | 720 J | 1 | 10/18/2011 | 10/19/2011 | |
| **Sample ID: PUJ0935-06 (IKMHSR-OFS-133-002-002 - Soil)** | | | | Sampled: 10/13/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0706 | 5.0 | 71 | 0.997 | 10/18/2011 | 10/19/2011 | |
| Lead | EPA 6010B | 11J0706 | 5.0 | 220 J | 0.997 | 10/18/2011 | 10/19/2011 | |
| **Sample ID: PUJ0935-07 (Arrowhead-Common-007 - Soil)** | | | | Sampled: 10/13/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0706 | 5.0 | 12 | 0.997 | 10/18/2011 | 10/19/2011 | |
| Barium | EPA 6010B | 11J0706 | 5.0 | 77 | 0.997 | 10/18/2011 | 10/19/2011 | |
| Cadmium | EPA 6010B | 11J0706 | 0.50 | ND | 0.997 | 10/18/2011 | 10/19/2011 | |
| Chromium | EPA 6010B | 11J0706 | 2.0 | 5.5 J | 0.997 | 10/18/2011 | 10/19/2011 | |
| Lead | EPA 6010B | 11J0706 | 5.0 | 7.6 J | 0.997 | 10/18/2011 | 10/19/2011 | |
| Mercury | EPA 7471A | 11J0718 | 0.10 | ND | 0.934 | 10/19/2011 | 10/20/2011 | |
| Selenium | EPA 6010B | 11J0706 | 5.0 | ND | 0.997 | 10/18/2011 | 10/19/2011 | |
| Silver | EPA 6010B | 11J0706 | 2.5 | ND | 0.997 | 10/18/2011 | 10/19/2011 | |

1/25/12

TestAmerica Phoenix

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mindy Song

Project ID: T02-09-11-08-0005

Report Number: PUJ0935

Sampled: 10/07/11-10/13/11
Received: 10/14/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUJ0935-08 (Arrowhead-Common-008 - Soil)** | | | | **Sampled: 10/13/11** | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11J0706 | 5.0 | **12** | 0.998 | 10/18/2011 | 10/19/2011 | |
| **Barium** | EPA 6010B | 11J0706 | 5.0 | **99** | 0.998 | 10/18/2011 | 10/19/2011 | |
| Cadmium | EPA 6010B | 11J0706 | 0.50 | ND | 0.998 | 10/18/2011 | 10/19/2011 | |
| **Chromium** | EPA 6010B | 11J0706 | 2.0 | **7.3** J | 0.998 | 10/18/2011 | 10/19/2011 | |
| **Lead** | EPA 6010B | 11J0706 | 5.0 | **8.0** J | 0.998 | 10/18/2011 | 10/19/2011 | |
| Mercury | EPA 7471A | 11J0718 | 0.10 | ND | 0.93 | 10/19/2011 | 10/20/2011 | |
| Selenium | EPA 6010B | 11J0706 | 5.0 | ND | 0.998 | 10/18/2011 | 10/19/2011 | |
| Silver | EPA 6010B | 11J0706 | 2.5 | ND | 0.998 | 10/18/2011 | 10/19/2011 | |
| **Sample ID: PUJ0935-09 (Arrowhead-Common-009 - Soil)** | | | | **Sampled: 10/13/11** | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11J0706 | 5.0 | **15** | 0.999 | 10/18/2011 | 10/19/2011 | |
| **Barium** | EPA 6010B | 11J0706 | 5.0 | **110** | 0.999 | 10/18/2011 | 10/19/2011 | |
| Cadmium | EPA 6010B | 11J0706 | 0.50 | ND | 0.999 | 10/18/2011 | 10/19/2011 | |
| **Chromium** | EPA 6010B | 11J0706 | 2.0 | **7.9** J | 0.999 | 10/18/2011 | 10/19/2011 | |
| **Lead** | EPA 6010B | 11J0706 | 5.0 | **9.6** J | 0.999 | 10/18/2011 | 10/19/2011 | |
| Mercury | EPA 7471A | 11J0718 | 0.10 | ND | 0.992 | 10/19/2011 | 10/20/2011 | |
| Selenium | EPA 6010B | 11J0706 | 5.0 | ND | 0.999 | 10/18/2011 | 10/19/2011 | |
| Silver | EPA 6010B | 11J0706 | 2.5 | ND | 0.999 | 10/18/2011 | 10/19/2011 | |
| **Sample ID: PUJ0935-10 (Arrowhead-Common-010 - Soil)** | | | | **Sampled: 10/13/11** | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11J0706 | 5.0 | **14** | 0.997 | 10/18/2011 | 10/19/2011 | |
| **Barium** | EPA 6010B | 11J0706 | 5.0 | **110** | 0.997 | 10/18/2011 | 10/19/2011 | |
| Cadmium | EPA 6010B | 11J0706 | 0.50 | ND | 0.997 | 10/18/2011 | 10/19/2011 | |
| **Chromium** | EPA 6010B | 11J0706 | 2.0 | **7.9** J | 0.997 | 10/18/2011 | 10/19/2011 | |
| **Lead** | EPA 6010B | 11J0706 | 5.0 | **8.9** J | 0.997 | 10/18/2011 | 10/19/2011 | |
| Mercury | EPA 7471A | 11J0718 | 0.10 | ND | 1.01 | 10/19/2011 | 10/20/2011 | |
| Selenium | EPA 6010B | 11J0706 | 5.0 | ND | 0.997 | 10/18/2011 | 10/19/2011 | |
| Silver | EPA 6010B | 11J0706 | 2.5 | ND | 0.997 | 10/18/2011 | 10/19/2011 | |

1/25/12

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mindy Song

Project ID: T02-09-11-08-0005

Report Number: PUJ0935

Sampled: 10/07/11-10/13/11
Received: 10/14/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUJ0935-11 (Arrowhead-Common-011 - Soil)** | | | | **Sampled: 10/13/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| **Arsenic** | EPA 6010B | 11J0706 | 5.0 | **15** | 0.998 | 10/18/2011 | 10/19/2011 | |
| **Barium** | EPA 6010B | 11J0706 | 5.0 | **120** | 0.998 | 10/18/2011 | 10/19/2011 | |
| Cadmium | EPA 6010B | 11J0706 | 0.50 | ND | 0.998 | 10/18/2011 | 10/19/2011 | |
| **Chromium** | EPA 6010B | 11J0706 | 2.0 | **7.3** J | 0.998 | 10/18/2011 | 10/19/2011 | |
| **Lead** | EPA 6010B | 11J0706 | 5.0 | **8.6** J | 0.998 | 10/18/2011 | 10/19/2011 | |
| Mercury | EPA 7471A | 11J0718 | 0.10 | ND | 1.02 | 10/19/2011 | 10/20/2011 | |
| Selenium | EPA 6010B | 11J0706 | 5.0 | ND | 0.998 | 10/18/2011 | 10/19/2011 | |
| Silver | EPA 6010B | 11J0706 | 2.5 | ND | 0.998 | 10/18/2011 | 10/19/2011 | |

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005 Iron King Mine - Humboldt Smelte

Report Number: PUI1073

Sampled: 09/17/11
Received: 09/19/11

# TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI1073-01 (IKMHSR-OFS-132-001-012 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110654 | 5.0 | 100 | 0.996 | 9/19/2011 | 9/20/2011 | |
| Lead | EPA 6010B | 1110654 | 5.0 | 230 | 0.996 | 9/19/2011 | 9/20/2011 | |
| **Sample ID: PUI1073-02 (IKMHSR-OFS-132-002-012 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110654 | 5.0 | 20 | 0.996 | 9/19/2011 | 9/20/2011 | |
| Lead | EPA 6010B | 1110654 | 5.0 | 52 | 0.996 | 9/19/2011 | 9/20/2011 | |
| **Sample ID: PUI1073-03 (IKMHSR-OFS-132-003-012 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110654 | 5.0 | 130 | 0.999 | 9/19/2011 | 9/20/2011 | |
| Lead | EPA 6010B | 1110654 | 5.0 | 480 | 0.999 | 9/19/2011 | 9/20/2011 | |
| **Sample ID: PUI1073-04 (IKMHSR-OFS-132-004-012 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110654 | 5.0 | 200 | 0.999 | 9/19/2011 | 9/20/2011 | |
| Lead | EPA 6010B | 1110654 | 5.0 | 1400 | 0.999 | 9/19/2011 | 9/20/2011 | |
| **Sample ID: PUI1073-05 (IKMHSR-OFS-132-005-012 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110654 | 5.0 | 100 | 0.996 | 9/19/2011 | 9/20/2011 | |
| Lead | EPA 6010B | 1110654 | 5.0 | 270 | 0.996 | 9/19/2011 | 9/20/2011 | |
| **Sample ID: PUI1073-06 (IKMHSR-OFS-306-001-012 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110654 | 5.0 | 23 | 0.996 | 9/19/2011 | 9/20/2011 | |
| Lead | EPA 6010B | 1110654 | 5.0 | 41 | 0.996 | 9/19/2011 | 9/20/2011 | |
| **Sample ID: PUI1073-07 (IKMHSR-OFS-306-002-012 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110654 | 5.0 | 54 | 0.998 | 9/19/2011 | 9/20/2011 | |
| Lead | EPA 6010B | 1110654 | 5.0 | 81 | 0.998 | 9/19/2011 | 9/20/2011 | |

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1/12/12

TestAmerica Phoenix

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| | | |
|---|---|---|
| Ecology and Environment - Lakewood<br>3700 Industry Ave, Suite 102<br>Lakewood, CA 90712<br>Attention: Mike Schwennesen | Project ID: T02-09-11-08-0005<br><br>Report Number: PUK0002 | Sampled: 10/24/11<br>Received: 10/28/11 |

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUK0002-01 (IKMHSR-0FS-133-004-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| **Arsenic** | EPA 6010B | 11K0042 | 5.0 | 90 | 0.997 | 11/1/2011 | 11/3/2011 | |
| **Lead** | EPA 6010B | 11K0042 | 5.0 | 280 | 0.997 | 11/1/2011 | 11/3/2011 | |

1/25/12

**TestAmerica Phoenix**

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUI1385

Sampled: 09/21/11-09/22/11
Received: 09/22/11

# TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI1385-01 (IKMHSR-OFS-148-006-002 - Soil)** | | | | **Sampled: 09/21/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110831 | 5.0 | 69 J | 0.997 | 9/23/2011 | 9/23/2011 | M2 |
| Lead | EPA 6010B | 1110831 | 5.0 | 450 J | 0.997 | 9/23/2011 | 9/23/2011 | M3, N1 |
| **Sample ID: PUI1385-02 (IKMHSR-OFS-148-010-002 - Soil)** | | | | **Sampled: 09/21/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110831 | 5.0 | 39 J | 0.979 | 9/23/2011 | 9/23/2011 | |
| Lead | EPA 6010B | 1110831 | 5.0 | 310 J | 0.979 | 9/23/2011 | 9/23/2011 | |
| **Sample ID: PUI1385-03 (IKMHSR-OFS-148-007-002 - Soil)** | | | | **Sampled: 09/21/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110831 | 5.0 | 120 J | 0.954 | 9/23/2011 | 9/23/2011 | |
| Lead | EPA 6010B | 1110831 | 5.0 | 420 J | 0.954 | 9/23/2011 | 9/23/2011 | |
| **Sample ID: PUI1385-04 (IKMHSR-OFS-148-008-002 - Soil)** | | | | **Sampled: 09/21/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110831 | 5.0 | 290 J | 0.962 | 9/23/2011 | 9/23/2011 | |
| Lead | EPA 6010B | 1110831 | 5.0 | 1500 J | 0.962 | 9/23/2011 | 9/23/2011 | |
| **Sample ID: PUI1385-05 (IKMHSR-OFS-148-009-002 - Soil)** | | | | **Sampled: 09/21/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110831 | 5.0 | 93 J | 1 | 9/23/2011 | 9/23/2011 | |
| Lead | EPA 6010B | 1110831 | 5.0 | 380 J | 1 | 9/23/2011 | 9/23/2011 | |
| **Sample ID: PUI1385-06 (BA-OFS-103-COMMON-9/22/11 - Soil)** | | | | **Sampled: 09/22/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1110831 | 5.0 | 9.0 J | 1 | 9/23/2011 | 9/23/2011 | |
| Barium | EPA 6010B | 1110831 | 5.0 | 110 | 1 | 9/23/2011 | 9/23/2011 | |
| Cadmium | EPA 6010B | 1110831 | 0.50 | ND | 1 | 9/23/2011 | 9/23/2011 | |
| Chromium | EPA 6010B | 1110831 | 2.0 | 24 | 1 | 9/23/2011 | 9/23/2011 | |
| Lead | EPA 6010B | 1110831 | 5.0 | 8.2 J | 1 | 9/23/2011 | 9/23/2011 | |
| Mercury | EPA 7471A | 1110809 | 0.10 | ND | 1.09 | 9/22/2011 | 9/23/2011 | |
| Selenium | EPA 6010B | 1110831 | 5.0 | ND | 1 | 9/23/2011 | 9/23/2011 | |
| Silver | EPA 6010B | 1110831 | 2.5 | ND | 1 | 9/23/2011 | 9/23/2011 | |

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1/12/12

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Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUI1385

Sampled: 09/21/11-09/22/11
Received: 09/22/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI1385-07 (BA-OFS-103-TOP-9/22/11 - Soil)** | | | | **Sampled: 09/22/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0831 | 5.0 | **6.8** J | 0.993 | 9/23/2011 | 9/23/2011 | |
| **Barium** | EPA 6010B | 11I0831 | 5.0 | **69** | 0.993 | 9/23/2011 | 9/23/2011 | |
| Cadmium | EPA 6010B | 11I0831 | 0.50 | ND | 0.993 | 9/23/2011 | 9/23/2011 | |
| **Chromium** | EPA 6010B | 11I0831 | 2.0 | **17** J | 0.993 | 9/23/2011 | 9/23/2011 | |
| Lead | EPA 6010B | 11I0831 | 5.0 | ND | 0.993 | 9/23/2011 | 9/23/2011 | |
| Mercury | EPA 7471A | 11I0809 | 0.10 | ND | 1.03 | 9/22/2011 | 9/23/2011 | |
| Selenium | EPA 6010B | 11I0831 | 5.0 | ND | 0.993 | 9/23/2011 | 9/23/2011 | |
| Silver | EPA 6010B | 11I0831 | 2.5 | ND | 0.993 | 9/23/2011 | 9/23/2011 | |

1/12/12

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Project ID: T02-09-11-08-0005

Report Number: PUJ0029

Sampled: 10/03/11
Received: 10/03/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUJ0029-01 (IKMHSR-OFS-244/208-001-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0041 | 5.0 | 26 | 1 | 10/3/2011 | 10/4/2011 | |
| Lead | EPA 6010B | 11J0041 | 5.0 | 18 | 1 | 10/3/2011 | 10/4/2011 | |
| **Sample ID: PUJ0029-02 (IKMHSR-OFS-244/208-002-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0041 | 5.0 | 21 | 1 | 10/3/2011 | 10/4/2011 | |
| Lead | EPA 6010B | 11J0041 | 5.0 | 14 | 1 | 10/3/2011 | 10/4/2011 | |
| **Sample ID: PUJ0029-03 (IKMHSR-OFS132-005-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0041 | 5.0 | 93 | 1 | 10/3/2011 | 10/4/2011 | |
| Lead | EPA 6010B | 11J0041 | 5.0 | 320 | 1 | 10/3/2011 | 10/4/2011 | |
| **Sample ID: PUJ0029-04 (IKMHSR-OFS132-006-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0041 | 5.0 | 14 | 1 | 10/3/2011 | 10/4/2011 | |
| Lead | EPA 6010B | 11J0041 | 5.0 | 23 | 1 | 10/3/2011 | 10/4/2011 | |
| **Sample ID: PUJ0029-05 (IKMHSR-OFS132-007-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0041 | 5.0 | 52 | 1 | 10/3/2011 | 10/4/2011 | |
| Lead | EPA 6010B | 11J0041 | 5.0 | 400 | 1 | 10/3/2011 | 10/4/2011 | |
| **Sample ID: PUJ0029-06 (IKMHSR-OFS132-008-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0041 | 5.0 | 150 | 1 | 10/3/2011 | 10/4/2011 | |
| Lead | EPA 6010B | 11J0041 | 5.0 | 660 | 1 | 10/3/2011 | 10/4/2011 | M3 |

BLIND DUPLICATES TO LAB
MS 1/29/12

1/20/12

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Attention: Mike Schwennesen

Project ID: TO2-09-11-08-0005

Report Number: PUJ0335

Sampled: 10/05/11-10/06/11
Received: 10/06/11

# TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUJ0335-01 (IKMHSR-OFS-260-002-002 - Soil)** | | | | **Sampled: 10/05/11** | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11J0213 | 5.0 | **200** | 0.999 | 10/6/2011 | 10/7/2011 | |
| **Lead** | EPA 6010B | 11J0213 | 5.0 | **770** | 0.999 | 10/6/2011 | 10/7/2011 | |
| **Sample ID: PUJ0335-02 (IKMHSR-OFS-260-003-002 - Soil)** | | | | **Sampled: 10/05/11** | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11J0213 | 5.0 | **75** | 0.997 | 10/6/2011 | 10/7/2011 | |
| **Lead** | EPA 6010B | 11J0213 | 5.0 | **330** | 0.997 | 10/6/2011 | 10/7/2011 | |
| **Sample ID: PUJ0335-03 (IKMHSR-OFS-118-001-002 - Soil)** | | | | **Sampled: 10/06/11** | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11J0213 | 5.0 | **95** | 0.996 | 10/6/2011 | 10/7/2011 | |
| **Lead** | EPA 6010B | 11J0213 | 5.0 | **310** | 0.996 | 10/6/2011 | 10/7/2011 | |
| **Sample ID: PUJ0335-04 (IKMHSR-OFS-118-002-002 - Soil)** | | | | **Sampled: 10/06/11** | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11J0213 | 5.0 | **85** | 0.996 | 10/6/2011 | 10/7/2011 | |
| **Lead** | EPA 6010B | 11J0213 | 5.0 | **400** | 0.996 | 10/6/2011 | 10/7/2011 | |

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Project ID: T02-09-11-08-005

Report Number: PUI0034

Sampled: 08/31/11-09/01/11
Received: 09/01/11

# TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI0034-01 (OFS-260-11-002 - Soil)** | | | | **Sampled: 08/31/11** | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| Arsenic | EPA 6010B | 11I0028 | 5.0 | 21 | 0.998 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | 40 | 0.998 | 9/1/2011 | 9/2/2011 | |
| **Sample ID: PUI0034-02 (OFS-260-10-002 - Soil)** | | | | **Sampled: 08/31/11** | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| Arsenic | EPA 6010B | 11I0028 | 5.0 | 28 | 0.998 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | 110 | 0.998 | 9/1/2011 | 9/2/2011 | |
| **Sample ID: PUI0034-03 (OFS-260-12-002 - Soil)** | | | | **Sampled: 08/31/11** | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| Arsenic | EPA 6010B | 11I0028 | 5.0 | 41 | 0.997 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | 63 | 0.997 | 9/1/2011 | 9/2/2011 | |
| **Sample ID: PUI0034-04 (OFS-260-13-002 - Soil)** | | | | **Sampled: 08/31/11** | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| Arsenic | EPA 6010B | 11I0028 | 5.0 | 27 | 0.996 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | 52 | 0.996 | 9/1/2011 | 9/2/2011 | |
| **Sample ID: PUI0034-05 (BA-1-1 - Soil)** | | | | **Sampled: 08/31/11** | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| Arsenic | EPA 6010B | 11I0028 | 5.0 | 350 | 0.999 | 9/1/2011 | 9/2/2011 | |
| Barium | EPA 6010B | 11I0028 | 5.0 | 390 | 0.999 | 9/1/2011 | 9/2/2011 | |
| Cadmium | EPA 6010B | 11I0028 | 0.50 | ND | 0.999 | 9/1/2011 | 9/2/2011 | B3 |
| Chromium | EPA 6010B | 11I0028 | 2.0 | 120 | 0.999 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | 8.7 | 0.999 | 9/1/2011 | 9/2/2011 | |
| Mercury | EPA 7471A | 11I0113 | 0.10 | 0.16 | 1.04 | 9/6/2011 | 9/7/2011 | |
| Selenium | EPA 6010B | 11I0028 | 5.0 | 10 | 0.999 | 9/1/2011 | 9/2/2011 | |
| Silver | EPA 6010B | 11I0028 | 2.5 | ND | 0.999 | 9/1/2011 | 9/2/2011 | |

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[initials] 10/3/11

[signature] 1/12/12

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Project ID: T02-09-11-08-005

Report Number: PUI0034

Sampled: 08/31/11-09/01/11
Received: 09/01/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI0034-06 (BA-1-2 - Soil)** | | | | Sampled: 08/31/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0028 | 5.0 | **210** | 0.998 | 9/1/2011 | 9/2/2011 | |
| **Barium** | EPA 6010B | 11I0028 | 5.0 | **220** | 0.998 | 9/1/2011 | 9/2/2011 | |
| Cadmium | EPA 6010B | 11I0028 | 0.50 | ND | 0.998 | 9/1/2011 | 9/2/2011 | B3 |
| **Chromium** | EPA 6010B | 11I0028 | 2.0 | **110** | 0.998 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | ND | 0.998 | 9/1/2011 | 9/2/2011 | |
| Mercury | EPA 7471A | 11I0113 | 0.090 | ND | 0.898 | 9/6/2011 | 9/7/2011 | |
| **Selenium** | EPA 6010B | 11I0028 | 5.0 | **5.4** | 0.998 | 9/1/2011 | 9/2/2011 | |
| Silver | EPA 6010B | 11I0028 | 2.5 | ND | 0.998 | 9/1/2011 | 9/2/2011 | |
| **Sample ID: PUI0034-07 (BA-2-1 - Soil)** | | | | Sampled: 08/31/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0028 | 5.0 | **30** | 0.999 | 9/1/2011 | 9/2/2011 | |
| **Barium** | EPA 6010B | 11I0028 | 5.0 | **37** | 0.999 | 9/1/2011 | 9/2/2011 | |
| Cadmium | EPA 6010B | 11I0028 | 0.50 | ND | 0.999 | 9/1/2011 | 9/2/2011 | B3 |
| **Chromium** | EPA 6010B | 11I0028 | 2.0 | **33** | 0.999 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | ND | 0.999 | 9/1/2011 | 9/2/2011 | |
| Mercury | EPA 7471A | 11I0113 | 0.10 | ND | 1.09 | 9/6/2011 | 9/7/2011 | |
| **Selenium** | EPA 6010B | 11I0028 | 5.0 | **5.0** | 0.999 | 9/1/2011 | 9/2/2011 | M1 |
| Silver | EPA 6010B | 11I0028 | 2.5 | ND | 0.999 | 9/1/2011 | 9/2/2011 | |
| **Sample ID: PUI0034-08 (BA-2-2 - Soil)** | | | | Sampled: 08/31/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0028 | 5.0 | **43** | 0.998 | 9/1/2011 | 9/2/2011 | |
| **Barium** | EPA 6010B | 11I0028 | 5.0 | **63** | 0.998 | 9/1/2011 | 9/2/2011 | |
| Cadmium | EPA 6010B | 11I0028 | 0.50 | ND | 0.998 | 9/1/2011 | 9/2/2011 | B3 |
| **Chromium** | EPA 6010B | 11I0028 | 2.0 | **120** | 0.998 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | ND | 0.998 | 9/1/2011 | 9/2/2011 | |
| Mercury | EPA 7471A | 11I0113 | 0.10 | ND | 0.963 | 9/6/2011 | 9/7/2011 | |
| **Selenium** | EPA 6010B | 11I0028 | 5.0 | **5.0** | 0.998 | 9/1/2011 | 9/2/2011 | |
| Silver | EPA 6010B | 11I0028 | 2.5 | ND | 0.998 | 9/1/2011 | 9/2/2011 | |

1/12/12

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Project ID: T02-09-11-08-005

Report Number: PUI0034

Sampled: 08/31/11-09/01/11
Received: 09/01/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI0034-09 (BA-3-1 - Soil)** | | | | Sampled: 09/01/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0028 | 5.0 | 8.1 | 0.999 | 9/1/2011 | 9/2/2011 | |
| Barium | EPA 6010B | 11I0028 | 5.0 | 62 | 0.999 | 9/1/2011 | 9/2/2011 | |
| Cadmium | EPA 6010B | 11I0028 | 0.50 | ND | 0.999 | 9/1/2011 | 9/2/2011 | B3 |
| Chromium | EPA 6010B | 11I0028 | 2.0 | 18 | 0.999 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | 5.5 | 0.999 | 9/1/2011 | 9/2/2011 | |
| Mercury | EPA 7471A | 11I0113 | 0.10 | ND | 0.995 | 9/6/2011 | 9/7/2011 | |
| Selenium | EPA 6010B | 11I0028 | 5.0 | ND | 0.999 | 9/1/2011 | 9/2/2011 | |
| Silver | EPA 6010B | 11I0028 | 2.5 | ND | 0.999 | 9/1/2011 | 9/2/2011 | |
| **Sample ID: PUI0034-10 (OFS-116-001-002-COMP - Soil)** | | | | Sampled: 09/01/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0028 | 5.0 | 35 | 0.998 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | 41 | 0.998 | 9/1/2011 | 9/2/2011 | |
| **Sample ID: PUI0034-11 (OFS-116-002-002-COMP - Soil)** | | | | Sampled: 09/01/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0028 | 5.0 | 150 | 0.996 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | 200 | 0.996 | 9/1/2011 | 9/2/2011 | |
| **Sample ID: PUI0034-12 (OFS-116-902-002-COMP - Soil)** | | | | Sampled: 09/01/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0028 | 5.0 | 160 | 0.999 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | 230 | 0.999 | 9/1/2011 | 9/2/2011 | |
| **Sample ID: PUI0034-13 (OFS-116-003-002-COMP - Soil)** | | | | Sampled: 09/01/11 | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0028 | 5.0 | 19 | 0.996 | 9/1/2011 | 9/2/2011 | |
| Lead | EPA 6010B | 11I0028 | 5.0 | 23 | 0.996 | 9/1/2011 | 9/2/2011 | |

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TestAmerica Phoenix

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Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUI1702

Sampled: 09/27/11
Received: 09/28/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI1702-01 (IKMHSR-OFS-301-002-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I1033 | 5.0 | 69 | 0.999 | 9/28/2011 | 9/29/2011 | |
| Lead | EPA 6010B | 11I1033 | 5.0 | 230 | 0.999 | 9/28/2011 | 9/29/2011 | |
| **Sample ID: PUI1702-02 (IKMHSR-OFS-103-001-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I1033 | 5.0 | 62 | 0.996 | 9/28/2011 | 9/29/2011 | |
| Lead | EPA 6010B | 11I1033 | 5.0 | 180 | 0.996 | 9/28/2011 | 9/29/2011 | |
| **Sample ID: PUI1702-03 (IKMHSR-OFS-260-001-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I1033 | 5.0 | 220 | 0.998 | 9/28/2011 | 9/29/2011 | |
| Lead | EPA 6010B | 11I1033 | 5.0 | 870 | 0.998 | 9/28/2011 | 9/29/2011 | M3 |

1/20/12

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mindy Song

Project ID: T02-09-11-08-0005

Report Number: PUI1573

Sampled: 09/26/11
Received: 09/26/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI1573-01 (IKMHSR-OFS-301-001-002 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0915 | 5.0 | **110** | 0.998 | 9/26/2011 | 9/27/2011 | |
| **Lead** | EPA 6010B | 11I0915 | 5.0 | **770** | 0.998 | 9/26/2011 | 9/27/2011 | M3 |
| **Sample ID: PUI1573-02 (IKMHSR-OFS-111-007-002 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0915 | 5.0 | **140** | 0.997 | 9/26/2011 | 9/27/2011 | |
| **Lead** | EPA 6010B | 11I0915 | 5.0 | **290** | 0.997 | 9/26/2011 | 9/27/2011 | |
| **Sample ID: PUI1573-03 (IKMHSR-OFS-111-008-002 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0915 | 5.0 | **160** | 0.996 | 9/26/2011 | 9/27/2011 | |
| **Lead** | EPA 6010B | 11I0915 | 5.0 | **570** | 0.996 | 9/26/2011 | 9/27/2011 | |

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUJ0107

Sampled: 10/04/11
Received: 10/04/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUJ0107-01 (Arrowhead-Common-003 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0100 | 5.0 | **15** | 0.996 | 10/4/2011 | 10/5/2011 | |
| Lead | EPA 6010B | 11J0100 | 5.0 | **9.9** | 0.996 | 10/4/2011 | 10/5/2011 | |
| **Sample ID: PUJ0107-02 (Arrowhead-Common-004 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0100 | 5.0 | **15** | 0.998 | 10/4/2011 | 10/5/2011 | |
| Lead | EPA 6010B | 11J0100 | 5.0 | **11** | 0.998 | 10/4/2011 | 10/5/2011 | |
| **Sample ID: PUJ0107-03 (Arrowhead-Common-005 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0100 | 5.0 | **16** | 0.997 | 10/4/2011 | 10/5/2011 | |
| Lead | EPA 6010B | 11J0100 | 5.0 | **12** | 0.997 | 10/4/2011 | 10/5/2011 | |
| **Sample ID: PUJ0107-04 (Arrowhead-Common-006 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11J0100 | 5.0 | **14** | 0.997 | 10/4/2011 | 10/5/2011 | |
| Lead | EPA 6010B | 11J0100 | 5.0 | **10** | 0.997 | 10/4/2011 | 10/5/2011 | |

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Attention: Mike Schwennesen

Project ID: T02-02-09-11-08-0005

Report Number: PUI0848

Sampled: 09/14/11
Received: 09/14/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI0848-01 (BA-2-3 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0488 | 5.0 | **37** | 0.999 | 9/14/2011 | 9/15/2011 | |
| **Barium** | EPA 6010B | 11I0488 | 5.0 | **54** | 0.999 | 9/14/2011 | 9/15/2011 | |
| Cadmium | EPA 6010B | 11I0488 | 0.50 | ND | 0.999 | 9/14/2011 | 9/15/2011 | |
| **Chromium** | EPA 6010B | 11I0488 | 2.0 | **57** | 0.999 | 9/14/2011 | 9/15/2011 | |
| **Lead** | EPA 6010B | 11I0488 | 5.0 | **8.3** | 0.999 | 9/14/2011 | 9/15/2011 | |
| Mercury | EPA 7471A | 11I0506 | 0.10 | ND | 1.05 | 9/15/2011 | 9/15/2011 | |
| **Selenium** | EPA 6010B | 11I0488 | 5.0 | **6.5** | 0.999 | 9/14/2011 | 9/15/2011 | |
| Silver | EPA 6010B | 11I0488 | 2.5 | ND | 0.999 | 9/14/2011 | 9/15/2011 | |
| **Sample ID: PUI0848-02 (BA-2-4 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0488 | 5.0 | **17** | 0.996 | 9/14/2011 | 9/15/2011 | |
| **Barium** | EPA 6010B | 11I0488 | 5.0 | **77** | 0.996 | 9/14/2011 | 9/15/2011 | |
| Cadmium | EPA 6010B | 11I0488 | 0.50 | ND | 0.996 | 9/14/2011 | 9/15/2011 | |
| **Chromium** | EPA 6010B | 11I0488 | 2.0 | **13** | 0.996 | 9/14/2011 | 9/15/2011 | |
| **Lead** | EPA 6010B | 11I0488 | 5.0 | **16** | 0.996 | 9/14/2011 | 9/15/2011 | |
| Mercury | EPA 7471A | 11I0506 | 0.10 | ND | 0.985 | 9/15/2011 | 9/15/2011 | |
| Selenium | EPA 6010B | 11I0488 | 5.0 | ND | 0.996 | 9/14/2011 | 9/15/2011 | |
| Silver | EPA 6010B | 11I0488 | 2.5 | ND | 0.996 | 9/14/2011 | 9/15/2011 | |
| **Sample ID: PUI0848-03 (BA-2-5 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0488 | 5.0 | **17** | 0.999 | 9/14/2011 | 9/15/2011 | |
| **Barium** | EPA 6010B | 11I0488 | 5.0 | **73** | 0.999 | 9/14/2011 | 9/15/2011 | M1, M2 |
| Cadmium | EPA 6010B | 11I0488 | 0.50 | ND | 0.999 | 9/14/2011 | 9/15/2011 | |
| **Chromium** | EPA 6010B | 11I0488 | 2.0 | **15** | 0.999 | 9/14/2011 | 9/15/2011 | |
| **Lead** | EPA 6010B | 11I0488 | 5.0 | **16** | 0.999 | 9/14/2011 | 9/15/2011 | |
| Mercury | EPA 7471A | 11I0506 | 0.10 | ND | 1.07 | 9/15/2011 | 9/15/2011 | |
| Selenium | EPA 6010B | 11I0488 | 5.0 | ND | 0.999 | 9/14/2011 | 9/15/2011 | |
| Silver | EPA 6010B | 11I0488 | 2.5 | ND | 0.999 | 9/14/2011 | 9/15/2011 | |

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Attention: Mike Schwennesen

Project ID: T02-02-09-11-08-0005

Report Number: PUI0848

Sampled: 09/14/11
Received: 09/14/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI0848-04 (BA-7-1 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| Arsenic | EPA 6010B | 11I0488 | 5.0 | ND | 0.996 | 9/14/2011 | 9/15/2011 | |
| **Barium** | EPA 6010B | 11I0488 | 5.0 | 77 | 0.996 | 9/14/2011 | 9/15/2011 | |
| Cadmium | EPA 6010B | 11I0488 | 0.50 | ND | 0.996 | 9/14/2011 | 9/15/2011 | |
| **Chromium** | EPA 6010B | 11I0488 | 2.0 | **15** | 0.996 | 9/14/2011 | 9/15/2011 | |
| Lead | EPA 6010B | 11I0488 | 5.0 | ND | 0.996 | 9/14/2011 | 9/15/2011 | |
| Mercury | EPA 7471A | 11I0506 | 0.11 | ND | 1.12 | 9/15/2011 | 9/15/2011 | |
| Selenium | EPA 6010B | 11I0488 | 5.0 | ND | 0.996 | 9/14/2011 | 9/15/2011 | |
| Silver | EPA 6010B | 11I0488 | 2.5 | ND | 0.996 | 9/14/2011 | 9/15/2011 | |

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Ecology and Environment - Lakewood
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Lakewood, CA 90712
Attention: Mindy Song

Project ID: T02-09-11-08-0005

Report Number: PUI0643

Sampled: 09/12/11
Received: 09/12/11

# TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI0643-01 (BA-3-2 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0376 | 5.0 | **11** | 0.998 | 9/12/2011 | 9/13/2011 | |
| **Barium** | EPA 6010B | 11I0376 | 5.0 | **64** | 0.998 | 9/12/2011 | 9/13/2011 | |
| Cadmium | EPA 6010B | 11I0376 | 0.50 | ND | 0.998 | 9/12/2011 | 9/13/2011 | |
| **Chromium** | EPA 6010B | 11I0376 | 2.0 | **14** | 0.998 | 9/12/2011 | 9/13/2011 | |
| **Lead** | EPA 6010B | 11I0376 | 5.0 | **5.4** | 0.998 | 9/12/2011 | 9/13/2011 | |
| Mercury | EPA 7471A | 11I0417 | 0.10 | ND | 0.989 | 9/13/2011 | 9/13/2011 | M2 |
| Selenium | EPA 6010B | 11I0376 | 5.0 | ND | 0.998 | 9/12/2011 | 9/13/2011 | |
| Silver | EPA 6010B | 11I0376 | 2.5 | ND | 0.998 | 9/12/2011 | 9/13/2011 | |
| **Sample ID: PUI0643-02 (BA-3-3 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0376 | 5.0 | **8.2** | 0.996 | 9/12/2011 | 9/13/2011 | |
| **Barium** | EPA 6010B | 11I0376 | 5.0 | **73** | 0.996 | 9/12/2011 | 9/13/2011 | |
| Cadmium | EPA 6010B | 11I0376 | 0.50 | ND | 0.996 | 9/12/2011 | 9/13/2011 | |
| **Chromium** | EPA 6010B | 11I0376 | 2.0 | **16** | 0.996 | 9/12/2011 | 9/13/2011 | |
| **Lead** | EPA 6010B | 11I0376 | 5.0 | **5.7** | 0.996 | 9/12/2011 | 9/13/2011 | |
| Mercury | EPA 7471A | 11I0417 | 0.10 | ND | 0.991 | 9/13/2011 | 9/13/2011 | |
| Selenium | EPA 6010B | 11I0376 | 5.0 | ND | 0.996 | 9/12/2011 | 9/13/2011 | |
| Silver | EPA 6010B | 11I0376 | 2.5 | ND | 0.996 | 9/12/2011 | 9/13/2011 | |
| **Sample ID: PUI0643-03 (BA-6-1 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0376 | 5.0 | **11** | 0.999 | 9/12/2011 | 9/13/2011 | |
| **Barium** | EPA 6010B | 11I0376 | 5.0 | **73** | 0.999 | 9/12/2011 | 9/13/2011 | |
| Cadmium | EPA 6010B | 11I0376 | 0.50 | ND | 0.999 | 9/12/2011 | 9/13/2011 | |
| **Chromium** | EPA 6010B | 11I0376 | 2.0 | **4.0** | 0.999 | 9/12/2011 | 9/13/2011 | |
| **Lead** | EPA 6010B | 11I0376 | 5.0 | **8.6** | 0.999 | 9/12/2011 | 9/13/2011 | |
| Mercury | EPA 7471A | 11I0417 | 0.10 | ND | 1.11 | 9/13/2011 | 9/13/2011 | |
| Selenium | EPA 6010B | 11I0376 | 5.0 | ND | 0.999 | 9/12/2011 | 9/13/2011 | |
| Silver | EPA 6010B | 11I0376 | 2.5 | ND | 0.999 | 9/12/2011 | 9/13/2011 | |

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Lakewood, CA 90712
Attention: Mindy Song

Project ID: T02-09-1L-08-0005 Iron King Mine-Humboldt Smelter

Report Number: PUI0617

Sampled: 09/12/11
Received: 09/12/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI0617-01 (BA-4-1 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| Arsenic | EPA 6010B | 11I0376 | 5.0 | ND | 0.998 | 9/12/2011 | 9/13/2011 | |
| **Barium** | EPA 6010B | 11I0376 | 5.0 | **77** | 0.998 | 9/12/2011 | 9/13/2011 | |
| Cadmium | EPA 6010B | 11I0376 | 0.50 | ND | 0.998 | 9/12/2011 | 9/13/2011 | |
| **Chromium** | EPA 6010B | 11I0376 | 2.0 | **7.4** | 0.998 | 9/12/2011 | 9/13/2011 | |
| **Lead** | EPA 6010B | 11I0376 | 5.0 | **6.1** | 0.998 | 9/12/2011 | 9/13/2011 | |
| Mercury | EPA 7471A | 11I0364 | 0.10 | ND | 0.919 | 9/12/2011 | 9/13/2011 | |
| Selenium | EPA 6010B | 11I0376 | 5.0 | ND | 0.998 | 9/12/2011 | 9/13/2011 | |
| Silver | EPA 6010B | 11I0376 | 2.5 | ND | 0.998 | 9/12/2011 | 9/13/2011 | |
| **Sample ID: PUI0617-02 (BA-4-2 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| Arsenic | EPA 6010B | 11I0376 | 5.0 | ND | 0.999 | 9/12/2011 | 9/13/2011 | |
| **Barium** | EPA 6010B | 11I0376 | 5.0 | **93** | 0.999 | 9/12/2011 | 9/13/2011 | |
| Cadmium | EPA 6010B | 11I0376 | 0.50 | ND | 0.999 | 9/12/2011 | 9/13/2011 | |
| **Chromium** | EPA 6010B | 11I0376 | 2.0 | **8.7** | 0.999 | 9/12/2011 | 9/13/2011 | |
| **Lead** | EPA 6010B | 11I0376 | 5.0 | **7.1** | 0.999 | 9/12/2011 | 9/13/2011 | |
| Mercury | EPA 7471A | 11I0364 | 0.10 | ND | 0.994 | 9/12/2011 | 9/13/2011 | M2 |
| Selenium | EPA 6010B | 11I0376 | 5.0 | ND | 0.999 | 9/12/2011 | 9/13/2011 | |
| Silver | EPA 6010B | 11I0376 | 2.5 | ND | 0.999 | 9/12/2011 | 9/13/2011 | |
| **Sample ID: PUI0617-03 (BA-5-1 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0376 | 5.0 | **7.4** | 0.997 | 9/12/2011 | 9/13/2011 | |
| **Barium** | EPA 6010B | 11I0376 | 5.0 | **80** | 0.997 | 9/12/2011 | 9/13/2011 | |
| Cadmium | EPA 6010B | 11I0376 | 0.50 | ND | 0.997 | 9/12/2011 | 9/13/2011 | |
| **Chromium** | EPA 6010B | 11I0376 | 2.0 | **15** | 0.997 | 9/12/2011 | 9/13/2011 | |
| **Lead** | EPA 6010B | 11I0376 | 5.0 | **5.9** | 0.997 | 9/12/2011 | 9/13/2011 | |
| Mercury | EPA 7471A | 11I0364 | 0.11 | ND | 1.14 | 9/12/2011 | 9/13/2011 | |
| Selenium | EPA 6010B | 11I0376 | 5.0 | ND | 0.997 | 9/12/2011 | 9/13/2011 | |
| Silver | EPA 6010B | 11I0376 | 2.5 | ND | 0.997 | 9/12/2011 | 9/13/2011 | |

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3700 Industry Ave, Suite 102
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Project ID: T02-09-1L-08-0005 Iron King Mine-Humboldt Smelter
Report Number: PUI0617
Sampled: 09/12/11
Received: 09/12/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI0617-04 (BA-5-2 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0376 | 5.0 | **7.3** | 1 | 9/12/2011 | 9/13/2011 | |
| **Barium** | EPA 6010B | 11I0376 | 5.0 | **90** | 1 | 9/12/2011 | 9/13/2011 | |
| Cadmium | EPA 6010B | 11I0376 | 0.50 | ND | 1 | 9/12/2011 | 9/13/2011 | |
| **Chromium** | EPA 6010B | 11I0376 | 2.0 | **16** | 1 | 9/12/2011 | 9/13/2011 | |
| **Lead** | EPA 6010B | 11I0376 | 5.0 | **5.8** | 1 | 9/12/2011 | 9/13/2011 | |
| Mercury | EPA 7471A | 11I0364 | 0.091 | ND | 0.906 | 9/12/2011 | 9/13/2011 | |
| Selenium | EPA 6010B | 11I0376 | 5.0 | ND | 1 | 9/12/2011 | 9/13/2011 | |
| Silver | EPA 6010B | 11I0376 | 2.5 | ND | 1 | 9/12/2011 | 9/13/2011 | |

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Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005 Iron King Mine-Humboldt Smelter
Report Number: PUI1047
Sampled: 09/16/11
Received: 09/16/11

# TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI1047-01 (BA-7-2 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0581 | 5.0 | **5.1** | 0.998 | 9/16/2011 | 9/18/2011 | |
| **Barium** | EPA 6010B | 11I0581 | 5.0 | **81** | 0.998 | 9/16/2011 | 9/18/2011 | |
| Cadmium | EPA 6010B | 11I0581 | 0.50 | ND | 0.998 | 9/16/2011 | 9/18/2011 | |
| **Chromium** | EPA 6010B | 11I0581 | 2.0 | **18** | 0.998 | 9/16/2011 | 9/18/2011 | |
| Lead | EPA 6010B | 11I0581 | 5.0 | ND | 0.998 | 9/16/2011 | 9/18/2011 | |
| Mercury | EPA 7471A | 11I0619 | 0.10 | ND | 0.925 | 9/19/2011 | 9/19/2011 | |
| Selenium | EPA 6010B | 11I0581 | 5.0 | ND | 0.998 | 9/16/2011 | 9/18/2011 | |
| Silver | EPA 6010B | 11I0581 | 2.5 | ND | 0.998 | 9/16/2011 | 9/18/2011 | |
| **Sample ID: PUI1047-02 (BA-7-3 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0581 | 5.0 | ND | 0.998 | 9/16/2011 | 9/18/2011 | |
| **Barium** | EPA 6010B | 11I0581 | 5.0 | **70** | 0.998 | 9/16/2011 | 9/18/2011 | |
| Cadmium | EPA 6010B | 11I0581 | 0.50 | ND | 0.998 | 9/16/2011 | 9/18/2011 | |
| **Chromium** | EPA 6010B | 11I0581 | 2.0 | **18** | 0.998 | 9/16/2011 | 9/18/2011 | |
| Lead | EPA 6010B | 11I0581 | 5.0 | ND | 0.998 | 9/16/2011 | 9/18/2011 | |
| Mercury | EPA 7471A | 11I0619 | 0.10 | ND | 1.01 | 9/19/2011 | 9/19/2011 | |
| Selenium | EPA 6010B | 11I0581 | 5.0 | ND | 0.998 | 9/16/2011 | 9/18/2011 | |
| Silver | EPA 6010B | 11I0581 | 2.5 | ND | 0.998 | 9/16/2011 | 9/18/2011 | |
| **Sample ID: PUI1047-03 (IKMHSR-OFS-148-004-002 - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| **Arsenic** | EPA 6010B | 11I0581 | 5.0 | **120** | 0.999 | 9/16/2011 | 9/18/2011 | |
| **Lead** | EPA 6010B | 11I0581 | 5.0 | **470** | 0.999 | 9/16/2011 | 9/18/2011 | |

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Ecology and Environment - Lakewood
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Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUK0352

Sampled: 11/03/11
Received: 11/04/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUK0352-01 (IKMHSR-OFS-002-010-002 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11K0189 | 5.0 | **21** | 0.998 | 11/4/2011 | 11/5/2011 | |
| **Lead** | EPA 6010B | 11K0189 | 5.0 | **6.1** | 0.998 | 11/4/2011 | 11/5/2011 | |
| **Sample ID: PUK0352-02 (IKMHSR-OFS-002-011-002 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11K0189 | 5.0 | **18** | 0.997 | 11/4/2011 | 11/5/2011 | |
| Lead | EPA 6010B | 11K0189 | 5.0 | ND | 0.997 | 11/4/2011 | 11/5/2011 | |
| **Sample ID: PUK0352-03 (IKMHSR-OFS-002-012-120 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11K0189 | 5.0 | **190** | 0.998 | 11/4/2011 | 11/5/2011 | |
| **Lead** | EPA 6010B | 11K0189 | 5.0 | **31** | 0.998 | 11/4/2011 | 11/5/2011 | |
| **Sample ID: PUK0352-04 (IKMHSR-OFS-002-013-002 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 11K0189 | 5.0 | **43** | 0.999 | 11/4/2011 | 11/5/2011 | |
| **Lead** | EPA 6010B | 11K0189 | 5.0 | **25** | 0.999 | 11/4/2011 | 11/5/2011 | |

1/25/12

**TestAmerica Phoenix**

Erik 'aasen
Project Manager

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUI1808

Sampled: 09/28/11-09/29/11
Received: 09/29/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI1808-01 (Arrowhead-Common-001 - Soil)** | | | | **Sampled: 09/29/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1111086 | 5.0 | **14** | 0.996 | 9/29/2011 | 9/30/2011 | |
| Lead | EPA 6010B | 1111086 | 5.0 | **8.8** | 0.996 | 9/29/2011 | 9/30/2011 | |
| **Sample ID: PUI1808-02 (Arrowhead-Common-002 - Soil)** | | | | **Sampled: 09/29/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1111086 | 5.0 | **13** | 0.996 | 9/29/2011 | 9/30/2011 | |
| Lead | EPA 6010B | 1111086 | 5.0 | **8.8** | 0.996 | 9/29/2011 | 9/30/2011 | |
| **Sample ID: PUI1808-03 (MDI-GD-Common-001 - Soil)** | | | | **Sampled: 09/28/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1111086 | 5.0 | **8.9** | 0.995 | 9/29/2011 | 9/30/2011 | |
| Lead | EPA 6010B | 1111086 | 5.0 | ND | 0.995 | 9/29/2011 | 9/30/2011 | |
| **Sample ID: PUI1808-04 (MDI-GD-Common-002 - Soil)** | | | | **Sampled: 09/28/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1111086 | 5.0 | **8.3** | 0.998 | 9/29/2011 | 9/30/2011 | |
| Lead | EPA 6010B | 1111086 | 5.0 | **5.7** | 0.998 | 9/29/2011 | 9/30/2011 | |
| **Sample ID: PUI1808-05 (NCLS-Topsoil-001 - Soil)** | | | | **Sampled: 09/29/11** | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 1111086 | 5.0 | ND | 0.998 | 9/29/2011 | 9/30/2011 | |
| Lead | EPA 6010B | 1111086 | 5.0 | ND | 0.998 | 9/29/2011 | 9/30/2011 | |

1/20/12

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUI1474

Sampled: 09/23/11
Received: 09/23/11

# TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI1474-01 (MDi-GLENDALE-TOPSOILA - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0855 | 5.0 | 9.0 | 0.995 | 9/23/2011 | 9/26/2011 | |
| Barium | EPA 6010B | 11I0855 | 5.0 | 100 J | 0.995 | 9/23/2011 | 9/26/2011 | M2 |
| Cadmium | EPA 6010B | 11I0855 | 0.50 | ND | 0.995 | 9/23/2011 | 9/26/2011 | |
| Chromium | EPA 6010B | 11I0855 | 2.0 | 23 | 0.995 | 9/23/2011 | 9/26/2011 | |
| Lead | EPA 6010B | 11I0855 | 5.0 | 5.8 | 0.995 | 9/23/2011 | 9/26/2011 | |
| Mercury | EPA 7471A | 11I0900 | 0.10 | ND | 0.933 | 9/26/2011 | 9/26/2011 | |
| Selenium | EPA 6010B | 11I0855 | 5.0 | ND | 0.995 | 9/23/2011 | 9/26/2011 | |
| Silver | EPA 6010B | 11I0855 | 2.5 | ND | 0.995 | 9/23/2011 | 9/26/2011 | |
| **Sample ID: PUI1474-02 (MDi-GLENDALE-TOPSOILB - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0855 | 5.0 | 11 | 0.998 | 9/23/2011 | 9/26/2011 | |
| Barium | EPA 6010B | 11I0855 | 5.0 | 110 J | 0.998 | 9/23/2011 | 9/26/2011 | |
| Cadmium | EPA 6010B | 11I0855 | 0.50 | ND | 0.998 | 9/23/2011 | 9/26/2011 | |
| Chromium | EPA 6010B | 11I0855 | 2.0 | 25 | 0.998 | 9/23/2011 | 9/26/2011 | |
| Lead | EPA 6010B | 11I0855 | 5.0 | 6.4 | 0.998 | 9/23/2011 | 9/26/2011 | |
| Mercury | EPA 7471A | 11I0900 | 0.10 | ND | 0.915 | 9/26/2011 | 9/26/2011 | |
| Selenium | EPA 6010B | 11I0855 | 5.0 | ND | 0.998 | 9/23/2011 | 9/26/2011 | |
| Silver | EPA 6010B | 11I0855 | 2.5 | ND | 0.998 | 9/23/2011 | 9/26/2011 | |
| **Sample ID: PUI1474-03 (MDi-RG-COMMON - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0855 | 5.0 | 10 | 0.999 | 9/23/2011 | 9/26/2011 | |
| Barium | EPA 6010B | 11I0855 | 5.0 | 120 J | 0.999 | 9/23/2011 | 9/26/2011 | |
| Cadmium | EPA 6010B | 11I0855 | 0.50 | ND | 0.999 | 9/23/2011 | 9/26/2011 | |
| Chromium | EPA 6010B | 11I0855 | 2.0 | 25 | 0.999 | 9/23/2011 | 9/26/2011 | |
| Lead | EPA 6010B | 11I0855 | 5.0 | 9.1 | 0.999 | 9/23/2011 | 9/26/2011 | |
| Mercury | EPA 7471A | 11I0900 | 0.10 | ND | 0.978 | 9/26/2011 | 9/26/2011 | |
| Selenium | EPA 6010B | 11I0855 | 5.0 | ND | 0.999 | 9/23/2011 | 9/26/2011 | |
| Silver | EPA 6010B | 11I0855 | 2.5 | ND | 0.999 | 9/23/2011 | 9/26/2011 | |

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Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUI1474

Sampled: 09/23/11
Received: 09/23/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUI1474-04 (MDI-MG-TOPSOIL - Soil)** | | | | | | | | |
| Reporting Units: mg/kg | | | | | | | | |
| Arsenic | EPA 6010B | 11I0855 | 5.0 | ND | 0.996 | 9/23/2011 | 9/26/2011 | |
| **Barium** | EPA 6010B | 11I0855 | 5.0 | **87** J | 0.996 | 9/23/2011 | 9/26/2011 | |
| Cadmium | EPA 6010B | 11I0855 | 0.50 | ND | 0.996 | 9/23/2011 | 9/26/2011 | |
| **Chromium** | EPA 6010B | 11I0855 | 2.0 | **12** | 0.996 | 9/23/2011 | 9/26/2011 | |
| **Lead** | EPA 6010B | 11I0855 | 5.0 | **8.4** | 0.996 | 9/23/2011 | 9/26/2011 | |
| Mercury | EPA 7471A | 11I0900 | 0.10 | ND | 1.02 | 9/26/2011 | 9/26/2011 | |
| Selenium | EPA 6010B | 11I0855 | 5.0 | ND | 0.996 | 9/23/2011 | 9/26/2011 | |
| Silver | EPA 6010B | 11I0855 | 2.5 | ND | 0.996 | 9/23/2011 | 9/26/2011 | |

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUK0099

Sampled: 11/01/11
Received: 11/02/11

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PUK0099-01RE1 (IKMHSR-OFS-002-006-002 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| Arsenic | EPA 6010B | 11K0255 | 5.0 | **42** | 0.998 | 11/7/2011 | 11/9/2011 | |
| Lead | EPA 6010B | 11K0255 | 5.0 | **42** | 0.998 | 11/7/2011 | 11/9/2011 | |
| **Sample ID: PUK0099-02RE1 (IKMHSR-OFS-002-007-002 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| Arsenic | EPA 6010B | 11K0255 | 5.0 | **110** | 0.996 | 11/7/2011 | 11/9/2011 | |
| Lead | EPA 6010B | 11K0255 | 5.0 | **71** | 0.996 | 11/7/2011 | 11/9/2011 | |
| **Sample ID: PUK0099-03RE1 (IKMHSR-OFS-002-008-060 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| Arsenic | EPA 6010B | 11K0255 | 5.0 | **86** | 0.998 | 11/7/2011 | 11/9/2011 | |
| Lead | EPA 6010B | 11K0255 | 5.0 | **85** | 0.998 | 11/7/2011 | 11/9/2011 | |
| **Sample ID: PUK0099-04REI (IKMHSR-OFS-002-009-060 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| Arsenic | EPA 6010B | 11K0255 | 5.0 | **1300** | 0.997 | 11/7/2011 | 11/9/2011 | |
| Lead | EPA 6010B | 11K0255 | 5.0 | **2000** | 0.997 | 11/7/2011 | 11/9/2011 | |

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| | | | |
|---|---|---|---|
| Ecology and Environment - Lakewood | Work Order: PUI1583 | Received: | 09/27/11 |
| 3700 Industry Ave, Suite 102 | | Reported: | 09/28/11 17:01 |
| Lakewood, CA 90712 | Project: Iron King Mine - Humboldt Smelter Removal | | |
| Mindy Song | Project Number: T02-09-11-08-0005 | | |

# ANALYTICAL REPORT

| Analyte | Result | | | Qual | Date Analyzed | Analyst | Rpt Limit ug, Total | Method |
|---|---|---|---|---|---|---|---|---|
| **Metals using ICP-AES by NIOSH 7300 (Modified)** | | | | | | | | |
| **Sample ID: PUI1583-01 (IKMHSR-9/22/11-Air-1)** | | **Filter** | | **Sample Air Volume: 1056L** | | | **Sampled: 09/22/11** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 09/27/11 18:32** | |
| Arsenic | <2.50 | <0.00237 | <0.000773 | | 9/28/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | <0.000295 | <0.0000349 | | 9/28/2011 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PUI1583-02 (IKMHSR-9/22/11-Air-2)** | | **Filter** | | **Sample Air Volume: 1045L** | | | **Sampled: 09/22/11** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 09/27/11 18:32** | |
| Arsenic | <2.50 | <0.00239 | <0.000781 | | 9/28/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | <0.000299 | <0.0000352 | | 9/28/2011 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PUI1583-03 (IKMHSR-9/22/11-Air-3)** | | **Filter** | | **Sample Air Volume: 1056L** | | | **Sampled: 09/22/11** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 09/27/11 18:32** | |
| Arsenic | <2.50 | <0.00237 | <0.000773 | | 9/28/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | <0.000295 | <0.0000349 | | 9/28/2011 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PUI1583-04 (IKMHSR-9/22/11-Air-FB)** | | **Filter** | | **Sample Air Volume: L** | | | **Sampled: 09/22/11** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 09/27/11 18:32** | |
| Arsenic | <2.50 | -- | -- | | 9/28/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | -- | -- | | 9/28/2011 | bb | 0.312 | NIOSH 7300 |

1/10/12

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THE LEADER IN ENVIRONMENTAL TESTING

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Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Mike Schwennesen

Work Order: PUJ1805
Project: Iron King Mine - Humboldt Smelter Removal
Project Number: T02-09-11-08-0005

Received: 10/28/11
Reported: 11/04/11 14:49

# ANALYTICAL REPORT

| Analyte | Result | | | Qual | Date Analyzed | Analyst | Rpt Limit ug, Total | Method |
|---|---|---|---|---|---|---|---|---|
| **Metals using ICP-AES by NIOSH 7300 (Modified)** | | | | | | | | |
| **Sample ID: PUJ1805-01 (1 KMHSR-10/10/11-AIR-1)** | | **Filter** | | **Sample Air Volume: 1165L** | | | **Sampled: 10/10/11 08:00** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/02/11 19:20** | |
| Arsenic | <2.50 | <0.00215 | <0.000700 | | 11/3/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | 0.521 | 0.000447 | 0.0000528 | | 11/3/2011 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PUJ1805-02 (1 KMHSR-10/10/11-AIR-2)** | | **Filter** | | **Sample Air Volume: 1109L** | | | **Sampled: 10/10/11 08:00** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/02/11 19:20** | |
| Arsenic | <2.50 | <0.00225 | <0.000736 | | 11/3/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | <0.000281 | <0.0000332 | | 11/3/2011 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PUJ1805-03 (1 KMHSR-10/10/11-AIR-3)** | | **Filter** | | **Sample Air Volume: 1112L** | | | **Sampled: 10/10/11 08:00** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/02/11 19:20** | |
| Arsenic | <2.50 | <0.00225 | <0.000734 | | 11/3/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | <0.000281 | <0.0000331 | | 11/3/2011 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PUJ1805-04 (1 KMHSR-10/10/11-AIR-4)** | | **Filter** | | **Sample Air Volume: 1106L** | | | **Sampled: 10/10/11 08:00** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/02/11 19:20** | |
| Arsenic | <2.50 | <0.00226 | <0.000738 | | 11/3/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | <0.000282 | <0.0000333 | | 11/3/2011 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PUJ1805-05 (1 KMHSR-10/10/11-AIR-FB)** | | **Filter** | | **Sample Air Volume: L** | | | **Sampled: 10/10/11 08:00** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/02/11 19:20** | |
| Arsenic | <2.50 | -- | -- | | 11/3/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | -- | -- | | 11/3/2011 | bb | 0.312 | NIOSH 7300 |

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THE LEADER IN ENVIRONMENTAL TESTING

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| | | | |
|---|---|---|---|
| Ecology and Environment - Lakewood<br>3700 Industry Ave, Suite 102<br>Lakewood, CA 90712<br>Mike Schwennesen | Work Order: PUK0100<br><br>Project: Iron King Mine - Humboldt Smelter Removal<br>Project Number: T02-09-11-08-0005 | Received:<br>Reported: | 11/02/11<br>11/09/11 17:13 |

# ANALYTICAL REPORT

| Analyte | Result | | | Qual | Date Analyzed | Analyst | Rpt Limit ug, Total | Method |
|---|---|---|---|---|---|---|---|---|
| **Metals using ICP-AES by NIOSH 7300 (Modified)** | | | | | | | | |
| **Sample ID: PUK0100-01 (IKMHSR-10/31/11-Air-1)** | **Filter** | | | **Sample Air Volume: 1294L** | | | **Sampled: 11/01/11** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/02/11 19:20** | |
| **Arsenic** | <2.50 | <0.00193 | <0.000630 | | 11/3/2011 | bb | 2.50 | NIOSH 7300 |
| **Lead** | <0.312 | <0.000241 | <0.0000285 | | 11/3/2011 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PUK0100-02 (IKMHSR-10/31/11-Air-2)** | **Filter** | | | **Sample Air Volume: 1234L** | | | **Sampled: 11/01/11** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/02/11 19:20** | |
| **Arsenic** | <2.50 | <0.00203 | <0.000661 | | 11/3/2011 | bb | 2.50 | NIOSH 7300 |
| **Lead** | <0.312 | <0.000253 | <0.0000298 | | 11/3/2011 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PUK0100-03 (IKMHSR-10/31/11-Air-3)** | **Filter** | | | **Sample Air Volume: 1313L** | | | **Sampled: 11/01/11** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/02/11 19:20** | |
| **Arsenic** | <2.50 | <0.00190 | <0.000621 | | 11/3/2011 | bb | 2.50 | NIOSH 7300 |
| **Lead** | <0.312 | <0.000238 | <0.0000280 | | 11/3/2011 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PUK0100-04 (IKMHSR-10/31/11-Air-FB)** | **Filter** | | | **Sample Air Volume: L** | | | **Sampled: 11/01/11** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/02/11 19:20** | |
| **Arsenic** | <2.50 | -- | -- | | 11/8/2011 | MDD | 2.50 | NIOSH 7300 |
| **Lead** | <0.312 | -- | -- | | 11/8/2011 | MDD | 0.312 | NIOSH 7300 |

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| | | | |
|---|---|---|---|
| Ecology and Environment - Lakewood | Work Order: PUK0709 | Received: | 11/09/11 |
| 3700 Industry Ave, Suite 102 | | Reported: | 11/17/11 08:58 |
| Lakewood, CA 90712 | Project: Iron King Mine - Humboldt Smelter Removal | | |
| Mike Schwennesen | Project Number: T02-09-11-08-0005 | | |

# ANALYTICAL REPORT

| Analyte | Result | | | Qual | Date Analyzed | Analyst | Rpt Limit ug, Total | Method |
|---|---|---|---|---|---|---|---|---|
| **Metals using ICP-AES by NIOSH 7300 (Modified)** | | | | | | | | |
| **Sample ID: PUK0709-01 (IKMHSR-11/8/11-AIR-1)** | | **Filter** | | **Sample Air Volume: 1281L** | | | **Sampled: 11/08/11** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/14/11 18:50** | |
| Arsenic | <2.50 | <0.00195 | <0.000637 | | 11/15/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | <0.000244 | <0.0000287 | | 11/16/2011 | MDD | 0.312 | NIOSH 7300 |
| **Sample ID: PUK0709-02 (IKMHSR-11/8/11-AIR-2)** | | **Filter** | | **Sample Air Volume: 1212L** | | | **Sampled: 11/08/11** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/14/11 18:50** | |
| Arsenic | <2.50 | <0.00206 | <0.000673 | | 11/15/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | <0.000257 | <0.0000304 | | 11/16/2011 | MDD | 0.312 | NIOSH 7300 |
| **Sample ID: PUK0709-03 (IKMHSR-11/8/11-AIR-3)** | | **Filter** | | **Sample Air Volume: 1283L** | | | **Sampled: 11/08/11** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/14/11 18:50** | |
| Arsenic | <2.50 | <0.00195 | <0.000636 | | 11/15/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | <0.000243 | <0.0000287 | | 11/16/2011 | MDD | 0.312 | NIOSH 7300 |
| **Sample ID: PUK0709-04 (IKMHSR-11/8/11-AIR-FB)** | | **Filter** | | **Sample Air Volume: L** | | | **Sampled: 11/08/11** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/14/11 18:50** | |
| Arsenic | <2.50 | -- | -- | | 11/15/2011 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | -- | -- | | 11/16/2011 | MDD | 0.312 | NIOSH 7300 |

1/10/12

# D

# START Borrow Material Memorandum

ecology and environment, inc.
International Specialists in the Environment

3700 Industry Avenue, Suite 102
Lakewood, California 90712

October 26, 2011

MEMORANDUM

SUBJECT: Import Material Delivery and Sampling for the Iron King Mine – Humboldt Smelter Time-Critical Removal Action

FROM: Christopher Myers, START
Ecology and Environment, Inc.

TO: Craig Benson, Federal On-Scene Coordinator
US EPA Region 9 Emergency Response Section

During removal activities at the Iron King Mine – Humboldt Smelter site, Ecology and Environment, Inc.'s Superfund Technical Assessment and Response Team (START) was directed by the United States Environmental Protection Agency (U.S. EPA) to collect samples of borrow material from local suppliers in the area of the Iron King Mine – Humboldt Smelter Removal site (the Site). The samples were necessary to determine which material would be suitable to replace contaminated soil removed from residential properties at the Site as part of a time-critical removal action (TCRA).

The contaminants of concern at the Site are arsenic and lead in soil. The site-specific action levels for these contaminants are 38 milligrams per kilogram (mg/kg) for arsenic, and 23 mg/kg for lead. Concentrations of arsenic and lead in borrow material must be at or below these concentrations. The type of soil needed to replace the removed contaminated soil is referred to as "one-inch minus" because it is run through a screen with one-inch mesh.

The START collected samples of the material to initially characterize the material and collected additional samples periodically as it was imported to the Site.

Over the period August 31 through October 13, 2011 the START collected composite samples of the borrow material from each of the sources, and had the samples analyzed by TestAmerica Laboratory in Phoenix, Arizona. The requested analytes and analytical methods were Resource Conservation and Recovery Act (RCRA) metals by U.S. EPA Methods 6010B/7471A. The volumes of material from the suppliers and the results for the arsenic and lead analytes are presented below. Note that the results only represent a "snapshot" of the material available on the date sampled, and that the results are based on a single composite sample. Sampling of backfill material was an ongoing process and was performed as needed to stay ahead of the import events. The following tables provide all relevant information for borrow material delivery and sampling through the close of the project.

| Common Soil | | | | |
|---|---|---|---|---|
| Date | Origin | Load Count | Weight (tons) | Total Import (tons) |
| 09/22/11 | MDI Rock Rose Garden | 1 | 23.79 | 23.79 |
| 09/22/11 | MDI Rock Paradise Valley | 1 | 23.44 | 47.23 |
| 09/22/11 | MDI Rock Rose Garden | 1 | 24.45 | 71.68 |
| 09/22/11 | MDI Rock Rose Garden | 1 | 22.91 | 94.59 |
| 09/22/11 | MDI Rock Rose Garden | 1 | 24.37 | 118.96 |
| 09/22/11 | MDI Rock Paradise Valley | 1 | 22.80 | 141.76 |
| 09/22/11 | MDI Rock Rose Garden | 1 | 23.36 | 165.12 |
| 09/22/11 | MDI Rock Paradise Valley | 1 | 32.32 | 197.44 |
| 09/28/11 | MDI Rock Paradise Valley | 1 | 23.61 | 221.05 |
| 09/28/11 | MDI Rock Paradise Valley | 1 | 23.60 | 244.65 |
| 09/28/11 | MDI Rock Rose Garden | 1 | 21.91 | 266.56 |
| 09/28/11 | MDI Rock Paradise Valley | 1 | 23.88 | 290.44 |
| 09/28/11 | MDI Rock Rose Garden | 1 | 22.83 | 313.27 |
| 09/29/11 | MDI Rock Rose Garden | 1 | 23.16 | 336.43 |
| 09/29/11 | MDI Rock Rose Garden | 1 | 23.07 | 359.50 |
| 09/29/11 | MDI Rock Rose Garden | 1 | 25.64 | 385.14 |
| 09/29/11 | MDI Rock Rose Garden | 1 | 24.03 | 409.17 |
| 09/29/11 | MDI Rock Rose Garden | 1 | 24.90 | 434.07 |
| 09/29/11 | MDI Rock Rose Garden | 1 | 23.93 | 458.00 |
| 10/03/11 | MDI Rock Glendale | 1 | 23.81 | 481.81 |
| 10/03/11 | C&R Trucking | 4 | 90.28 | 572.09 |
| 10/03/11 | C&R Trucking | 5 | 115.21 | 687.30 |
| 10/03/11 | C&R Trucking | 5 | 117.16 | 804.46 |
| 10/03/11 | C&R Trucking | 5 | 97.26 | 901.72 |
| 10/04/11 | MDI Rock Glendale | 1 | 23.92 | 925.64 |
| 10/04/11 | MDI Rock Glendale | 1 | 23.86 | 949.50 |
| 10/04/11 | MDI Rock Glendale | 1 | 24.57 | 974.07 |
| 10/04/11 | MDI Rock Glendale | 1 | 23.88 | 997.95 |
| 10/04/11 | MDI Rock Glendale | 1 | 23.82 | 1021.77 |
| 10/04/11 | MDI Rock Glendale | 1 | 24.50 | 1046.27 |
| 10/04/11 | MDI Rock Glendale | 1 | 23.93 | 1070.20 |
| 10/04/11 | C&R Trucking | 5 | 113.34 | 1183.54 |
| 10/04/11 | C&R Trucking | 5 | 116.28 | 1299.82 |
| 10/04/11 | C&R Trucking | 5 | 90.52 | 1390.34 |
| 10/04/11 | C&R Trucking | 3 | 69.64 | 1459.98 |
| 10/05/11 | C&R Trucking | 5 | 118.82 | 1578.80 |
| 10/05/11 | C&R Trucking | 5 | 92.77 | 1671.57 |
| 10/05/11 | C&R Trucking | 4 | 96.85 | 1768.42 |
| 10/05/11 | C&R Trucking | 5 | 113.85 | 1882.27 |
| 10/05/11 | MDI Rock Glendale | 1 | 24.29 | 1906.56 |
| 10/05/11 | MDI Rock Glendale | 1 | 23.84 | 1930.40 |
| 10/05/11 | MDI Rock Glendale | 1 | 24.29 | 1954.69 |
| 10/05/11 | MDI Rock Glendale | 1 | 22.60 | 1977.29 |
| 10/05/11 | MDI Rock Glendale | 1 | 24.03 | 2001.32 |

| Common Soil | | | | |
|---|---|---|---|---|
| **Date** | **Origin** | **Load Count** | **Weight (tons)** | **Total Import (tons)** |
| 10/05/11 | MDI Rock Glendale | 1 | 23.91 | 2025.23 |
| 10/05/11 | MDI Rock Glendale | 1 | 24.02 | 2049.25 |
| 10/05/11 | MDI Rock Glendale | 1 | 23.45 | 2072.70 |
| 10/05/11 | MDI Rock Glendale | 1 | 24.42 | 2097.12 |
| 10/05/11 | MDI Rock Glendale | 1 | 23.69 | 2120.81 |
| 10/05/11 | MDI Rock Glendale | 1 | 23.89 | 2144.70 |
| 10/06/11 | C&R Trucking | 5 | 119.17 | 2263.87 |
| 10/06/11 | C&R Trucking | 5 | 89.50 | 2353.37 |
| 10/06/11 | C&R Trucking | 5 | 114.39 | 2467.76 |
| 10/06/11 | C&R Trucking | 5 | 122.14 | 2589.90 |
| 10/06/11 | MDI Rock Glendale | 1 | 24.91 | 2614.81 |
| 10/06/11 | MDI Rock Glendale | 1 | 23.82 | 2638.63 |
| 10/06/11 | MDI Rock Glendale | 1 | 23.84 | 2662.47 |
| 10/06/11 | MDI Rock Glendale | 1 | 23.68 | 2686.15 |
| 10/06/11 | MDI Rock Glendale | 1 | 23.91 | 2710.06 |
| 10/06/11 | MDI Rock Glendale | 1 | 24.04 | 2734.10 |
| 10/06/11 | MDI Rock Glendale | 1 | 24.48 | 2758.58 |
| 10/06/11 | MDI Rock Glendale | 1 | 23.78 | 2782.36 |
| 10/06/11 | MDI Rock Glendale | 1 | 24.11 | 2806.47 |
| 10/06/11 | MDI Rock Glendale | 1 | 24.06 | 2830.53 |
| 10/06/11 | MDI Rock Glendale | 1 | 23.89 | 2854.42 |
| 10/06/11 | MDI Rock Glendale | 1 | 24.51 | 2878.93 |
| 10/06/11 | MDI Rock Glendale | 1 | 24.12 | 2903.05 |
| 10/06/11 | MDI Rock Glendale | 1 | 23.67 | 2926.72 |
| 10/06/11 | MDI Rock Glendale | 1 | 24.16 | 2950.88 |
| 10/10/11 | C&R Trucking | 5 | 117.58 | 3068.46 |
| 10/10/11 | C&R Trucking | 5 | 114.81 | 3183.27 |
| 10/10/11 | C&R Trucking | 5 | 122.27 | 3305.54 |
| 10/10/11 | C&R Trucking | 5 | 91.16 | 3396.70 |
| 10/10/11 | C&R Trucking | 1 | 12.48 | 3409.18 |
| 10/10/11 | MDI Rock Glendale | 1 | 24.23 | 3433.41 |
| 10/10/11 | MDI Rock Glendale | 1 | 24.00 | 3457.41 |
| 10/10/11 | MDI Rock Glendale | 1 | 24.21 | 3481.62 |
| 10/10/11 | MDI Rock Glendale | 1 | 22.75 | 3504.37 |
| 10/10/11 | MDI Rock Glendale | 1 | 23.12 | 3527.49 |
| 10/10/11 | MDI Rock Glendale | 1 | 25.10 | 3552.59 |
| 10/10/11 | MDI Rock Glendale | 1 | 24.41 | 3577.00 |
| 10/10/11 | MDI Rock Glendale | 1 | 24.12 | 3601.12 |
| 10/10/11 | MDI Rock Glendale | 1 | 24.14 | 3625.26 |
| 10/10/11 | MDI Rock Glendale | 1 | 22.95 | 3648.21 |
| 10/11/11 | MDI Rock Glendale | 1 | 24.06 | 3672.27 |
| 10/11/11 | MDI Rock Glendale | 1 | 24.00 | 3696.27 |
| 10/11/11 | MDI Rock Glendale | 1 | 23.72 | 3719.99 |
| 10/11/11 | MDI Rock Glendale | 1 | 24.26 | 3744.25 |
| 10/11/11 | MDI Rock Glendale | 1 | 23.99 | 3768.24 |
| 10/11/11 | MDI Rock Glendale | 1 | 25.00 | 3793.24 |

| Common Soil | | | | |
|---|---|---|---|---|
| Date | Origin | Load Count | Weight (tons) | Total Import (tons) |
| 10/11/11 | MDI Rock Glendale | 1 | 24.32 | 3817.56 |
| 10/11/11 | MDI Rock Glendale | 1 | 23.52 | 3841.08 |
| 10/11/11 | MDI Rock Glendale | 1 | 23.96 | 3865.04 |
| 10/11/11 | C&R Trucking | 5 | 117.27 | 3982.31 |
| 10/11/11 | C&R Trucking | 5 | 92.84 | 4075.15 |
| 10/11/11 | C&R Trucking | 4 | 95.60 | 4170.75 |
| 10/11/11 | C&R Trucking | 3 | 42.23 | 4212.98 |
| 10/11/11 | C&R Trucking | 1 | 12.36 | 4225.34 |
| 10/11/11 | C&R Trucking | 5 | 122.59 | 4347.93 |
| 10/12/11 | MDI Rock Glendale | 1 | 22.69 | 4370.62 |
| 10/12/11 | MDI Rock Glendale | 1 | 24.03 | 4394.65 |
| 10/12/11 | MDI Rock Glendale | 1 | 26.60 | 4421.25 |
| 10/12/11 | MDI Rock Glendale | 1 | 23.98 | 4445.23 |
| 10/12/11 | MDI Rock Glendale | 1 | 24.24 | 4469.47 |
| 10/12/11 | MDI Rock Glendale | 1 | 23.94 | 4493.41 |
| 10/12/11 | MDI Rock Glendale | 1 | 24.62 | 4518.03 |
| 10/12/11 | MDI Rock Glendale | 1 | 23.95 | 4541.98 |
| 10/12/11 | MDI Rock Glendale | 1 | 23.62 | 4565.60 |
| 10/12/11 | MDI Rock Glendale | 1 | 26.13 | 4591.73 |
| 10/12/11 | MDI Rock Glendale | 1 | 23.71 | 4615.44 |
| 10/12/11 | MDI Rock Glendale | 1 | 24.07 | 4639.51 |
| 10/12/11 | MDI Rock Glendale | 1 | 23.79 | 4663.30 |
| 10/12/11 | MDI Rock Glendale | 1 | 23.67 | 4686.97 |
| 10/12/11 | C&R Trucking | 5 | 121.67 | 4808.64 |
| 10/12/11 | C&R Trucking | 5 | 118.21 | 4926.85 |
| 10/12/11 | C&R Trucking | 5 | 116.80 | 5043.65 |
| 10/12/11 | C&R Trucking | 3 | 38.33 | 5081.98 |
| 10/12/11 | C&R Trucking | 5 | 91.88 | 5173.86 |
| 10/13/11 | MDI Rock Glendale | 1 | 24.04 | 5197.90 |
| 10/13/11 | MDI Rock Glendale | 1 | 24.04 | 5221.94 |
| 10/13/11 | MDI Rock Glendale | 1 | 23.87 | 5245.81 |
| 10/13/11 | MDI Rock Glendale | 1 | 23.71 | 5269.52 |
| 10/13/11 | MDI Rock Glendale | 1 | 23.60 | 5293.12 |
| 10/13/11 | MDI Rock Glendale | 1 | 25.46 | 5318.58 |
| 10/13/11 | MDI Rock Glendale | 1 | 23.72 | 5342.30 |
| 10/13/11 | MDI Rock Glendale | 1 | 23.67 | 5365.97 |
| 10/13/11 | MDI Rock Glendale | 1 | 24.04 | 5390.01 |
| 10/13/11 | C&R Trucking | 5 | 120.61 | 5510.62 |
| 10/13/11 | C&R Trucking | 5 | 92.53 | 5603.15 |
| 10/13/11 | C&R Trucking | 5 | 116.00 | 5719.15 |
| 10/13/11 | C&R Trucking | 3 | 37.74 | 5756.89 |
| 10/14/11 | MDI Rock Glendale | 1 | 23.88 | 5780.77 |
| 10/14/11 | MDI Rock Glendale | 1 | 23.78 | 5804.55 |
| 10/14/11 | MDI Rock Glendale | 1 | 23.52 | 5828.07 |
| 10/14/11 | MDI Rock Glendale | 1 | 24.03 | 5852.10 |
| 10/14/11 | MDI Rock Glendale | 1 | 24.28 | 5876.38 |

| Common Soil | | | | |
|---|---|---|---|---|
| **Date** | **Origin** | **Load Count** | **Weight (tons)** | **Total Import (tons)** |
| 10/14/11 | MDI Rock Glendale | 1 | 23.86 | 5900.24 |
| 10/14/11 | MDI Rock Glendale | 1 | 24.02 | 5924.26 |
| 10/14/11 | MDI Rock Glendale | 1 | 24.31 | 5948.57 |
| 10/14/11 | C&R Trucking | 5 | 114.37 | 6062.94 |
| 10/14/11 | C&R Trucking | 5 | 123.15 | 6186.09 |
| 10/14/11 | C&R Trucking | 3 | 41.03 | 6227.12 |
| 10/14/11 | C&R Trucking | 4 | 71.87 | 6298.99 |
| 10/14/11 | C&R Trucking | 5 | 116.82 | 6415.81 |
| 10/24/11 | MDI Rock Glendale | 1 | 23.44 | 6439.25 |
| 10/24/11 | MDI Rock Glendale | 1 | 24.07 | 6463.32 |
| 10/24/11 | MDI Rock Glendale | 1 | 23.70 | 6487.02 |
| 10/24/11 | MDI Rock Glendale | 1 | 24.07 | 6511.09 |
| 10/24/11 | MDI Rock Glendale | 1 | 12.45 | 6523.54 |
| 10/24/11 | MDI Rock Glendale | 1 | 22.82 | 6546.36 |
| 10/24/11 | C&R Trucking | 5 | 115.85 | 6662.21 |
| 10/24/11 | C&R Trucking | 5 | 119.35 | 6781.56 |
| 10/24/11 | C&R Trucking | 5 | 121.95 | 6903.51 |
| 10/24/11 | C&R Trucking | 5 | 93.54 | 6997.05 |
| 10/24/11 | C&R Trucking | 3 | 42.82 | 7039.87 |
| 10/25/11 | C&R Trucking | 2 | 35.92 | 7075.79 |
| 10/25/11 | C&R Trucking | 2 | 48.22 | 7124.01 |
| 10/25/11 | C&R Trucking | 2 | 45.62 | 7169.63 |

| Topsoil | | | |
|---|---|---|---|
| **Date Delivered** | **Origin** | **Weight (tons)** | **Total Import (tons)** |
| 9/22/2011 | MDI Rock | 23.79 | 23.79 |
| 9/22/2011 | MDI Rock | 24.23 | 48.02 |
| 9/23/2011 | MDI Rock | 23.39 | 71.41 |

**Sampling**

| Supplier | Fill Type | Material Origin | Sample ID | Date Sampled | Date Results Reported | Result (As) | Result (Pb) |
|---|---|---|---|---|---|---|---|
| MDI Phoenix | Topsoil | Glendale | MDI-Glendale-Topsoil(A+B) | 9/23/2011 | 9/27/2011 | 11 & 9 | 5.8 & 6.4 |
| | Topsoil | Paradise Valley | MDI-MG-Topsoil | | | <5.0 | 8.4 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MDI Glendale | Common | Glendale | MDI-GD-Common-001 | 9/28/2011 | 9/30/2011 | 8.9 | <5.0 |
| | Common | Glendale | MDI-GD-Common-002 | | | 8.3 | 5.7 |
| MDI Phoenix | Common | Rose Garden | MDI-RG-Common | 9/23/2011 | 9/27/2011 | 10 | 9.1 |
| Arrowhead | Common | Arrowhead | Arrowhead-Common-001 | 9/29/2011 | 9/30/2011 | 14 | 8.8 |
| | Common | Arrowhead | Arrowhead-Common-002 | | | 13 | 8.8 |
| | Common | Arrowhead | Arrowhead-Common-003 | 10/4/2011 | 10/5/2011 | 15 | 9.9 |
| | Common | Arrowhead | Arrowhead-Common-004 | | | 15 | 11 |
| | Common | Arrowhead | Arrowhead-Common-005 | | | 16 | 12 |
| | Common | Arrowhead | Arrowhead-Common-006 | | | 14 | 12 |
| | Common | Arrowhead | Arrowhead-Common-007 | 10/13/11 | 10/20/11 | 12 | 7.8 |
| | Common | Arrowhead | Arrowhead-Common-008 | | | 12 | 8.0 |
| | Common | Arrowhead | Arrowhead-Common-009 | | | 15 | 9.6 |
| | Common | Arrowhead | Arrowhead-Common-010 | | | 14 | 8.9 |

The addresses for the facilities providing the borrow material are:

Material Delivery, Inc. (MDI)
10233 W. Northern Avenue
Glendale, AZ  85355

MDI
2815 East Rose Garden Lane
Phoenix, AZ  85050

MDI
8524 North Morning Glory Road
Paradise Valley, AZ  85253

C&R Arrowhead
1405 Road 6 North
Chino Valley, AZ  86323

# E Photo Documentation

**ECOLOGY AND ENVIRONMENT, INC.**
**Superfund Technical Assessment and Response Team**
Iron King Mine – Humboldt Smelter Removal
Dewey-Humboldt, Yavapai County, Arizona

E&E Project. No.: 002693.2155.01RF

TDD No: TO2-09-11-08-0005
Contract No. EP-S5-08-01

**PHOTO 1**
**Date**: 10/6/11
**Direction**: Northeast
**Photographer**: M. Schwennesen, START
**Description**: Backfill soil being placed over snow fence at two-foot depth on the southeast side of OFS-133/northwest side of OFS-119.

**PHOTO 2**
**Date**: 11/4/11
**Direction**: Northeast
**Photographer**:
M. Schwennesen, START
**Description**: OFS-133 after site restoration that included a new fence.

**PHOTO 3**
**Date**: 10/3/11
**Direction**: Southeast
**Photographer**:
M. Schwennesen, START
**Description**: Pre-removal back yard of OFS-118.

**PHOTO 4**
**Date**: 10/7/11
**Direction**: Northwest
**Photographer**:
M. Schwennesen, START
**Description**: Placement of clean soil over snow fence in progress in back yard of OFS-118.

**PHOTO 5**
**Date**: 10/14/11
**Direction**: Southeast
**Photographer**:
M. Schwennesen, START
**Description**: Back yard of OFS-118 after completion of site restoration.

**PHOTO 6**
**Date**: 9/24/11
**Direction**: Southeast
**Photographer**: M. Schwennesen, START
**Description**: Foreground excavator removes contaminated soil from the backyard of OFS-111 while a second excavator removes contaminated soil at OFS-260. Humboldt Smelter is visible in the background.

**PHOTO 7**
**Date**: 10/27/11
**Direction**: North
**Photographer**:
M. Schwennesen, START
**Description**: The Small Tailings Pile in background (to the left of the bulldozer), with START's southern air station in the foreground.

**PHOTO 8**
**Date**: 10/29/11
**Direction**: West
**Photographer**:
M. Schwennesen, START
**Description**: Excavator removing gray sludge material from the north end of the Small Tailings Pile.

**PHOTO 9**
**Date**: 11/9/11
**Direction**: Northeast
**Photographer**:
M. Schwennesen, START
**Description**: Most of the Small Tailings Pile has been removed. The excavator is working in the northwest portion of the pile, near the spill point leading from Iron King Mine property.

**PHOTO 10**
**Date**: 11/14/11
**Direction**: North
**Photographer**:
M. Schwennesen, START
**Description**: The Small Tailings Pile has been removed and the area has been re-contoured. Construction of a 400-foot diversion channel made with filter fabric and riprap is in progress.

F

# ERT Site Restoration and Design Implementation Report

LOCKHEED MARTIN

Lockheed Martin Information Systems & Global Solutions - Civil
Environmental Services SERAS
2890 Woodbridge Avenue, Building 209 Annex
Edison, NJ 08837-3679
Telephone 732-321-4200, Facsimile 732-494-4021

DATE: March 27, 2012

TO: Terrence Johnson, Ph.D., U.S. EPA/ERT Work Assignment Manager

THROUGH: Dennis Miller, SERAS Program Manager
Rick Leuser, SERAS Deputy Program Manager

FROM: David Aloysius, PG/CPG, SERAS Task Leader

SUBJECT: **SITE RESTORATION DESIGN AND IMPLEMENTATION**
**IRON KING MINE SITE HYDROLOGIC RESTORATION**
**DEWEY-HUMBOLDT, ARIZONA**
**WORK ASSIGNMENT - SERAS 0-146: TECHNICAL MEMORANDUM**

## INTRODUCTION

This technical memorandum presents the results of design-related calculations, proposed remedies, and on-site observations concerning area-specific hydrologic restoration at the Iron King Mine Site. The work was performed by the Lockheed Martin Task Leader (TL) from the Scientific, Engineering, Response and Analytical Services (SERAS) contract in consultation with the Environmental Protection Agency (EPA) Environmental Response Team (ERT) Work Assignment Manager (WAM) and the EPA Region 9 On-Scene Coordinator (OSC). The SERAS TL was present on site from November 10 through November 15, 2011 to observe all on-site construction activities critical to the hydrologic restoration effort. Site restoration was completed by an EPA Region 9 contractor.

## SITE BACKGROUND

The Iron King Mine Site is located in the Town of Dewey-Humboldt, Arizona (AZ). The site, which occupies approximately 153 acres, was periodically operated from 1906 to 1969 for extraction of gold, silver, copper, lead and zinc. The Iron King Mine is bordered by Chaparral Gulch to the north (Figure 1), Galena Gulch to the south, State Highway 69 to the east, and undeveloped land to the west.

There are two tailings piles at the site: the Large Tailings Pile (LTP) and the Small Tailings Pile (STP). The LTP, located just west of Highway 69, covers over 55 acres, is over 100 feet in height and contains over six million cubic yards of mine tailings. The STP is located approximately 600 feet north of the LTP and was found to contain approximately 21,500 cubic yards of tailings (based on field delineation and excavation in November 2011). Chaparral Gulch borders the STP along the northern and eastern sides and is impacted by both runoff and sediment transport from the pile. This pile was an accumulation of tailings materials that resulted from surface water-related sediment transport over many decades, which began as early as 1940.

The EPA Region 9 Removal Program proposed to excavate and move materials from the STP, and subsequently consolidate the materials immediately adjacent to the LTP, within a temporary storage pile (TSP). Based on the physical characteristics of the site and the general nature of the proposed work, EPA Region 9 requested assistance from the ERT to provide technical support for area restoration of the STP and adjoining areas. This effort included a combination of hydrologic, open channel, and slope stabilization designs for minimizing runoff, erosion, and sediment transport. In addition, interim measures were also required for stabilizing the tailings within the TSP and minimizing surface erosion.

Site Geology

The Iron King mine is approximately located in the geographical center of the Humboldt region. The underlying bedrock is Precambrian in age (Creasey, 1952). Late Cenozoic unconsolidated river wash and valley fill, with some interbedded basalt, locally mantle the Precambrian rocks, especially in the north-central part of the region. The Precambrian rocks consist of two metamorphosed volcanic formations and intrusive rocks that range in composition from quartz porphyry to gabbro. The volcanic formations originally were flows, volcanic breccias, and tuffaceous sedimentary rocks. Dynamo-thermal metamorphism of these rocks formed textures, structures, and mineral assemblages characteristic of low-grade metamorphic rocks; however, sufficient relict textures and structures remain to permit delineation of formations. The Precambrian rocks strike north to northwest and steeply dip in a predominant westward direction.

## METHODS

Site Assessment and Proposed Plans

An initial visit to the Iron King Mine Site occurred on July 18, 2011. Parties in attendance included the EPA/ERT WAM and the Lockheed Martin SERAS TL. The purpose of this visit was to visually evaluate and assess the specific areas under investigation. The SERAS TL returned to the site for a one day visit on November 1, 2011 to meet with the EPA Region 9 OSC and the Region 9 contractor to discuss specific details regarding the hydrologic restoration effort.

Proposed final plans for area-specific restoration included the following:

- Subsequent to moving the STP and re-grading the area, a new riprap-lined diversion channel would be constructed, extending from the base of a nickpoint (an abrupt elevation change in the existing channel) to a tributary channel that leads into Chaparral Gulch: a total distance of approximately 400 feet (Figure 1). It was believed that the alignment of the new channel would be a more direct course to Chaparral Gulch (compared to the pre-restoration site drainage channels) and therefore, would be capable of diverting storm water runoff more efficiently and effectively across the site.

- Straw-bales had originally lined the face of the nickpoint. The bales would be removed, the exposed area would be covered with non-woven filter fabric, and then coarse riprap, up to 24-inches in size, would strategically be placed throughout the area to ensure future stability.

- Original drainage channels (gullies) that had originally surrounded the STP (Figure 1) would be partially backfilled with riprap (in key areas) to minimize future erosion, gully formation, and mass wasting of adjoining slopes. In areas where remnant gully walls remained very steep to vertical (i.e., after site re-grading), coarse riprap would be used to buttress the toes of the embankments.

- Straw wattles would be placed along key slopes throughout the restored STP area in order to intercept surface water runoff and minimize soil erosion and rilling.

- Prior to construction of the TSP, a geosynthetic-reinforced foundation pad would be placed over the ground surface for base reinforcement and subgrade stabilization.

Hydrologic Calculations

Based on discussions with the EPA/ERT WAM, a 50-year return period storm for the local area was used for the design.

Drainage Area Evaluation: A watershed analysis was initially performed using geographic information system (GIS) software to calculate the total drainage area upstream of the new channel discharge point.

Peak discharge estimates: Computer software was used to determine a peak discharge resulting from a 50-year return period storm (NRCS, 2009). Key data that were gathered and incorporated into the analysis included the following:

- Hydrologic Soil Group: Site-specific information obtained from the Natural Resources Conservation Service (NRCS). The soils at the site are classified as Group B. Group B soils have moderate infiltration rates when thoroughly wetted and consist chiefly of soils that are moderately deep to deep, moderately well drained to well drained, and have moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15 to 0.30 inches per hour).

- Runoff Curve Number (RCN): A numerical representation of the cover type, which directly affects runoff. The RCN for a given soil-cover type is not constant but varies from storm to storm. The index of runoff potential for a given storm is the antecedent runoff condition (ARC). The ARC is an attempt to account for the variation in the RCN at the site from storm to storm. RCNs used for design purposes are typically based on an average ARC. The site-specific RCN was classified as arid rangeland, desert shrub, with poor coverage.

- Watershed Length: Length in feet along the flow path from the hydraulically most distant point within the watershed to the point of interest (i.e., the intersection of the new channel with Chaparral Gulch).

- Watershed Slope: Average slope in percent of the all the contributing land within the watershed boundary (not simply the slope of the main channel or steepest watercourse). This was determined mathematically using GIS software by summing all the individual contour lengths within the watershed, multiplying the total contour length by the contour interval, dividing the product by the watershed area, and then multiplying by 100.

- Time of Concentration: A calculated parameter that relates to the time in hours for runoff to flow from the most hydraulically remote point within the watershed to the point of interest.

- 24-hour Rainfall: The amount of precipitation in a 24-hour period for the corresponding frequency (for this study, a 50-year return period storm). Precipitation data for Dewey, AZ were obtained from the National Oceanic and Atmospheric Administration‟s (NOAA) National Weather Service (NWS) Hydrometeorological Design Studies Center (Point Precipitation Frequency Estimates, NOAA Atlas 14). Station location: Latitude: 34.5050; Longitude: -112.1422.

- Rainfall Type: Refers to a set of synthetic rainfall distributions having "nested" rainfall intensities. The set maximizes the rainfall intensities by including selected short-duration intensities with those needed for longer duration. The Type II storm distribution for this region is typical of the more intense storms that occur over much of the United States.

Hydraulic Calculations

A user-developed spreadsheet program was used to determine critical hydraulic parameters for the new channel, which included channel geometry, maximum flow depth, and resulting shear stresses. The program is based on the Manning‟s equation (McCuen, 1998).

The Manning‟s roughness coefficient (n), a number that describes the relative roughness of a surface, is an important parameter that is included in the analysis. As this number increases so does the surface roughness. Reduced velocities associated with increased roughness will decrease the amount of erosion. Based on site conditions, an estimated value of 0.025 was used in the analysis. Note, for „natural‟ stream channels, values can exceed 0.10.

Riprap Size and Thickness Design

A number of riprap design methods were investigated for the new channel in order to meet the overall goals of the project (Blodgett and McConaughy, 1986; FHWA, 2001). Manual calculations were subsequently compared to methods developed by the Army Corps of Engineers (Maynord *et.al*, 1998).

RESULTS

Derived Hydrologic/Hydraulic Data and Riprap Specifications

The derived data are summarized in Table 1. Hydraulic data for the new channel are based on a trapezoidal design with an average bottom width of 3 feet, side slopes of 3: 1 (horizontal: vertical), an average depth of 3 feet, and an average top width of 21 feet.

The D-size for the riprap relates to the rock diameter (measured as „equivalent spherical diameter‟). For example, D-15 relates to a rock size diameter at which 85 percent of the other rocks are larger. D-100 is the maximum rock size and D-50 is the „median‟ rock size. A minimum riprap thickness of 24-inches was recommended, based on an assumed rock density or specific gravity of 165 pounds per cubic foot (pcf).

The final design details for the new diversion channel are presented in Figure 2.

Field Construction Design Specifications

*Diversion Channel Depth and Grade*: In most areas, the average channel depth would be at least 1-foot greater than the riprap thickness. During construction, the channel gradient or slope would be periodically measured to ensure proper grade control (on average, 1-foot drop over 15.4 feet). This would be accomplished using standard surveying, laser-leveling, or line-leveling field methods.

*Subgrade Preparation*: Prior to filter fabric installation, any additional grade-control fill that could be required in the subgrade would be compacted to a density approximating that of the surrounding undisturbed materials, or any obvious depressions would be overfilled with small riprap. Small brush, trees, stumps, and other objectionable materials would be removed. The subgrade would be cut sufficiently deep so that the finished grade of the riprap along the side slopes would roughly equal the surface elevation of the surrounding areas. The channel would be excavated sufficiently to allow placement of the riprap in a manner such that the finished inside channel dimensions and riprap grade would meet the design specifications.

*Non-Woven Filter Fabric*: Filter fabric sheeting would be placed directly on the prepared foundation surfaces with a 12-inch minimum overlap. The upper and lower ends of the fabric would be buried to a minimum of 4-inches below the ground surface. Precautions would be taken not to damage the fabric by dropping the riprap. If damage occurred, the riprap would be removed and the sheet would be repaired by adding another layer of filter fabric with a minimum overlap of 12-inches around the damaged area.

*Riprap Placement*: Placement of the riprap would follow immediately after placement of the filter fabric. Riprap would be placed so that it formed a dense, well-graded mass of rock with minimal voids. The desired distribution of rocks throughout the mass would be obtained by selective loading at a local quarry and controlled dumping during final placement. The riprap would be placed to its full thickness in one operation. The finished channel slopes and channel bottom would be free of pockets (of both small rocks and clusters of large rocks). The finished grade of the riprap would blend in with the surrounding areas.

*Downstream Stilling Basin (Energy Dissipator)*: The downstream end of the diversion channel (before it intersects a small, existing tributary that leads into Chaparral Gulch), would be excavated to a maximum width of approximately 30 feet over a 25-foot horizontal distance, forming an enlarged basin. The minimum depth of the basin would be approximately 1.7 feet (20-inches). The „bottom width" of the basin would be gradually decreased in both upstream and downstream directions, from approximately 30 feet to 3 feet (to blend into the upstream diversion channel and downstream tributary), over horizontal distances of 15 feet, forming an elongated octagon in plan-view. Additionally, the depth of the diversion channel would be gradually decreased in a downstream direction, from 3 feet to no less than 1.7 feet. The installed thickness of the riprap within the stilling basin, subsequent to filter fabric placement, would be equal to the diameter of the largest rock size or not less than 1-foot. The stilling basin would be necessary in order to dissipate or slow downstream water flow before entering a natural watercourse that leads into Chaparral Gulch Arroyo.

ON-SITE CONSTRUCTION AND RESTORATION

The SERAS TL was present on site from November 10 through November 15, 2011 to observe all on-site construction activities critical to the hydrologic restoration effort. Notes, observations, and measurements recorded during the on-site construction-restoration phase are provided below:

<u>Diversion Channel Construction Materials</u>

- Base filter fabric: PermeaTex 4060 nonwoven geotextile (Northwest Linings & Geotextile Products, Inc.)
- Coarse riprap
  - Source: local quarry
  - Rock type: gabbro
  - Size gradation (approximate): 8- to 24-inches (larger sizes more abundant)
  - Specific gravity: 177 pounds per cubic foot (pcf)

    - Total tonnage used: 360
- Graded riprap
    - Source: same as above
    - Rock type: gabbro
    - Size gradation (approximate): 4- to 20-inches
    - Specific gravity: 177 pcf
    - Total tonnage used: 1,160

Construction Activities

- Removed materials from the Small Tailings Pile (STP). In some areas, the depth of excavation was up to 15 feet. Excavated materials were transported to the temporary storage pile (TSP) area. The STP footprint and surrounding areas were graded and contoured using soil material that was primarily acquired from adjacent on-site areas.

- Constructed a riprap-lined diversion channel, approximately 400 feet in length, which included a natural spillway (nickpoint) at the upstream end and a stilling basin (energy dissipator) at the downstream end (refer to Figure 1). Excavators were used to construct the channel and stilling basin and partially re-surface the nickpoint area.

    - After sections of earthwork were completed, nonwoven filter fabric was neatly laid out within the finished areas (i.e., nickpoint, channel, and stilling basin). The filter fabric provides a stable base for subsequent placement of riprap and also minimizes channeling of water beneath the riprap (which prevents undermining).

    - The upstream nickpoint was approximately 65 feet in width (arch-shaped), having a 3-foot vertical drop and a 5-degree slope along a 30-foot downstream section.

    - The diversion channel was approximately 3 feet deep with 3:1 slopes. The bottom width was approximately 3 feet and the top width, at ground surface, was approximately 21 feet (refer to Figure 2). Field measurements were periodically acquired using a Brunton™ pocket transit and laser level to ensure adherence to the design specifications.

    - The stilling basin was approximately 55 feet in length with 4: 1 slopes. In the center of the basin, the bottom width was approximately 30 feet, over a 25-foot distance, which tapered down to 3 feet in both upstream and downstream directions (forming an elongated octagonal shape in plane-view). The depth of the basin varied due to surface topography; however, the minimum depth was no less than 1.7 feet (20-inches).

    - The coarsest riprap was placed within the nickpoint area and along the upstream section of the channel to maximize the reduction of flow energy during peak runoff events. Within the nickpoint area, the riprap thickness was approximately 3 feet (placed to the top crest of the nickpoint). The average thickness of riprap along the channel bottom and side slopes was approximately 2 feet. Within the stilling basin, the average riprap thickness decreased to approximately 16-inches.

- Placed riprap (approximately 16-inches in thickness) along a newly-constructed graded outfall that intersects the southern gully (refer to Figure 1). The length and width of riprap treatment was approximately 26 feet by 25 feet, respectively. Riprap (up to 3 feet in thickness) was additionally placed along a 73-foot section of the southern gully, upstream of the outfall.

- Placed riprap along the toe of a vertical soil embankment (a remnant of the former gully), over a horizontal distance of approximately 70 feet, to provide slope stabilization. The height of the riprap ranged from 3.5 to 4 feet and the bottom width averaged around 8 feet. In cross-sectional view, the riprap formed a triangular buttress along the embankment toe, being widest at ground surface. The vertical height of the embankment ranged from approximately 7 to 12 feet.

- Installed five small riprap check dams along remaining gully sections to slow the movement of stromwater runoff during peak runoff events.

- Installed 675 feet of 8-inch diameter straw wattles along final graded slopes in key areas to minimize soil erosion.

NOTE: The original riprap design was based on an assumed rock density of 165 pcf. Considering that the actual rock density was approximately 177 pcf, it is expected that the final design should exceed the 50-year design storm event.

<u>TSP Design Summary</u>

- Geosynthetic base pad: PermeaTex HS0404 high-strength woven geotextile
- Base pad dimensions (approximate): 220 feet x 165 feet
- Base dimensions of tailings (approximate): 265 feet x 195 feet (tailings overlap base pad)
- Vertical height (approximate): 5.5 feet to less than or equal to 8 feet (height varied)
- Side slopes (approximate): 3:1
- Surface stabilizer: sprayed with an eco-safe, biodegradable, liquid co-polymer (Gorilla-Snot®) to stabilize the tailings and minimize future erosion.

<u>TSP Materials Summary</u>

- Tailings: placed in the TSP over geosynthetic pad: 19,058 cubic yards (cy)
- Tailings (with high moisture content): segregated and placed next to the TSP: 1,066 cy
- Tailings/sludge material: segregated and placed next to the TSP: 1,378 cy
- TOTAL volume of materials removed from the STP: 21,502 cy

<u>Photo-Documentation</u>

A number of photos obtained during the on-site construction activities are presented in Appendix A.

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Blodgett, J.C. and C.E. McConaughy, 1986. Rock Riprap Design for Protection of Stream Channels near Highway Structures, Volume 2: Evaluation of Riprap Design Procedures. U.S. Geological Survey Water Resources Investigation Report 86-4128. Prepared in cooperation with the Federal Highway Administration.

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Natural Resources Conservation Service (NRCS), 2009. EFH2 Computer Program: Estimating Runoff and Peak Discharge. U.S. Department of Agriculture. August 2009.

National Oceanic and Atmospheric Administration (NOAA). Point Precipitation Frequency Estimates, NOAA Atlas 14. National Weather Service (NWS), Hydrometeorological Design Studies Center.

Maynord, S.T., M.T. Hebler, and S.F. Knight, 1998. User"s Manual for CHANLPRO, PC Program for Channel Protection Design. U.S. Army Corps of Engineers, Waterways Experiment Station, Coastal & Hydraulics Laboratory, Vicksburg, Mississippi. Technical Report CHL-98-20. July 1998.

TABLE

TABLE 1
Hydrologic, Hydraulic and Riprap Size Data
Iron King Mine Site Hydrologic Restoration
Dewey-Humboldt, Arizona

<u>Watershed-Hydrologic Data</u>

| | |
|---|---|
| Drainage Area | 48.1 acres |
| Hydrologic Soil Group | B |
| Runoff Curve Number | 77 |
| Watershed Length | 2,710 feet |
| Watershed Slope | 15.0 % |
| Time of Concentration | 0.33 hours |
| Rainfall Distribution | Type II |
| 24-hour rainfall (50-year storm) | 3.76 inches |
| Peak Discharge | 75 cubic feet per second (cfs) |
| Runoff | 1.63 inches |

<u>Diversion Channel Hydraulic Data</u>

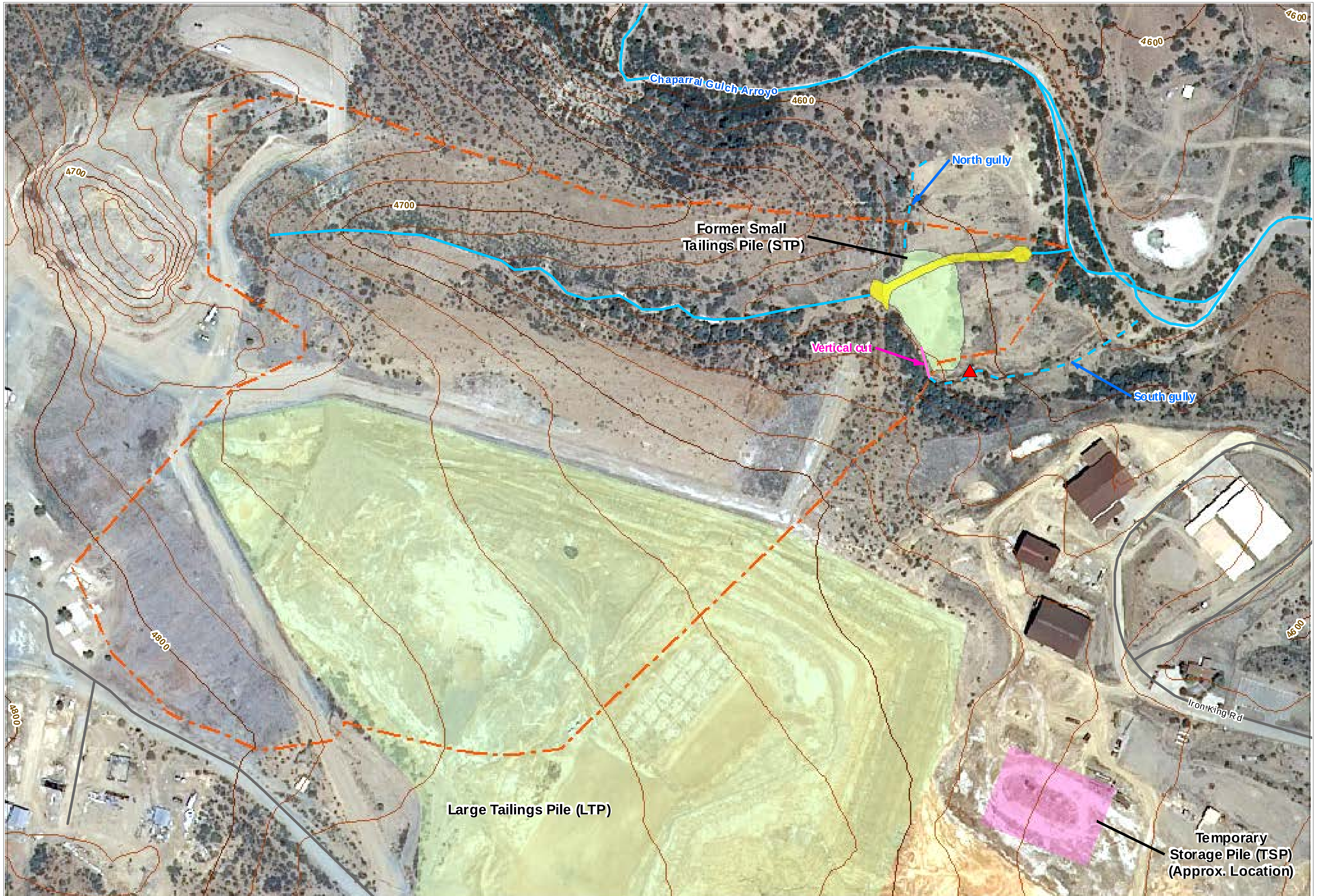
| | |
|---|---|
| Channel Length | 400 feet (+/-) |
| Channel Slope | 0.065 ft/ft (~ 3.7 degrees from horizontal) <u>or</u> a 1-foot drop over 15.4 feet of horizontal distance |
| Manning's n (estimated) | 0.025 |
| Channel Shape | trapezoidal |
| Bottom Width (avg.) | 3.0 feet |
| Channel Sides | 3: 1 slopes (horizontal: vertical) |
| Channel Depth | 3.0 feet (recommended average) |
| Channel Top Width | 21 feet |
| Max. Flow Depth | 1.05 feet |
| Max. Flow Width | 9.30 feet |
| Min. Freeboard | 0.92 feet |
| Max. Flow Velocity | 11.63 feet per second (fps) |
| Max. Shear Stress (bottom) | 2.64 pounds per square foot (psf) |
| Max. Shear Stress (sides) | 2.04 psf |

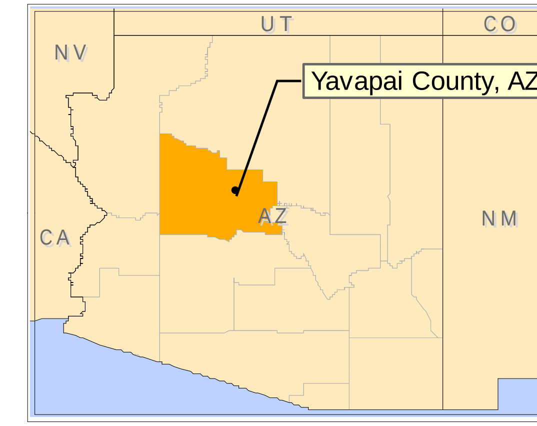
<u>Channel Riprap Specifications</u>

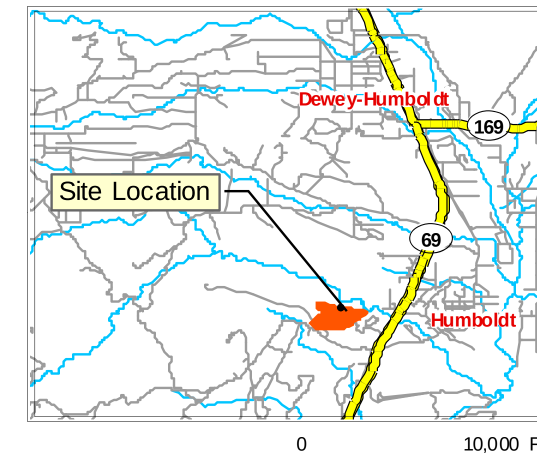
| | |
|---|---|
| D-100 Rock Size | 19-inches avg. (range 17- to 20-inches)* |
| D-50 | 13-inches avg. (range 10- to 16-inches)* |
| D-15 | 9-inches avg. (range 6- to 11-inches)* |
| Min. Riprap Thickness | 24-inches* |

* Based on a rock density of 165 pcf

FIGURES




N
W E
S

**Legend**

- Riprap Outfall
- Drainage Channel
- Gully Drainage
- Index Contour (C.I. = 100 feet)
- Intermediate Contour (C.I. = 20 feet)
- Riprap-Lined Diversion Channel (Channel Length = 402.4 feet)
- Sub-Watershed (48.08 Acres)

Base map created using NAIP orthoimagery from USGS, contour and watershed derived from DEM data from USGS.
Diversion channel data from GPS survey 2011.

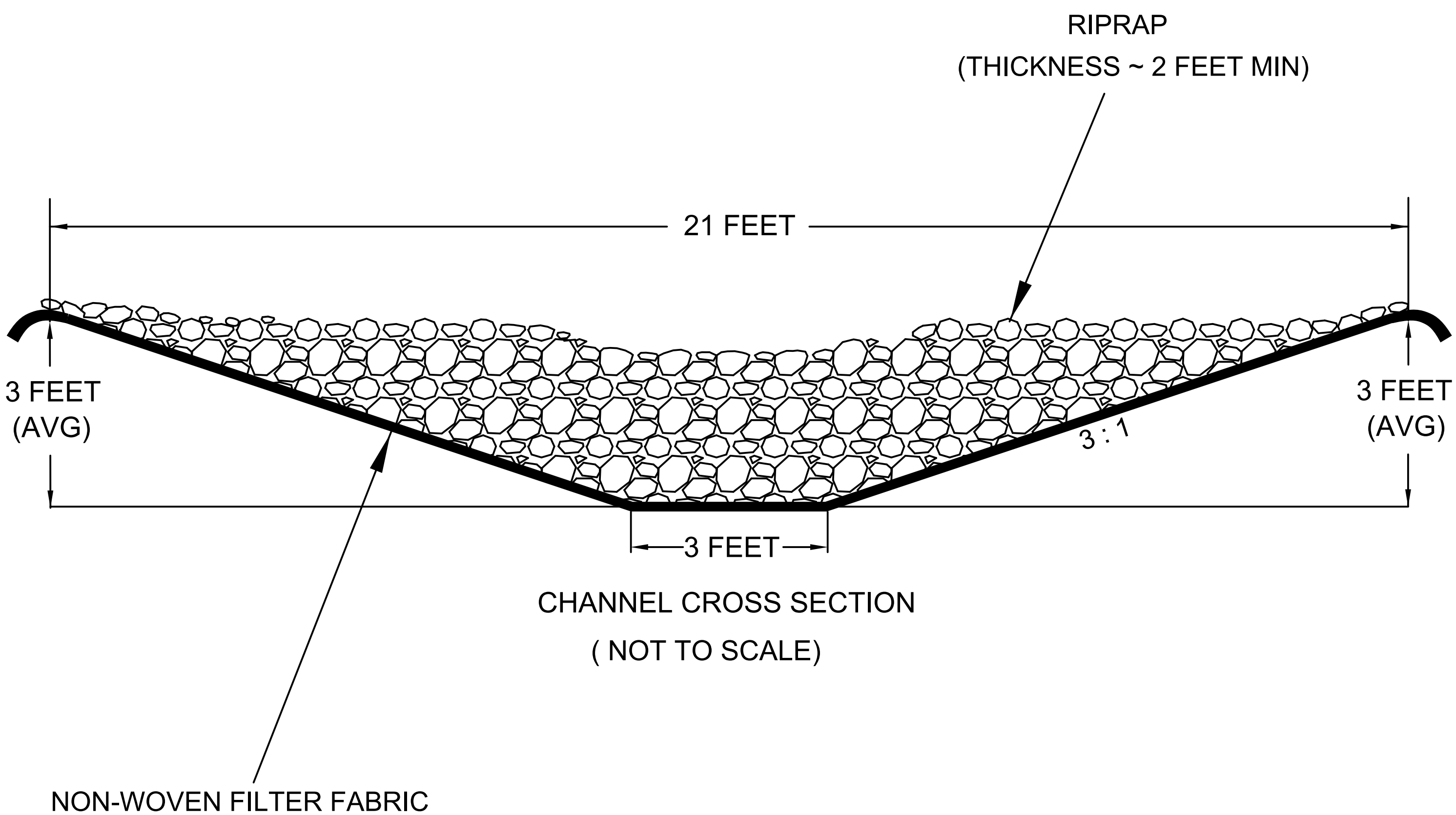
Map Creation Date: 01 December 2011

Coordinate system: Arizona State Plane
FIPS: 0202
Datum: NAD83
Units: Feet

Data: g:\arcviewprojects\SERAS01\00-146
MXD file: g:\arcinfoprojects\SERAS01\SER00146_IronKingMineSite\146_TM2011_Investigation_Area_FinalDesign_f1

240 0 240 Feet

| U.S EPA Environmental Response Team<br>Scientific Engineering Response and Analytical Services<br>EP-W-09-031<br>W.A.# 0-146 | Figure 1<br>Investigation Area: Final Design<br>Iron King Mine Site Hydrologic Restoration<br>Dewey-Humboldt, Arizona |
|---|---|




U.S. EPA Environmental Response Team
Scientific Engineering Response and Analytical Services
EP-W-09-031
W.A.# 0 - 146

Figure 2
Diversion Channel Design
Iron King Mine Site Hydrologic Restoration
Dewey-Humboldt, Arizona

SERAS01_Projects/00-146/Channel_Design_Fig2.dwg1.DWG 09/08/11

APPENDIX A

Photo Documentation
Iron King Mine Site Hydrologic Restoration
Dewey-Humboldt, Arizona
Technical Memorandum
March 2012

Nickpoint (NP) area prior to final slope adjustment and grading

NP area prior to final slope adjustment and grading

South gully prior to final grading


NP area – beginning of riprap treatment


Completed NP area, looking upstream

Diversion channel construction, downstream of NP area


Excavated centerline of diversion channel, downstream of NP area


Diversion channel excavation and shaping

Installation of straw wattles along slopes

Completed channel section, looking upstream


Construction of downstream stilling basin

South gully – after grading and riprap treatment

Vertical embankment with final riprap buttress

Final graded slopes with straw wattles

Rock check dam along downstream section of the south gully

Final riprap-lined outfall leading into the south gully

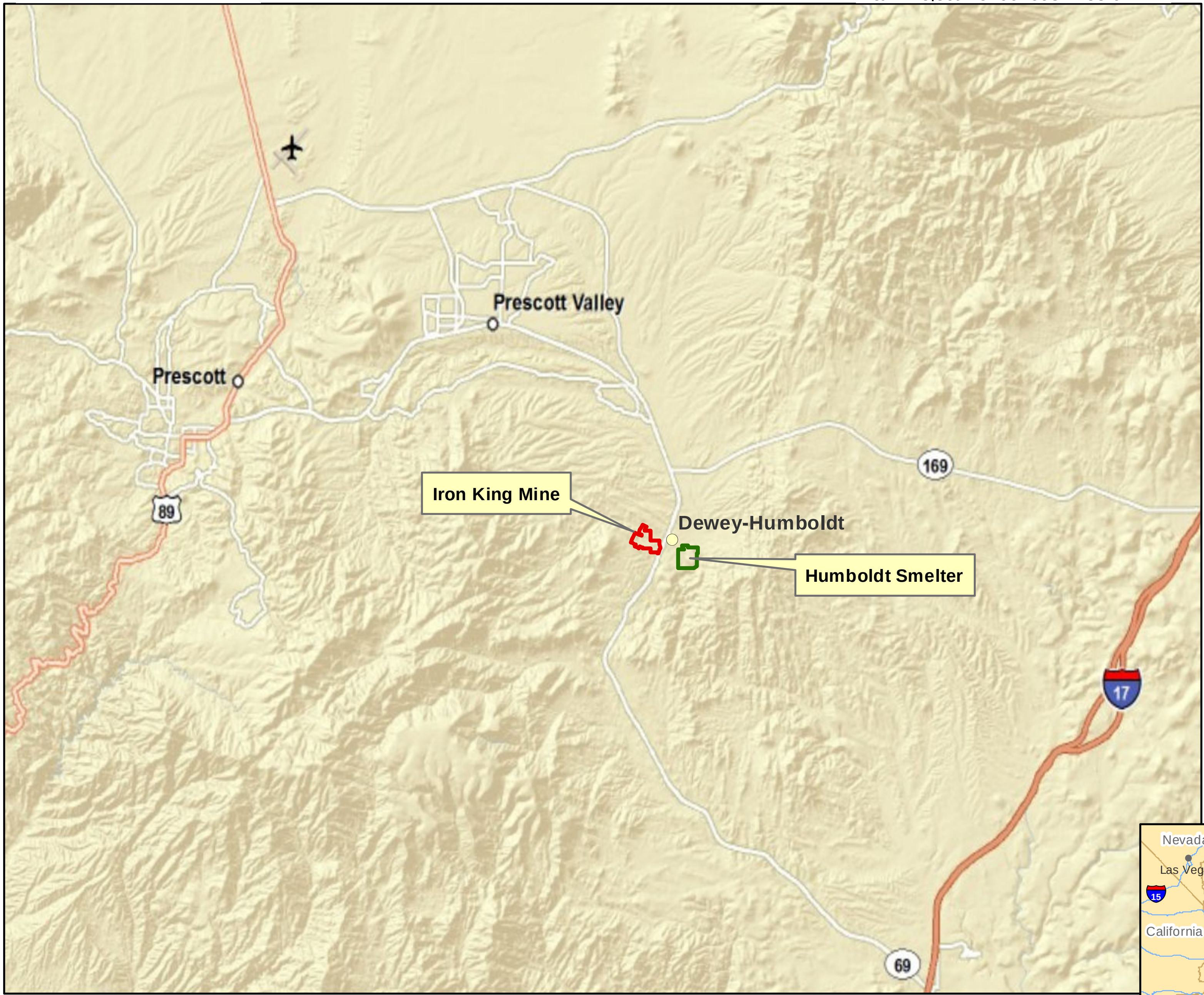
Completed diversion channel, looking downstream from NP area

Temporary storage pile (tailings repository)

# A Figures and Tables

TDD No. 02-09-11-08-0005

E&E Project No. 002693.2155.01RF




**Legend**

Iron King Mine

Humboldt Smelter

0 2 4

Miles

Source:
Background: ESRI World Street Map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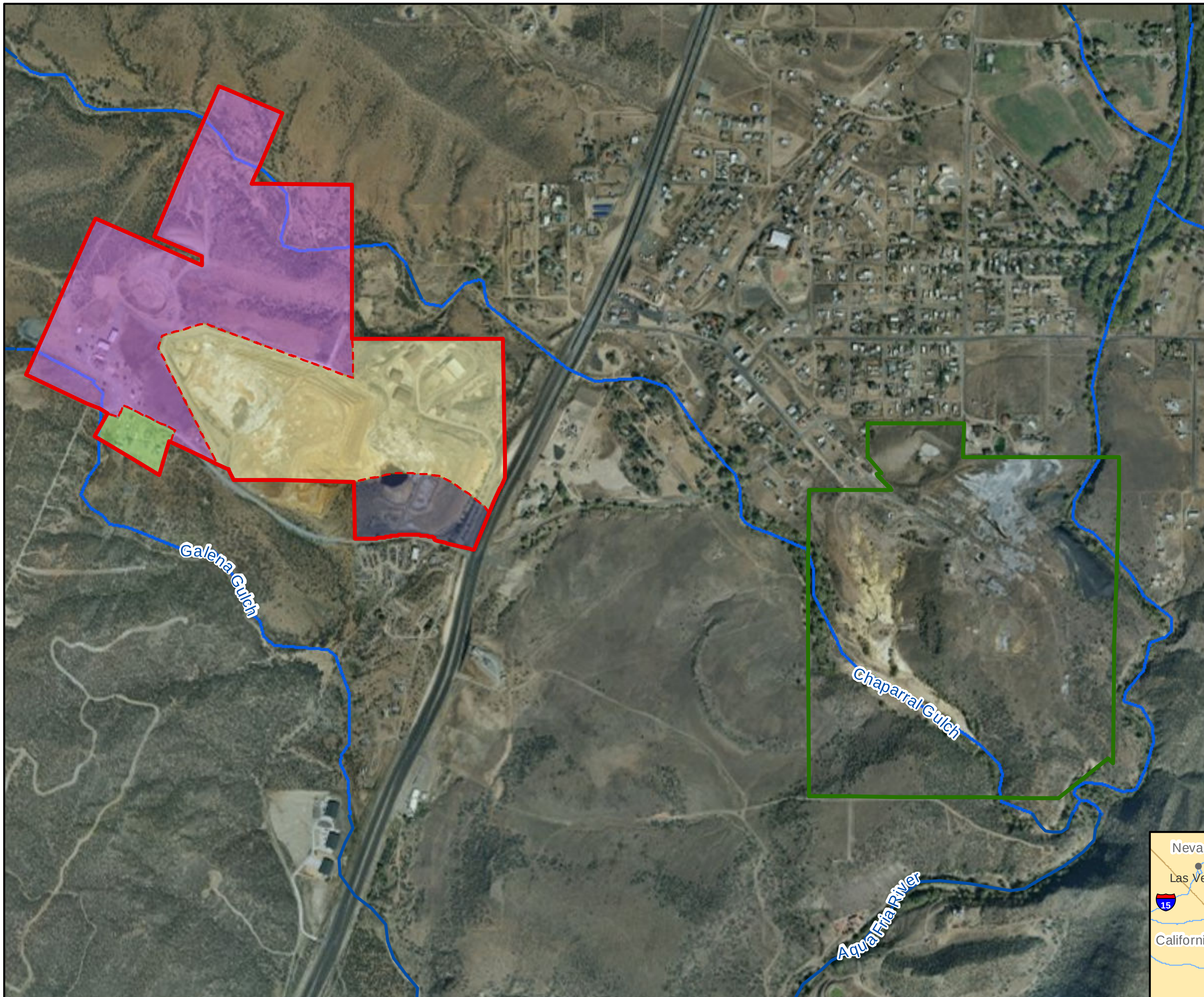
Global Environmental Specialists

**Figure 1**
**Site Location Map**

Iron King Mine - Humboldt Smelter Removal **Site**
Dewey-Humboldt, Yavapai County, Arizona

TDD No. 02-09-11-08-0005

Project No. 002693.2155.01RF




**Legend**

**Iron King Mine**

Iron King Mine Proper Area

Iron King Operations Center

Former Fertilizer Plant Area

Salvage Yard

**Humboldt Smelter**

**Waterways**

Chaparral Gulch, Galena Gulch, Agua Fria River

N

0 500 1,000

Feet

Source:
Aerial Photo: ESRI World Imagery

EA Remedial Investigation Report, Revision 01, March 2010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Global Environmental Specialists

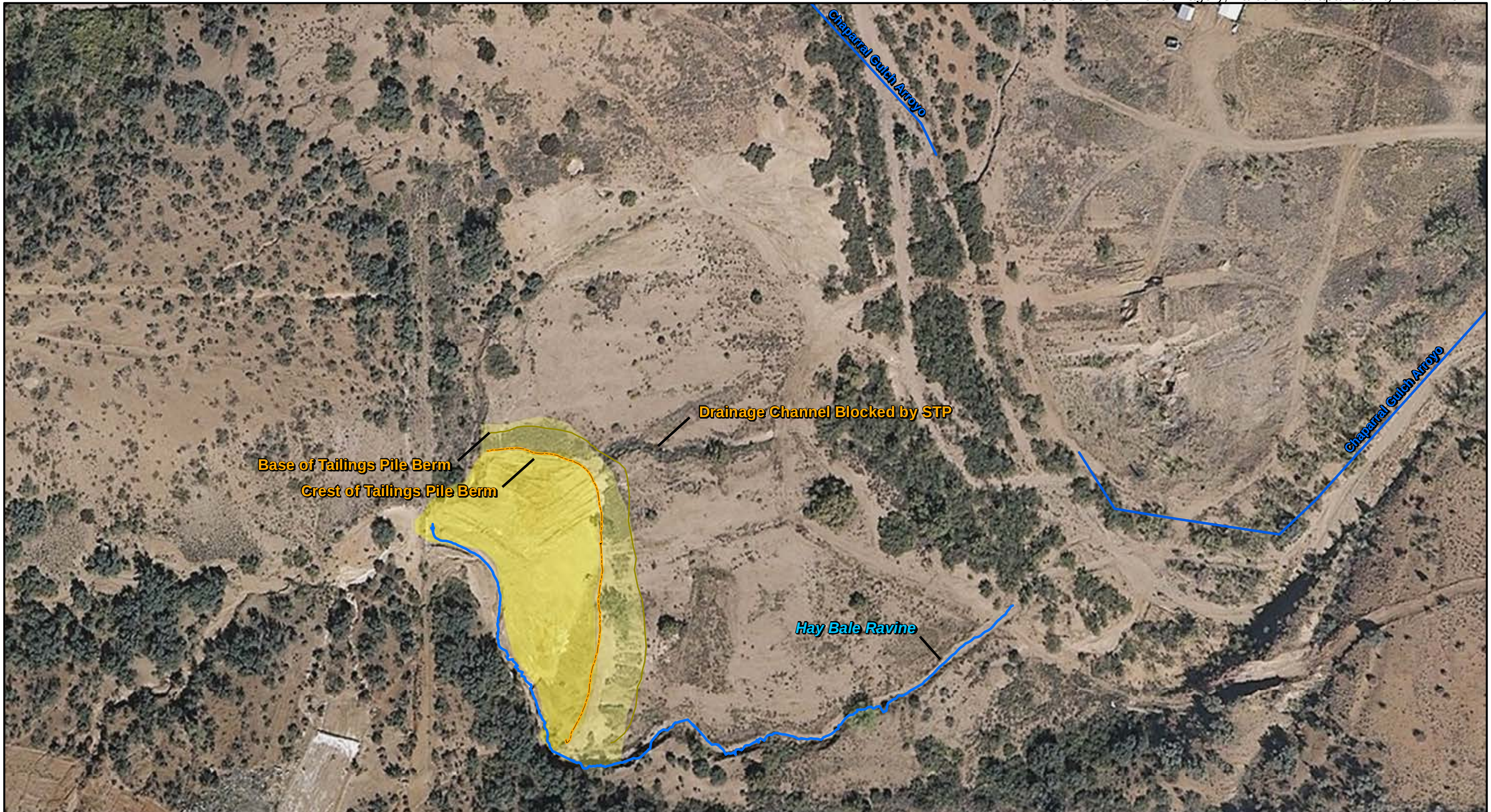
**Figure 2**
**Site Map**

Iron King Mine - Humboldt Smelter Removal Site

Dewey-Humboldt, Yavapai County, Arizona

Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: ESRI Wolrd Imagery, Parcels - Yavapai County GIS 2010




N

0 100 200 Feet

Figure 3
Former Small Tailings Pile
Iron King Mine - Humboldt Smelter Removal
Dewey-Humboldt, Yavapai County, AZ

ecology and environment, inc.
International Specialists in the Environment

Source: Aerial photo - Bing maps, Parcels - Yavapai County GIS 2010.


- Visually Assessed; No Current Removal Program Action Recommended
- Previously Assessed and Data Reviewed; No Current Removal Program Action Recommended
- No Further Removal Action Recommended; Removal Action Performed in 2006
- Removal Conducted
- Additional Removal Assessment Sampling Recommended; Unable to Obtain Access
- Yellow: Potential Candidate for Removal Assessment; Unable to Obtain Access
- Iron King Mine
- Humboldt Smelter
- Parcels

N

0 200 400 800 Feet

**Note: Recommendations based on START's understanding of criteria for time critical removal actions and do not necessarily indicate that soil concentrations for lead and arsenic are less than USEPA Region 9 Regional Screening Levels (RSLs) and/or ADEQ's Soil Screening Levels (SSLs)**

**Figure 4**
**In-Town Parcel Assessment and Removal**
**Iron King Mine - Humboldt Smelter Removal**
**Yavapai County, Arizona**

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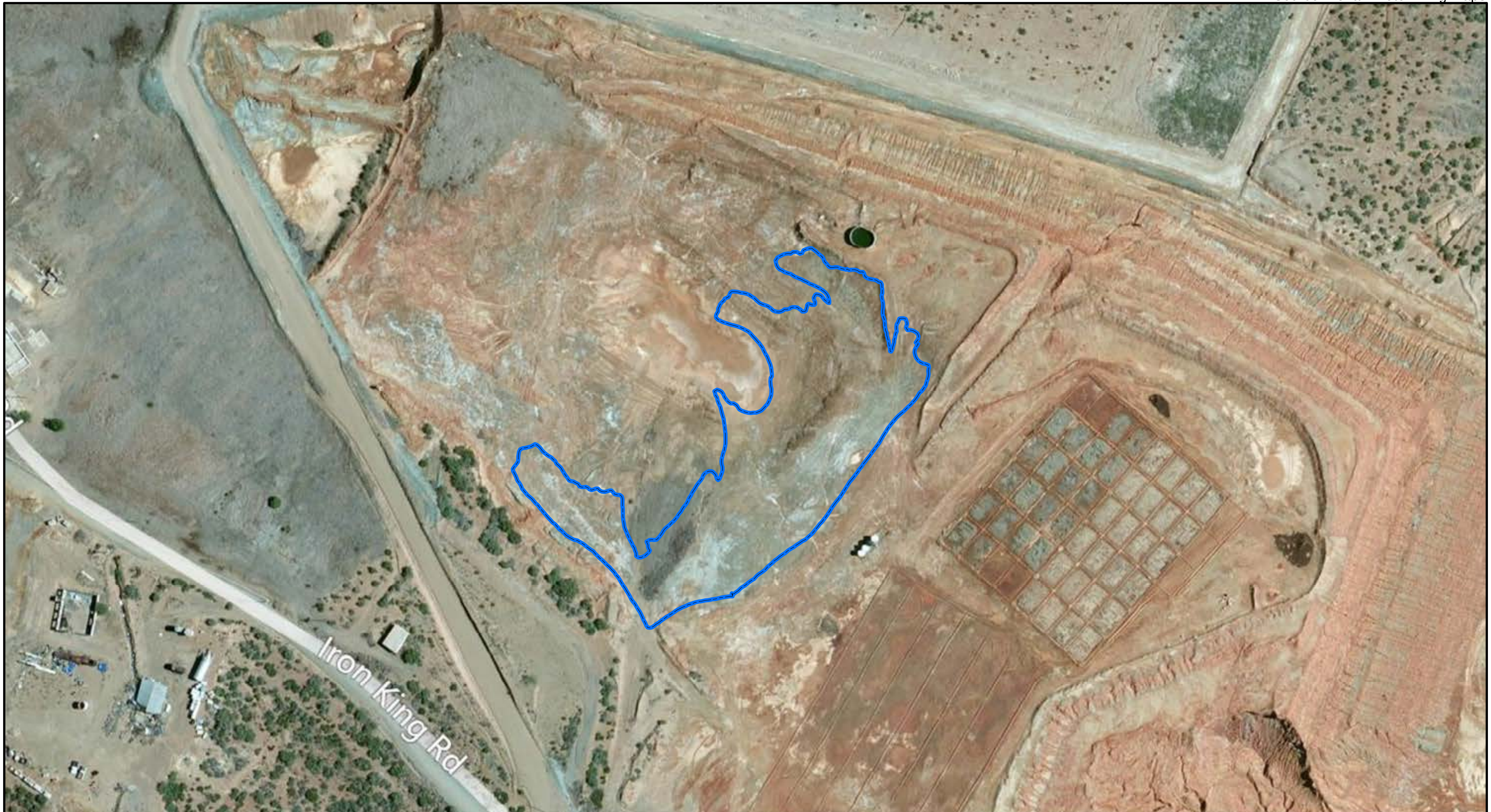
Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: Aerial Photo - Bing Maps




**LEGEND**

Footprint

N

0 200 400 Feet

**Figure 5**
**Footprint of Removed Soil Placed on Iron King Mine Main Tailings Pile**
**Iron King Mine - Humboldt Smelter Removal**
**Yavapai County, Arizona**

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Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: Aerial Photo - Bing Maps

**LEGEND**

Removal Area

N

0 50 100 Feet

**Figure 6**
**OFS-103 Removal Area**
**Iron King Mine - Humboldt Smelter Removal**
**Yavapai County, Arizona**

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Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: Aerial Photo - ESRI World Imagery


**LEGEND**

Removal area

Humboldt Smelter

1 = Confirmation Sample Identifier (represents sample OFS-111-001)

N

0 50 100 Feet

**Figure 7**
**OFS-111 Removal Areas**
**Iron King Mine - Humboldt Smelter Removal**
**Yavapai County, Arizona**

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International Specialists in the Environment

Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: Aerial Photo - ESRI World Imagery


**LEGEND**

Removal area

N

0 50 100 Feet

1 = Confirmation Sample Identifier
(represents sample OFS-118-001)

**Figure 8**
**OFS-118 Removal Areas**
**Iron King Mine - Humboldt Smelter Removal**
**Yavapai County, Arizona**

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International Specialists in the Environment

Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: Aerial photo - ESRI World Imagery


**LEGEND**

Removal area

1 = Confirmation Sample Identifier
(represents sample OFS-132-001)

N

0 50 100 Feet

**Figure 9**
**OFS-132 Removal Areas**
**Iron King Mine - Humboldt Smelter Removal**
**Yavapai County, Arizona**

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International Specialists in the Environment

Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: Aerial photo - ESRI World Imagery


**LEGEND**

Removal area

Humboldt Smelter

1 = Confirmation Sample Identifier
(represents sample OFS-133-001)

N

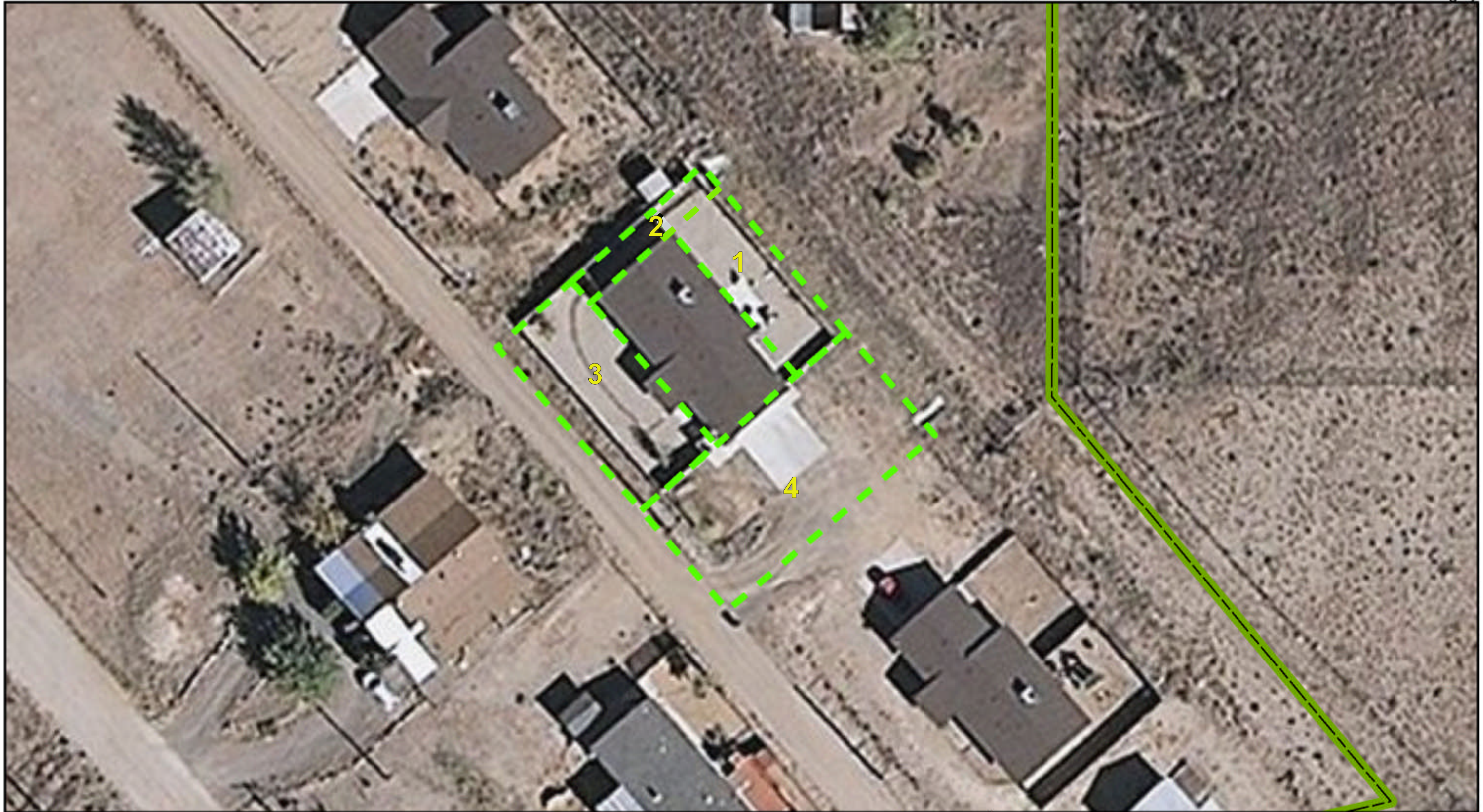
0 50 100 Feet

**Figure 10**
**OFS-133 and OFS-119 Removal Areas**
**Iron King Mine - Humboldt Smelter Removal**
**Yavapai County, Arizona**

ecology and environment, inc.
International Specialists in the Environment

Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: ESRI World Imagery




**LEGEND**

Removal area

Humboldt Smelter

1 = Confirmation Sample Identifier (represents sample OFS-148-001)

N

0 50 100 Feet

**Figure 11**
**OFS-148 Removal Areas**
**Iron King Mine - Humboldt Smelter Removal**
**Yavapai County, Arizona**

ecology and environment, inc.
International Specialists in the Environment

Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: Aerial photo - Bing maps.


**LEGEND**

Removal area

N

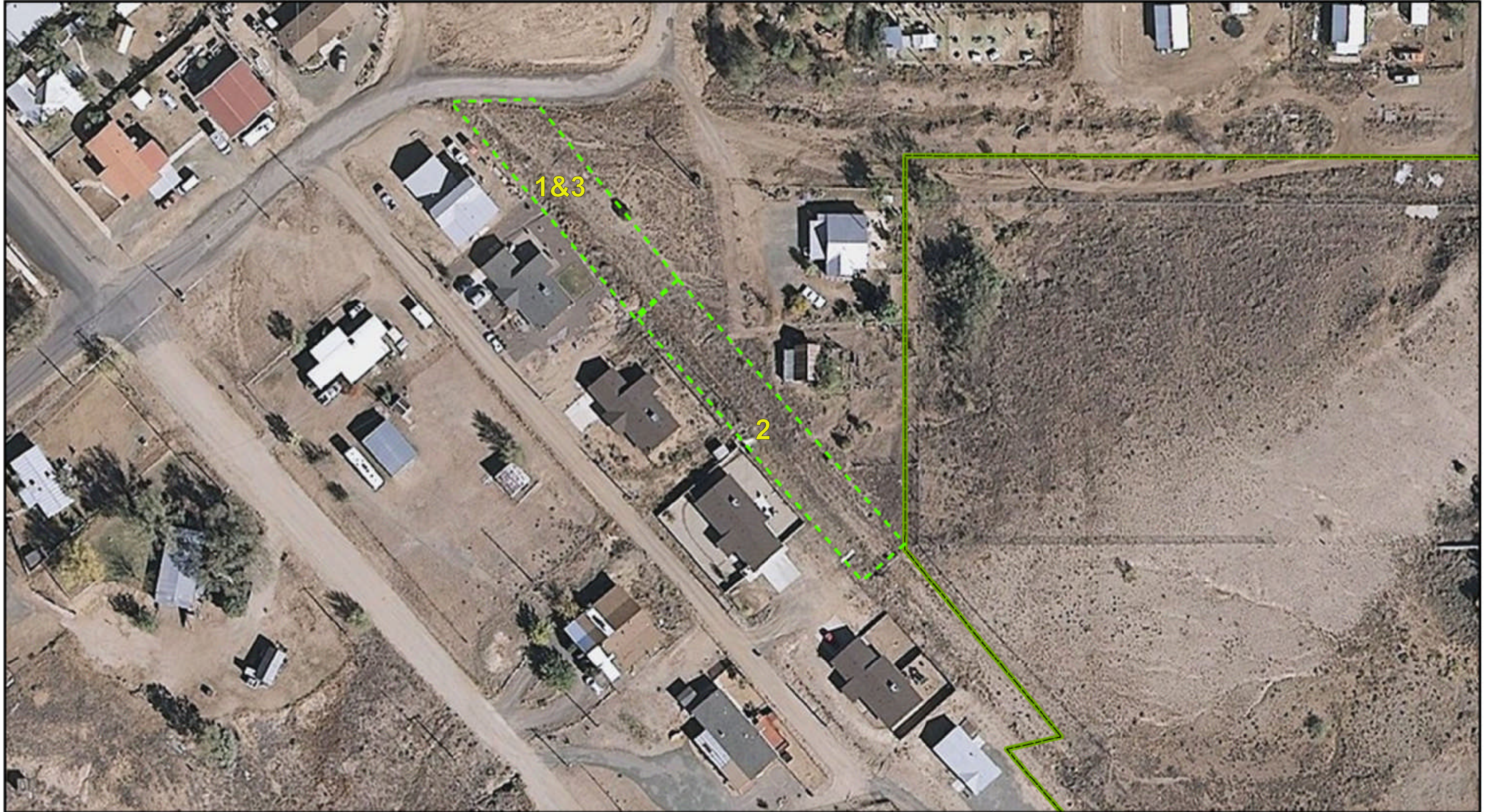
0 50 100 Feet

**Figure 12**
**OFS-208 and OFS-244 Removal Area**
**Iron King Mine - Humboldt Smelter Removal**
**Yavapai County, Arizona**

ecology and environment, inc.
International Specialists in the Environment

Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: Aerial photo - Bing maps.




**LEGEND**

Removal area

Humboldt Smelter

2 = Confirmation Sample Identifier (represents sample OFS-260-002)

N

0 100 200 Feet

**Figure 13**
**OFS-260 Removal Areas**
**Iron King Mine - Humboldt Smelter Removal**
**Yavapai County, Arizona**

ecology and environment, inc.
International Specialists in the Environment

Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: ESRI World Imagery


**LEGEND**

Removal area

Humboldt Smelter

2 = Confirmation Sample Identifier
(represents sample OFS-301-002)

N

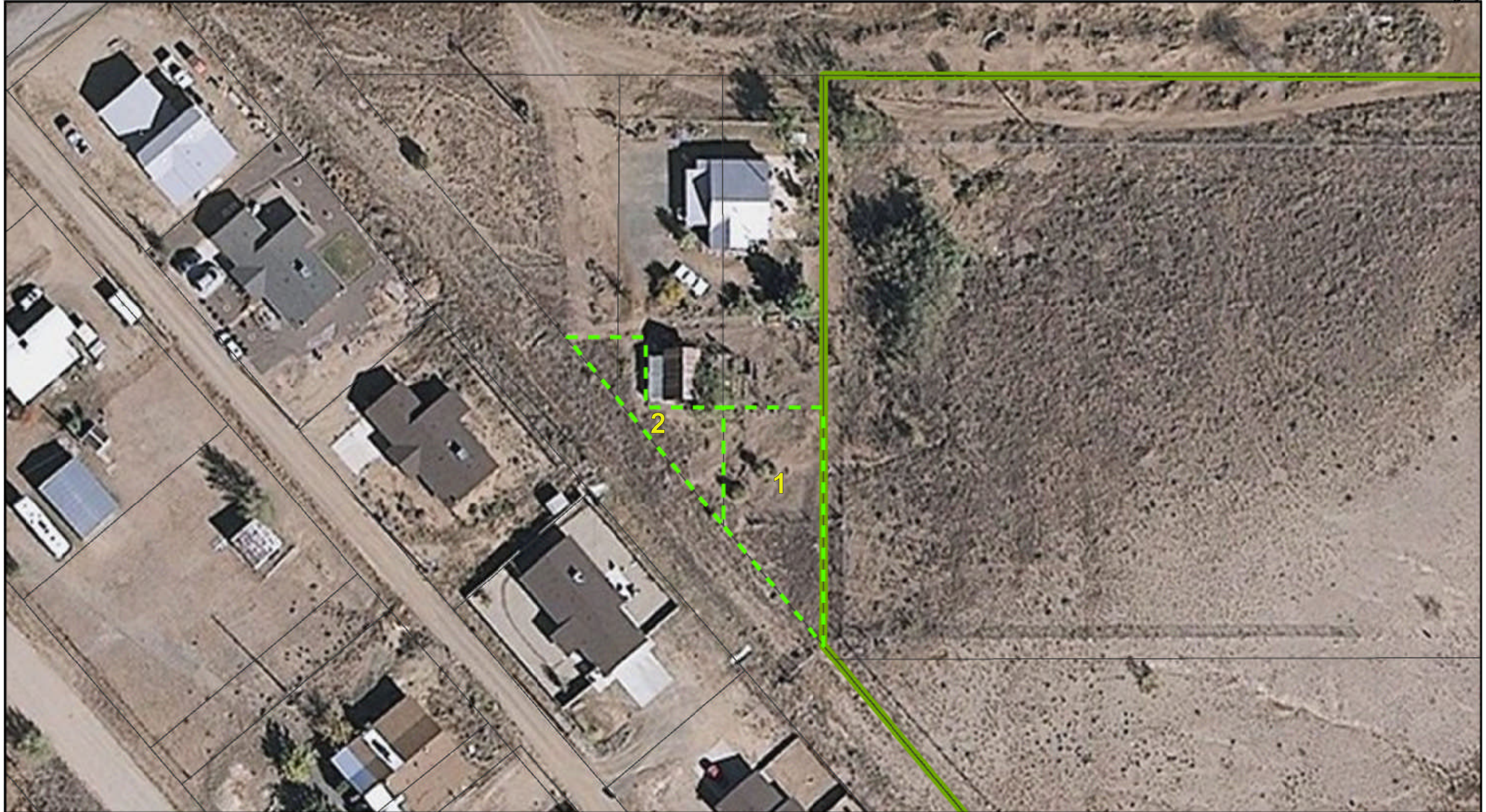
0 50 100 Feet

**Figure 14**
**OFS-301 Removal Areas**
**Iron King Mine - Humboldt Smelter Removal**
**Yavapai County, Arizona**

ecology and environment, inc.
International Specialists in the Environment

Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: ESRI World Imagery




**LEGEND**

Removal Area

Humboldt Smelter

1 = Confirmation Sample Identifier
(represents sample OFS-306-001)

N

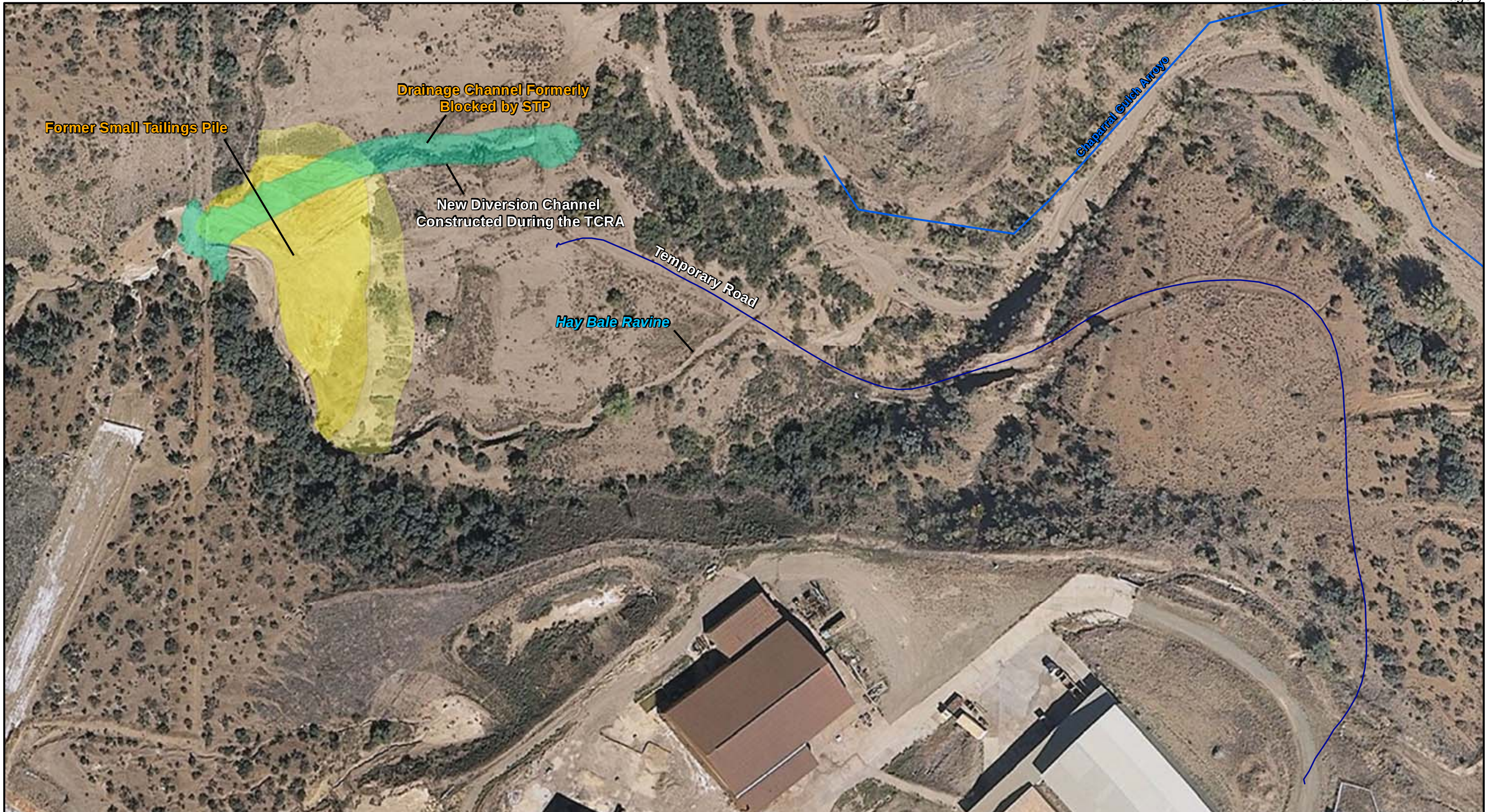
0 75 150 Feet

**Figure 15**
**OFS-306 Removal Areas**
**Iron King Mine - Humboldt Smelter Removal**
**Yavapai County, Arizona**

ecology and environment, inc.
International Specialists in the Environment

Project # 002693.2155.01RF
TDD# T02-09-11-08-0005

Source: ESRI Wolrd Imagery




N

0 100 200 Feet

Figure 16
New Diversion Channel and
Location of Temporary Road
Iron King Mine - Humboldt Smelter Removal
Dewey-Humboldt, Yavapai County, AZ

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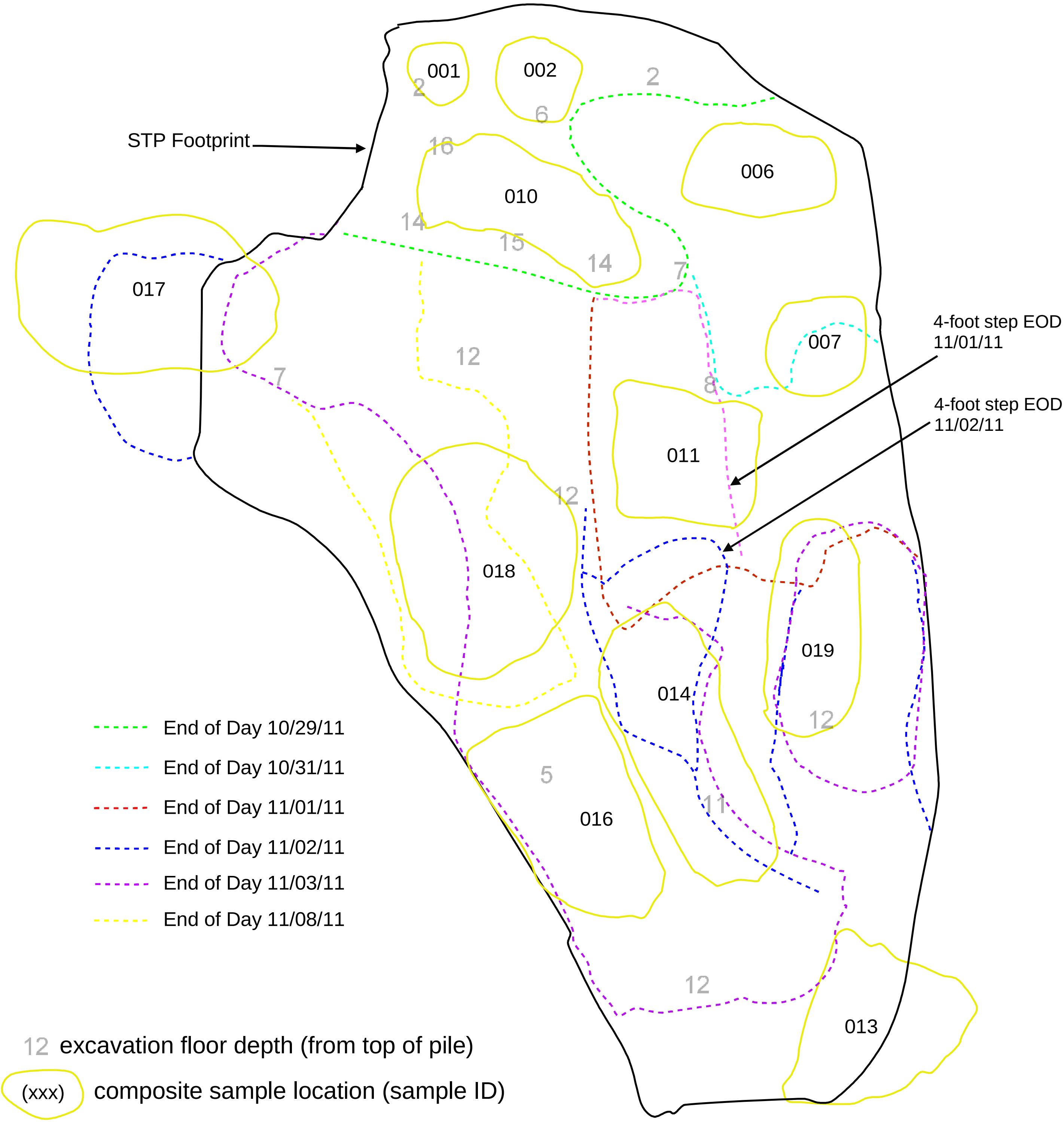


STP = Small Tailings Pile
EOD = End of Day

Figure 17
STP Excavation Progress and Excavation Floor
Confirmation Sampling Locations
Iron King Mine - Humboldt Smelter Removal
Yavapai County, Arizona


Applied October 1, 2011

Applied October 9, 2011

Applied October 27, 2011

Figure 18
Application of Fixative to Humboldt Smelter Ash
Iron King Mine - Humboldt Smelter Removal
Yavapai County, Arizona

Table 1
Properties Subject to U.S. EPA Time-Critical Removal Action
Dewey-Humboldt, Arizona

TDD No. 02-09-11-08-0005 | Project No. 002693.2155.01RF

| | Site ID | Parcel No. | Physical Address | Mailing Address | Acres |
|---|---|---|---|---|---|
| Complete Removal | OFS 111 | 402-06-102L | 2925 South Sweet Pea Lane | PO Box 485<br>Humboldt, AZ 86329 | 0.27 |
| Complete Removal | OFS 118 | 402-06-102K | 2905 South Sweet Pea Lane | PO Box 508<br>Humboldt, AZ 86329 | 0.27 |
| Complete Removal | OFS 132 | 402-06-102P | 2875 South Third Street | PO Box 122<br>Humboldt, AZ 86329 | 0.25 |
| Complete Removal | OFS 260 | 800-27-005T | Unsurfaced right-of-way behind Sweet Pea Lane | Municipal property | 0.5 (approx.) |
| Complete Removal | OFS 148 | 402-06-102M | 2945 Sweet Pea Lane | 1575 Purple Sage Road<br>Chino Valley, AZ 86323 | 0.27 |
| Complete Removal | OFS 133<br>OFS-119<br>(NE corner of OFS-119 added to removal at OFS-133) | 402-07-006 | 13070 Main Street | PO Box 338<br>Humboldt, AZ 86329 | 0.23 |
| Hot-Spot Removal | | 402-07-007C | 13080 East Main Street | PO Box 552<br>Humboldt, AZ 86329 | 0.48 |
| Hot-Spot Removal | OFS-103 | 402-07-002B | 13030 East Main Street | PO Box 488<br>Humboldt, AZ 86329 | 0.46 |
| Hot-Spot Removal | OFS 208<br>OFS-244<br>(one hot spot between two parcels) | 402-09-016D | 2565 Hill Street | PO Box 32<br>Humboldt, AZ 86329 | 0.21 |
| Hot-Spot Removal | | 402-09-016H | 2575 Hill Street | PO Box 548<br>Humboldt, AZ 86329 | 0.21 |
| Hot-Spot Removal | OFS-002<br>(hot spot is the STP) | 402-08-034A | 12470 East Yavapai Road | PO Box 721<br>Dewey, AZ 86327 | 0.6 |
| Hot-Spot Removal | OFS-301 | 402-06-102N | 2965 Sweet Pea Lane | PO Box 905<br>Humboldt, AZ 86329 | 0.28 |
| Hot-Spot Removal | OFS-306 | 402-06-026<br>402-06-027B | 13087 E. Main Street<br>13089 E. Main Street | PO Box 699<br>Humboldt, AZ 86329 | 0.19<br>0.32 |

2012 ecology and environment, inc.

Table 2
Air Monitoring and Sampling Results
Iron King Mine - Humboldt Smelter Removal
(mg/m$^3$)

TDD No. 02-09-11-08-0005 Project No. 002693.2155.01RF

| Date | Dust Monitor ID | Location | Maximum Per-Minute Average* | Overall Average* | Maximum STEL* | Comment | Air Sample Result |
|---|---|---|---|---|---|---|---|
| 9/13/2011 | D269 | Main Street at 3rd | N/A | 0.005 | N/A | | |
| | D271 | Main Street, near gate | N/A | 0.005 | N/A | | |
| | 1 | Main Street at 3rd | 0.006 | 0.000 | 0.002 | | |
| 9/14/2011 | 1 | North of OFS-148 | 0.095 | 0.012 | 0.022 | | As: ND; Pb: ND |
| | 2 | South of OFS-148 | 0.012 | 0.003 | 0.006 | | As: ND; Pb: ND |
| | 3 | West of OFS-148 | 0.067 | 0.005 | 0.024 | | As: ND; Pb: ND |
| 9/15/2011 | 1 | North of OFS-148 | 0.392 | 0.044 | 0.071 | | As: ND; Pb: ND |
| | 2 | South of OFS-148 | 0.106 | 0.009 | 0.041 | | As: ND; Pb: ND |
| | 3 | West of OFS-148 | 0.798 | 0.013 | 0.067 | | As: ND; Pb: ND |
| 9/16/2011 | 1 | North of OFS-111 | 0.659 | 0.029 | 0.095 | Maximum coincided with air monitor being dropped during relocation | |
| | 2 | South of OFS-148 | 0.054 | 0.000 | 0.019 | | |
| | 3 | West of OFS-148 | 0.273 | 0.008 | 0.043 | | |
| 9/17/2011 | 1 | North of OFS-111 | 0.212 | 0.006 | 0.023 | | |
| | 2 | South of OFS-111 | 0.072 | 0.000 | 0.007 | | |
| | 3 | West of OFS-111 | 0.142 | 0.009 | 0.027 | | |
| 9/19/2011 | 1 | North of OFS-111 | 0.085 | 0.011 | 0.037 | | |
| | 2 | South of OFS-111 | 0.052 | 0.006 | 0.020 | | |
| | 3 | West of OFS-111 | 0.776 | 0.008 | 0.088 | | |
| 9/20/2011 | 1 | North of OFS-148 | 0.104 | 0.007 | 0.026 | | |
| | 2 | West of OFS-148 | 0.417 | 0.000 | 0.011 | | |
| | 3 | South of OFS-148 | 0.224 | 0.008 | 0.030 | | |
| 9/21/2011 | 1 | North of OFS-148 | 0.085 | 0.004 | 0.014 | | |
| | 2 | East of OFS-148 | 0.075 | 0.006 | 0.013 | | |
| | 3 | South of OFS-148 | 0.244 | 0.023 | 0.072 | | |
| 9/22/2011 | 1 | OFS-111 | 0.073 | 0.000 | 0.011 | | As: ND; Pb: ND |
| | 2 | OFS-301 | 0.130 | 0.020 | 0.035 | | As: ND; Pb: ND |
| | 3 | OFS-306 | 0.643 | 0.030 | 0.104 | | As: ND; Pb: ND |
| 9/23/2011 | 1 | OFS-118 | 0.254 | 0.023 | 0.049 | | |
| | 2 | OFS-301 | 0.464 | 0.012 | 0.059 | | |
| | 3 | West of OFS-111 | 0.756 | 0.031 | 0.134 | | |
| | 4 | OFS-306 | 0.043 | 0.005 | 0.009 | | |
| 9/24/2011 | 1 | OFS-118 | 0.238 | 0.017 | 0.044 | | |
| | 2 | OFS-301 | 0.317 | 0.015 | 0.086 | | |
| | 3 | OFS-111 Fence | 0.176 | 0.027 | 0.044 | | |
| | 4 | Across 3rd Street/OFS-260 | 1.569 | 0.014 | 0.127 | | |
| 9/26/2011 | 1 | OFS-118 Swing Set | 0.148 | 0.019 | 0.034 | | |
| | 2 | OFS-301 | 0.050 | 0.002 | 0.012 | | |
| | 3 | OFS-111 Fence/OFS-103 | 0.129 | 0.025 | 0.038 | | |
| | 4 | OFS-306 | 0.021 | 0.000 | 0.003 | | |
| 9/27/2011 | 1 | OFS-111 Back Porch | 0.234 | 0.022 | 0.057 | | |
| | 2 | OFS-301 Table | 0.309 | 0.014 | 0.082 | | |
| | 3 | OFS-103 Chair | 0.136 | 0.000 | 0.019 | | |
| | 4 | OFS-132 Truck | 0.201 | 0.010 | 0.036 | | |
| 9/28/2011 | 1 | OFS-111 Back Porch | 1.567 | 0.009 | 0.214 | | |
| | 2 | OFS-301 Table | 0.254 | 0.019 | 0.55 | | |
| | 3 | OFS-103 Chair | 0.057 | 0.000 | 0.007 | | |
| | 4 | OFS-132 Truck | Data lost | 0.002 | 0.016 | | |
| 9/29/2011 | 1 | OFS-306 Fence by Shed | 0.143 | 0.006 | 0.035 | | |
| | 2 | OFS-111 Back Porch | 0.280 | 0.007 | 0.032 | | |
| | 3 | Sweet Pea Lane Fence | 0.393 | 0.003 | 0.053 | | |
| | 4 | OFS-132 Porch/ 2850 3rd Street | 0.425 | 0.012 | 0.043 | | |

Notes:
As - Arsenic
Pb - Lead
mg/m$^3$ - Milligrams per cubic meter
N/A - Not applicable
ND - Not detected above laboratory detection limit
STEL - Short Term Exposure Limit (reported by the instrument)
STP - Small tailings pile

Table 2
Air Monitoring and Sampling Results
Iron King Mine - Humboldt Smelter Removal
($mg/m^3$)

TDD No. 02-09-11-08-0005 Project No. 002693.2155.01RF

| Date | Dust Monitor ID | Location | Maximum Per-Minute Average* | Overall Average* | Maximum STEL* | Comment | Air Sample Result |
|---|---|---|---|---|---|---|---|
| 9/30/2011 | 1 | OFS-118 near Swing Set | 0.116 | 0.018 | 0.041 | | |
| | 2 | Sweet Pea Lane Fence by OFS-132 | 0.749 | 0.020 | 0.075 | | |
| | 3 | 2850 3rd Street | 0.589 | 0.030 | 0.155 | Spike likely due to street sweeper | |
| 10/1/2011 | 1 | 2850 3rd Street | 0.160 | 0.000 | 0.019 | | |
| | 2 | Sweet Pea Lane Fence by OFS-132 | 0.085 | 0.036 | 0.046 | | |
| | 3 | Fence betweeen OFS244/208 | 0.425 | 0.010 | 0.078 | | |
| 10/3/2011 | 1 | OFS-111 Back Porch | 0.262 | 0.000 | 0.083 | | |
| | 2 | Sweet Pea Lane next to OFS-132 | 0.766 | 0.031 | 0.133 | Spike likely caused by trash truck | |
| | 3 | 2850 3rd St | 0.227 | 0.009 | 0.034 | | |
| | 4 | OFS-244/208 | 0.194 | 0.013 | 0.056 | | |
| 10/4/2011 | 1 | OFS-111 | 0.457 | 0.045 | 0.164 | | |
| | 2 | OFS-118 | 0.448 | 0.035 | 0.105 | | |
| | 3 | OFS-132 | 0.424 | 0.029 | 0.081 | | |
| | 4 | EPA Command Post | 1.843 | 0.042 | 0.042 | Spike due to 40 mph wind gust blowing over porta-potty directly adjacent to air monitoring station | |
| 10/5/2011 | 1 | OFS-118 | 0.109 | 0.015 | 0.048 | | |
| | 2 | OFS-306 | 0.126 | 0.020 | 0.051 | | |
| | 3 | 2850 3rd Street | 0.575 | 0.151 | 0.054 | | |
| | 4 | OFS-103 | 0.083 | 0.009 | 0.021 | | |
| 10/6/2011 | 1 | OFS-118 | 0.117 | 0.009 | 0.036 | | |
| | 2 | OFS-306 | 0.588 | 0.007 | 0.058 | | |
| | 3 | 2850 3rd Street | 0.147 | 0.031 | 0.058 | | |
| | 4 | OFS-103 | 0.050 | 0.002 | 0.010 | | |
| 10/7/2011 | 1 | OFS-118 | 0.557 | 0.023 | 0.061 | | |
| | 2 | OFS-306 | 0.035 | 0.001 | 0.013 | | |
| | 3 | 2850 3rd Street | 0.953 | 0.016 | 0.094 | Wind gusts | |
| | 4 | OFS-103 | 0.028 | 0.004 | 0.009 | | |
| 10/8/2011 | 1 | 2850 3rd Street | 0.060 | 0.000 | 0.005 | | |
| | 2 | OFS-119 | 0.099 | 0.004 | 0.022 | | |
| | 3 | OFS-306 | 0.067 | 0.019 | 0.030 | | |
| | 4 | OFS-118 | 0.123 | 0.005 | 0.022 | | |
| 10/10/2011 | 1 | 2850 3rd Street | 0.330 | 0.033 | 0.087 | | As: ND Pb: 0.000447 |
| | 2 | OFS-119 | 0.218 | 0.023 | 0.042 | | As: ND; Pb: ND |
| | 3 | OFS-118 | 0.265 | 0.021 | 0.079 | | As: ND; Pb: ND |
| | 4 | South of OFS-103 on Main Street | 1.407 | 0.018 | 0.159 | Located next to import material gate | As: ND; Pb: ND |
| 10/11/2011 | 1 | 2850 3rd Street | Monitoring Data Lost - Equipment Malfunction | | | | |
| | 2 | OFS-119 | 0.719 | 0.064 | 0.180 | | |
| | 3 | OFS-118/SPL Fence | 0.368 | 0.030 | 0.122 | | |
| | 4 | South of OFS-103 on Main Street | 0.361 | 0.004 | 0.032 | | |
| 10/12/2011 | 1 | 2850 3rd Street | 1.307 | 0.011 | 0.136 | | |
| | 2 | OFS-119 | 0.310 | 0.040 | 0.078 | | |
| | 3 | OFS-119/SPL Fence | 0.199 | 0.021 | 0.050 | | |
| 10/13/2011 | 1 | 2850 3rd Street | 0.330 | 0.005 | 0.045 | | |
| | 2 | OFS-119 | 0.510 | 0.038 | 0.156 | | |
| | 3 | OFS-119/Sweet Pea Lane Fence | 0.284 | 0.040 | 0.080 | | |

Notes:
As - Arsenic
Pb - Lead
$mg/m^3$ - Milligrams per cubic meter
N/A - Not applicable
ND - Not detected above laboratory detection limit
STEL - Short Term Exposure Limit (reported by the instrument)
STP - Small tailings pile

Table 2
Air Monitoring and Sampling Results
Iron King Mine - Humboldt Smelter Removal
(mg/m$^3$)

TDD No. 02-09-11-08-0005 Project No. 002693.2155.01RF

| Date | Dust Monitor ID | Location | Maximum Per-Minute Average* | Overall Average* | Maximum STEL* | Comment | Air Sample Result |
|---|---|---|---|---|---|---|---|
| 10/14/2011 | 1 | OFS-119 | 0.258 | 0.022 | 0.095 | | |
| | 2 | 2850 3rd Street | 0.844 | 0.045 | 0.153 | | |
| | 3 | OFS-118/SPL fence | 0.783 | 0.047 | 0.096 | | |
| 10/24/2011 | 1 | 2850 3rd Street | 1.542 | 0.011 | 0.141 | | |
| | 2 | OFS-119 | 0.205 | 0.039 | 0.059 | | |
| | 3 | OFS-306 | 0.248 | 0.030 | 0.056 | | |
| 10/25/2011 | 1 | OFS-119 | 0.254 | 0.000 | 0.020 | | |
| | 2 | 2850 3rd Street | 2.130 | 0.034 | 0.204 | | |
| | 3 | OFS-306 | 0.326 | 0.047 | 0.995 | | |
| 10/26/2011 | 1 | OFS-119 | 0.147 | 0.060 | 0.103 | | |
| | 2 | 2850 3rd Street | 0.077 | 0.024 | 0.042 | | |
| | 3 | OFS-103 Fence | 0.061 | 0.037 | 0.041 | | |
| 10/27/2011 | 1 | STP North | 0.195 | 0.117 | 0.154 | | |
| | 2 | STP South | 0.046 | 0.018 | 0.022 | | |
| | 3 | STP East | 0.079 | 0.027 | 0.037 | | |
| 10/28/2011 | 1 | STP North | 0.384 | 0.168 | 0.345 | | |
| | 2 | STP South | 0.090 | 0.021 | 0.031 | | |
| | 3 | STP East | 0.171 | 0.027 | 0.044 | | |
| 10/29/2011 | 1 | STP North | 0.178 | 0.047 | 0.144 | | |
| | 2 | STP South | 0.038 | 0.019 | 0.028 | | |
| | 3 | STP East | 0.222 | 0.025 | 0.040 | | |
| 10/31/2011 | 1 | STP North | 0.470 | 0.115 | 0.315 | | As: ND; Pb: ND |
| | 2 | STP South | 0.043 | 0.014 | 0.020 | | As: ND; Pb: ND |
| | 3 | STP East | 0.181 | 0.029 | 0.058 | | As: ND; Pb: ND |
| 11/1/2011 | 1 | STP North | 0.809 | 0.346 | 0.664 | | |
| | 2 | STP South | 0.064 | 0.028 | 0.041 | | |
| | 3 | STP East | 0.071 | 0.003 | 0.041 | | |
| 11/2/2011 | 1 | STP North | 0.365 | 0.022 | 0.063 | | |
| | 2 | STP South | 0.074 | 0.008 | 0.025 | | |
| | 3 | STP East | 0.049 | 0.004 | 0.013 | | |
| 11/3/2011 | 1 | STP North | 0.148 | 0.021 | 0.054 | | |
| | 2 | STP South | 0.063 | 0.023 | 0.036 | | |
| | 3 | STP East | 0.447 | 0.008 | 0.035 | | |
| 11/4/2011 | 1 | STP North | 0.391 | 0.047 | 0.151 | | |
| | 2 | STP South | 0.078 | 0.013 | 0.044 | | |
| | 3 | STP East | 0.331 | 0.020 | 0.055 | | |
| 11/6/2011 | 1 | STP North | 0.083 | 0.017 | 0.043 | | |
| | 2 | STP South | 0.019 | 0.003 | 0.006 | | |
| | 3 | STP East | 0.048 | 0.009 | 0.016 | | |
| 11/8/2011 | 1 | STP North | 0.019 | 0.005 | 0.010 | | As: ND; Pb: ND |
| | 2 | STP South | 0.042 | 0.001 | 0.009 | | As: ND; Pb: ND |
| | 3 | STP East | 0.014 | 0.001 | 0.010 | | As: ND; Pb: ND |
| 11/9/2011 | 1 | STP North | 0.025 | 0.000 | 0.012 | | |
| | 2 | STP South | 0.023 | 0.004 | 0.006 | | |
| | 3 | STP East | 0.035 | 0.003 | 0.01 | | |
| 11/10/2011 | 1 | STP North | 0.076 | 0.011 | 0.025 | | |
| | 2 | STP South | 0.044 | 0.004 | 0.008 | | |
| | 3 | STP East | 0.046 | 0.002 | 0.010 | | |
| 11/11/2011 | 1 | STP North | 0.104 | 0.012 | 0.028 | | |
| | 2 | STP South | 0.070 | 0.008 | 0.019 | | |
| | 3 | STP East | 0.112 | 0.010 | 0.029 | | |
| 11/12/2011 | 1 | STP North | 0.119 | 0.011 | 0.031 | | |
| | 2 | STP South | 0.097 | 0.002 | 0.014 | | |
| | 3 | STP East | 0.047 | 0.007 | 0.023 | | |

* - The site-specific action level is 2.5 mg/m$^3$



Notes:
As - Arsenic
Pb - Lead
mg/m$^3$ - Milligrams per cubic meter
N/A - Not applicable
ND - Not detected above laboratory detection limit
STEL - Short Term Exposure Limit (reported by the instrument)
STP - Small tailings pile

Table 3
Borrow Area Sample Results
Iron King Mine - Humboldt Smelter Removal
Results in milligrams per kilogram

TDD No. 02-09-11-08-0005 | Project No. 002693.2155.01RF

| Borrow Source Identifier | Sample Description | Date Collected | Analyte (Site-Specific Action Level) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Arsenic** (38) | **Lead** (23) | **Barium** (5,300) | **Cadmium** (38) | **Chromium** (2,100) | **Mercury** (6.7) | **Selenium** (380) | **Silver** (380) |
| MDI Prescott Valley | BA-1-1 | 8/31/2011 | **350** | 8.7 | 390 | <0.50 | 120 | <0.10 | <5.0 | <2.5 |
| | BA-1-2 | | **210** | <5.0 | 220 | <0.50 | 110 | <0.090 | <5.0 | <2.5 |
| G&S Prescott Valley | BA-2-1 | | 30 | <5.0 | 37 | <0.50 | 33 | <0.10 | <5.0 | <2.5 |
| | BA-2-2 | | **43** | <5.0 | 63 | <0.50 | 120 | <0.10 | <5.0 | <2.5 |
| Dewey Dirt | BA-3-1 | 9/1/2011 | 8.1 | 5.5 | 62 | <0.50 | 18 | <0.10 | <5.0 | <2.5 |
| Rainbow Valley | BA-4-1 | 9/12/2011 | <5.0 | 6.1 | 77 | <0.50 | 7.4 | <0.10 | <5.0 | <2.5 |
| | BA-4-2 | | <5.0 | 7.1 | 93 | <0.50 | 8.7 | <0.10 | <5.0 | <2.5 |
| MDI Phoenix | BA-5-1 | | 7.4 | 5.9 | 80 | <0.50 | 15 | <0.11 | <5.0 | <2.5 |
| | BA-5-2 | | 7.3 | 5.8 | 90 | <0.50 | 16 | <0.091 | <5.0 | <2.5 |
| Dewey Dirt | BA-3-2 | | 11 | 5.4 | 64 | <0.50 | 14 | <0.10 | <5.0 | <2.5 |
| | BA-3-3 | | 8.2 | 5.7 | 73 | <0.50 | 16 | <0.10 | <5.0 | <2.5 |
| G&S Prescott Valley | BA-2-3 | 9/14/2011 | 37 | 8.3 | 54 | <0.50 | 57 | <0.10 | 6.5 | <2.5 |
| | BA-2-5 | | 17 | 16 | 73 | <0.50 | 15 | <0.10 | <5.0 | <2.5 |
| Prescott Dirt | BA-7-1 | | <5.0 | <5.0 | 77 | <0.50 | 15 | <0.11 | <5.0 | <2.5 |
| Prescott Dirt | BA-7-2 | 9/16/2011 | 5.1 | <5.0 | 81 | <0.50 | 18 | <0.10 | <5.0 | <2.5 |
| | BA-7-3 | | <5.0 | <5.0 | 70 | <0.50 | 18 | <0.10 | <5.0 | <2.5 |
| 13030 E. Main Street (sampled from delivered pile) | BA-OFS-103-Top-9/22/11 | 9/22/2011 | 6.8 J | <5.0 | 69 | <0.50 | 17 | <0.10 | <5.0 | <2.5 |
| | BA-OFS-103-Common-9/22/11 | | 9.0 J | 8.2 J | 110 | <0.50 | 24 | <0.10 | <5.0 | <2.5 |
| MDI Phoenix | MDI-Glendale-Topsoil | 9/23/2011 | 11 | 6.4 | 110 J | <0.50 | 25 | <0.10 | <5.0 | <2.5 |
| | MDI-RG-Common | | 10 | 9.1 | 120 J | <0.50 | 25 | <0.10 | <5.0 | <2.5 |
| | MDI-MG-Topsoil | | <5.0 | 8.4 | 87 J | <0.50 | 12 | <0.10 | <5.0 | <2.5 |
| MDI Glendale | MDI-GD-Common-001 | 9/28/2011 | 8.9 | <5.0 | NA | NA | NA | NA | NA | NA |
| | MDI-GD-Common-002 | | 8.3 | 5.7 | NA | NA | NA | NA | NA | NA |
| Arrowhead | Arrowhead-BA-6-1 | 9/12/2011 | 11 | 8.6 | 73 | <0.50 | 4.0 | <0.10 | <5.0 | <2.5 |
| | Arrowhead-Common-001 | 9/29/2011 | 14 | 8.8 | NA | NA | NA | NA | NA | NA |
| | Arrowhead-Common-002 | | 13 | 8.8 | NA | NA | NA | NA | NA | NA |
| | Arrowhead-Common-003 | 10/4/2011 | 15 | 9.9 | NA | NA | NA | NA | NA | NA |
| | Arrowhead-Common-004 | | 15 | 11 | NA | NA | NA | NA | NA | NA |
| | Arrowhead-Common-005 | | 16 | 12 | NA | NA | NA | NA | NA | NA |
| | Arrowhead-Common-006 | | 14 | 10 | NA | NA | NA | NA | NA | NA |
| | Arrowhead-Common-007 | 10/13/2011 | 12 | 7.6 J | 77 | <0.50 | 5.5 J | <0.10 | <5.0 | <2.5 |
| | Arrowhead-Common-008 | | 12 | 8.0 J | 99 | <0.50 | 7.3 J | <0.10 | <5.0 | <2.5 |
| | Arrowhead-Common-009 | | 15 | 9.6 J | 110 | <0.50 | 7.9 J | <0.10 | <5.0 | <2.5 |
| | Arrowhead-Common-010 | | 14 | 8.9 J | 110 | <0.50 | 7.9 J | <0.10 | <5.0 | <2.5 |
| North Country | NCLS-Topsoil-001 | 9/29/2011 | <5.0 | <5.0 | NA | NA | NA | NA | NA | NA |

Notes:
J - Estimated concentration
NA - Not analyzed
Results in **bold** exceed site-specific action level

Table 4
Analytical Results for Confirmation Samples
Iron King Mine - Humboldt Smelter Removal

TDD No. 02-09-11-08-0005 | Project No. 002693.2155.01RF

| OFS Number and Address | Sample Description (depth) | Date Collected | Result (mg/kg) | |
|---|---|---|---|---|
| | | | Arsenic | Lead |
| OFS-002 (STP) 12470 East Yavapai Road | OFS-002-001-002 (excavation floor) | 10/29/2011 | 24 | 11 |
| | OFS-002-002-002 (excavation floor) | 10/29/2011 | 25 | 12 |
| | OFS-002-004-072 (gray sludge material) | 10/29/2011 | **5000** | **5100** |
| | OFS-002-006 (excavation floor) | 11/1/2011 | **42** | **42** |
| | OFS-002-007 (excavation floor) | 11/1/2011 | **110** | **71** |
| | OFS-002-008 ("berm soil") | 11/1/2011 | **86** | **85** |
| | OFS-002-009 (tailings wall) | 11/1/2011 | **1300** | **2000** |
| | OFS-002-010 (excavation floor) | 11/3/2011 | 21 | 6.1 |
| | OFS-002-011 (excavation floor) | 11/3/2011 | 18 | <5.0 |
| | OFS-002-012 (reddish "tailings") | 11/3/2011 | **190** | **31** |
| | OFS-002-013 (excavation floor) | 11/3/2011 | **43** | **25** |
| | OFS-002-014 (excavation floor) | 11/9/2011 | **67 J** | **65 J** |
| | OFS-002-016 (excavation floor) | 11/9/2011 | **50 J** | **32 J** |
| | OFS-002-017 (excavation floor) | 11/10/2011 | **200 J** | **160** |
| | OFS-002-018 (excavation floor) | 11/10/2011 | 22 J | 9.1 |
| | OFS-002-019 (excavation floor) | 11/10/2011 | **56 J** | **47** |
| OFS-103 13030 East Main Street | OFS-103 001 (2 foot) | 9/27/2011 | **62** | **180** |
| OFS-111 2925 Sweet Pea Lane | OFS-111-001 (2 foot) below shed | 9/15/2011 | **170** | **460** |
| | OFS-111-002 (1 foot) | 9/19/2011 | **84** | **460** |
| | OFS-111-003 (1 foot) | | **160** | **620** |
| | OFS-111-004 (1 foot) | | **180** | **880** |
| | OFS-111-005 (1 foot) | | **190** | **820** |
| | OFS-111-006 (2 foot) (same location as -004) | 9/26/2011 | **120** | **390** |
| | OFS-111-007 (2 foot) (same location as -002) | | **140** | **290** |
| | OFS-111-008 (2 foot) (same location as -003) | | **180** | **570** |
| | OFS-111-009 (2 foot) (same location as -005) | | **160** | **610** |
| OFS-118 2905 Sweet Pea Lane | OFS-118-001 (2 foot) | 10/6/2011 | **95** | **310** |
| | OFS-118-002 (2 foot) | | **85** | **400** |
| | OFS-118-003 (2 foot) | 10/7/2011 | **250** | **820 J** |
| | OFS-118-004 (2 foot) | | **98** | **620 J** |
| OFS-132 2875 South Third Street | OFS-132-001 (1 foot) | 9/17/2011 | **100** | **230** |
| | OFS-132-002 (1 foot) | | 20 | **52** |
| | OFS-132-003 (1 foot) | | **130** | **480** |
| | OFS-132-004 (1 foot) | | **200** | **1400** |
| | OFS-132-005 (2 foot) (same location as -004) | 10/3/2011 | **93** | **320** |
| | OFS-132-006 (2 foot) (same location as -002) | | 14 | 23 |
| | OFS-132-007 (2 foot) (same location as -001) | | **52** | **400** |
| | OFS-132-008 (2 foot) ((same location as -003) | | **150** | **660** |
| OFS-133 and OFS-119 13070 Main Street | OFS-133-001 (2 foot) | 10/11/2011 | **320** | **1000 J** |
| | OFS-133-002 (2 foot)[1] | 10/13/2011 | **71** | **220 J** |
| | OFS-133-003 (2 foot) | 10/12/2011 | **240** | **720 J** |
| | OFS-133-004 (2 foot) | 10/24/2011 | **90** | **280** |
| OFS-148 2945 Sweet Pea Lane | OFS-148-001 (1 foot) | 9/15/2011 | **180** | **760** |
| | OFS-148-002 (1 foot) | | **200** | **850** |
| | OFS-148-003 (1 foot) | | 29 | **67** |
| | OFS-148-004 (1 foot) | 9/16/2011 | **120** | **470** |
| | OFS-148-006 (2 foot) (same location as -003) | 9/21/2011 | **69 J** | **450 J** |
| | OFS-148-007 (2 foot) (same location as -002) | | **120 J** | **470 J** |
| | OFS-148-008 (2 foot) (same location as -001) | | **290 J** | **1500 J** |
| | OFS-148-009 (2 foot) (same location as -004) | | **93 J** | **380 J** |
| OFS-208 and OFS-244 2575 Hill Street/2565 Hill Street | OFS-244/208 (2 foot) | 10/3/2011 | 26 | 18 |
| OFS-260 City Right-of-Way | OFS-260-001 (pothole composite, 1foot) | 9/27/2011 | **220** | **870** |
| | OFS-260-002 (composite, 2 foot) | 10/5/2011 | **200** | **700** |
| | OFS-260-003 (partial pothole composite, 2 foot) | | **75** | **330** |
| OFS-301 2965 Sweet Pea Lane | OFS-301-001 (2 foot) outside of fence | 9/26/2011 | **110** | **770** |
| | OFS-301-002 (2 foot) | 9/27/2011 | **69** | **230** |
| OFS-306 13087 East Main Street 13089 East Main Street | OFS-306-001 (1 foot) | 9/17/2011 | 23 | **41** |
| | OFS-306-002 (1 foot) | | **54** | **81** |
| | OFS-306-003 (2 foot) (same location as -001) | 9/26/2011 | 29 | **59** |
| | OFS-306-004 (2 foot) (same location as -002) | | **52** | **180** |

Notes:
J - Estimated concentration
mg/kg - milligrams per kilogram
Results in **bold** exceed the site-specific action levels for arsenic or lead of 38 mg/kg or 23 mg/kg, respectively.
[1] - This sample is from the area on the southeast side of OFS-133 and northwest side of OFS-119.

Table 5
STP Gray Sludge Material CAM-17 Metals and Total Cyanide Results
STP Sample ID IKMHSR-OFS-002-004-072
Iron King Mine - Humboldt Smelter Removal
Sample Collected October 29, 2011
Results in milligrams per kilogram

TDD No. 02-09-11-08-0005 Project No. 002693.2155.01RF

| Analyte | TTLC | Site-Specific Action Level | Sample Result |
|---|---|---|---|
| Antimony | 500 | none | 40 J |
| Arsenic | 500 | 38 | **5,000** |
| Barium | 10,000 | 5,300 | 26 |
| Beryllium | 75 | none | <0.50 |
| Cadmium | 100 | 38 | **120** |
| Chromium | 2,500 | 2,100 | 13 |
| Cobalt | 8,000 | none | 18 |
| Copper | 2,500 | none | 800 |
| Lead | 1,000 | 23 | 5,100 |
| Mercury | 20 | 6.7 | **17** |
| Molybdenum | 3,500 | none | 5.2 |
| Nickel | 2,000 | none | 14 |
| Selenium | 100 | 380 | 31 |
| Silver | 500 | 380 | 36 |
| Thallium | 700 | none | <5.0 |
| Vanadium | 2,400 | none | 29 |
| Zinc | 5,000 | none | **48,000** |
| Total Cyanide | NA | none | 1.9 |

Notes:
CAM-17 - California Assessment Manual 17 metals
J - Estimated concentration
NA - Not applicable
TTLC - California Title 22 Total Threshold Limit Concentration
Results in **bold** exceed site-specific action levels

# D4. Addendum to Removal Report (Ecology and Environment, Inc., 2013)

**ecology and environment, inc.**
International Specialists in the Environment

3700 Industry Avenue, Suite 102
Lakewood, California 90712
Tel: (562) 997-1200, Fax: (562) 391-4486

July 11, 2013

TDD No. 02-09-11-08-0005
E&E Project No. 002693.2155.01RF
Contract No. EP-S5-08-01

Craig Benson, Federal On-Scene Coordinator
United States Environmental Protection Agency
Emergency Response Section
2445 N. Palm Drive, Suite 100
Signal Hill, CA 90755

**Subject:** **Addendum to Iron King Mine – Humboldt Smelter Removal Report**
Latitude: 34.503043° north; Longitude: 112.243559° west

## INTRODUCTION

This addendum to the Iron King Mine – Humboldt Smelter Removal Report describes United States Environmental Protection Agency, Emergency Response Section (U.S. EPA) site restoration activities conducted at the Iron King Mine – Humboldt Smelter site in Dewey-Humboldt, Arizona, after the final removal report had been submitted. A severe storm that occurred on July 14, 2012, caused soil erosion around some areas that had undergone U.S. EPA soil remediation and backfilling activities in late 2011. According to the U.S. EPA, the storm was a 50-year storm event.

The 2011 activities conducted by the U.S. EPA with support from Ecology and Environment's Superfund Technical Assessment and Response Team (START) are described in the START document, *Iron King Mine – Humboldt Smelter Removal Report, Dewey-Humboldt, Yavapai County, Arizona* (June 2012). The removal work was conducted in order to remove arsenic- and lead-contaminated soil from certain properties in the town of Dewey-Humboldt, as well as to remove a small tailings pile (STP) from a private property located adjacent to the Iron King Mine. When the U.S. EPA removed the STP, it also restored a natural water channel leading from the Iron King Mine property.

## SITE RESTORATION ACTIVITIES

On August 15, 2012, U.S. EPA Federal On-Scene Coordinator (FOSC) Marty Powell, a representative of the START, a representative of the U.S. EPA's Emergency and Rapid Response Services (ERRS) contractor, and a representative from the U.S. EPA's Environmental Response Team (ERT) visited the site to survey the storm damage and obtain measurements for a plan of action to rectify the erosion damage. Erosion was found between homes on Sweet Pea Lane, specifically between the properties known as OFS-132 and OFS-118; between OFS-118 and

OFS-111; between OFS-111 and OFS-148; and between OFS-148 and OFS-301. Erosion was also found running through property OFS-111. The properties are shown on Figure 1. On the embankment immediately northeast of these properties (on a city of Dewey-Humboldt parcel known as OFS-260), deep erosion channels were found, and these erosion channels cut across the surface of OFS-260 to flow onto the residential property to the northeast of OFS-260 known as OFS-306. The OFS-306 property received the bulk of the silt carried from the other properties by the runoff, and therefore the southern and southwestern areas of OFS-306 were somewhat silted in. Although channels had been cut into the various properties, the channel depths did not reach down below 2 feet below ground surface (bgs) into still-contaminated soil left in place below a snow fence barrier in 2011. The spillway into the area of the former STP at Iron King Mine was also eroded, and it was apparent that a redirection of water flow would be required.

In the following weeks, ERT's contractor, Lockheed Martin's Scientific, Engineering, Response, and Analytical Services (SERAS) prepared a *Site Restoration Preliminary Design* (October 10, 2012) that included the addition of French drains and diversion channels; the fortification of rock-lined spillways; and soil grading and berm construction activities. This document is archived in the project file.

Site restoration activities were conducted from November 5 through November 17, 2012. All work was conducted in accordance with the SERAS document, *Site Restoration Preliminary Design*, but with modifications determined to be necessary at the time of field work based on site conditions. A representative of SERAS was on site during the site restoration activities and verbally approved all design modifications.

Prior to doing any work on any particular property, the U.S. EPA obtained the property owner's signature on a Property Assessment Form that specifically described the work the U.S. EPA intended to do. Upon completion of the work, the U.S. EPA again obtained the owner's signature approving the work conducted. The signed Property Assessment Forms are in the project file.

The ERRS installed three French drains and a swale on properties along Sweet Pea Lane and fortified (through the use of additional rock) six spillways on the slope below the French drains and swale. The French drains were constructed using 8-inch perforated pipe and 1-inch gravel, with pea gravel spread well beyond the trench at surface to provide a conduit for water flow into the drains. The French drains were directed into rock-lined spillways built into the side of the slope leading down from the properties located on Sweet Pea Lane onto the OFS-260 parcel. A rock-filled swale was added to the back (northeast) side of property OFS-111 to direct surface water flow into adjacent spillways, and rocks and ground contouring were added to OFS-111 to deter water runoff across the property. Trenches for French drains and the swale were lined with geotextile fabric, as were the spillways. Silt was removed from the southern and southwestern portions of OFS-306, and these areas were then graded to specifications provided by the property owner. The removed silt was replaced on the OFS-260 property. Compacted-soil berms were then installed on the southern and southwestern sides of OFS-306. The locations of the drains, spillways, and berms installed or modified during the November 2012 work are shown on Figure 1.

In addition to the restoration work conducted in the vicinity of Sweet Pea Lane, the ERRS

Source: Aerial Photography - Bing Maps


November 2012 Modifications

- Rock-lined spillway
- Swale
- Compacted soil berm
- French drain

Approximate property boundary

N

0 100 feet

Figure 1

U.S. EPA Modifications to Properties On or Near Sweet Pea Lane

Dewy-Humboldt, Arizona

modified the spillway at the former STP, using an excavator to reshape ground contours and to strategically arrange large boulders to better reduce the energy of water flow.

During all construction activities, the START maintained a weather station with logging capability to monitor and log on a per-minute basis parameters such as wind direction, wind speed, temperature, and other parameters. The resultant data are archived in the START project file.

Photo documentation of the November 2012 construction activities is provided in Attachment A.

## START SAMPLING AND AIR MONITORING

Soil and air samples were collected by the START during the construction activities to ensure that import material and breathing-zone dust were not contaminated with arsenic or lead. All sampling was conducted following guidelines provided in the Sampling and Analysis Plan appendix to the START's June 2012 *Iron King Mine – Humboldt Smelter Removal Report.* A START chemist conducted a Tier 2 data validation of all resultant sample data in accordance with the U.S. EPA Quality Assurance/Quality Control (QA/QC) Guidance for Removal Activities, Sampling QA/QC Plan and Data Validation Procedures (EPA/540/G-90/004 OSWER Directive 9360.4-01, dated April 1990). All data were found to be acceptable for use as definitive data. The data validation reports are archived in the project file. Laboratory data sheets are provided in Attachment B.

Upon completion of French drain and rock spillway construction in the vicinity of Sweet Pea Lane, the ERRS imported backfill material (1.5-inch AB roadbed) to the site to allow for better grading of the OFS-260 property. A sample of this backfill material was collected by the START in duplicate and submitted to TestAmerica Laboratory in Phoenix, Arizona (TestAmerica) to be analyzed for total arsenic and lead. The results for the import material samples are provided in Table 1. The results did not exceed site-specific action levels for arsenic or lead.

Table 1

Analytical Results for Import Material Samples Collected in November 2012

Iron King Mine - Humboldt Smelter Removal

TDD No. 02-09-11-08-0005 Project No. 002693.2155.01RF

| | | Result (mg/kg) | |
|---|---|---|---|
| **Sample ID** | **Date Collected** | **Arsenic** | **Lead** |
| IKMHSR-OFS-260-2 | 11/15/2012 | 13 | 9.0 |
| IKMHSR-OFS-260-4 (duplicate of 260-2) | 11/15/2012 | 12 | 10 |

Notes:
mg/kg = milligrams per kilogram
The current site-specific action levels for arsenic and lead are 38 mg/kg and 23 mg/kg, respectively.

The START conducted continuous air monitoring and air sampling on every day that operations involving soil movement occurred. Three air stations were placed about the perimeter of the removal activities in an upwind, downwind, and crosswind configuration. Each air station included one dust monitor equipped with data logging capability and alarm and one air sampler comprised of an air pump and attached mixed cellulose ester cartridge. Air monitors were set to alarm at 2.5 milligrams per cubic meter ($mg/m^3$), the action level specified in the Work Plan for the 2011 removal work. Air monitoring instruments were zeroed at the beginning of each day, and air sampling pump flow rates were logged at the beginning and end of each day. Air monitoring results were logged on a per-minute basis and the results downloaded and archived at the end of each day. No air monitoring maximum per-minute average exceeded the action level of 2.5 $mg/m^3$. All air monitoring data have been archived in the project file.

One set of air samples was submitted to TestAmerica to be analyzed for total arsenic and lead. The analytical results for the air samples are provided in Table 2. None of the air samples were found to contain detectable concentrations of arsenic or lead. Air samples that were not analyzed have been archived by the START.

Table 2

Analytical Results for One Set of Air Samples Collected During October - November 2012 Renovation Activities

Iron King Mine - Humboldt Smelter Removal

TDD No. 02-09-11-08-0005 Project No. 002693.2155.01RF

| Sample ID | Date Collected | Result ($mg/m^3$) | |
|---|---|---|---|
| | | **Arsenic** | **Lead** |
| IKMHSR-11/13/12-AIR-1 | 11/13/2012 | <0.00240 | <0.000300 |
| IKMHSR-11/13/12-AIR-2 | 11/13/2012 | <0.00240 | <0.000300 |
| IKMHSR-11/13/12-AIR-3 | 11/13/2012 | <0.00235 | <0.000296 |
| IKMHSR-11/13/12-FB | 11/13/2012 | ND | ND |

Notes:
FB = field blank
$mg/m^3$ = milligrams per cubic meter
ND - not detected above laboratory detection limit. Based on an ND value for total micrograms on filter.



## SUMMARY

In November 2012, the U.S. EPA conducted site restoration activities at the Iron King Mine – Humboldt Smelter site in order to correct erosion damage that occurred during a severe storm. Three French drains and a swale were constructed; spillways were fortified; silt infiltration was corrected; and compacted soil berms were emplaced. No further actions or U.S. EPA activities are expected to occur at the site.

Respectfully submitted,

Michael Schwennesen
START Member

Attachments:
Attachment A: Photo Documentation
Attachment B: Laboratory Data Sheets

cc: File; EDS

# ATTACHMENT A
# Photo Documentation

**ECOLOGY AND ENVIRONMENT, INC.**
**Superfund Technical Assessment and Response Team**
Addendum to Iron King Mine – Humboldt Smelter Removal
Dewey-Humboldt, Arizona

E&E Project. No.: 002693-2155 TDD No: TO2-09-11-08-0005 Contract No. EP-S5-08-01

**PHOTO 1**
**Date**: 8/15/12
**Direction**: Northeast
**Photographer**: M. Schwennesen, START
**Description**: ERRS and ERT personnel survey erosion damage leading across OFS-260. OFS-306 is visible in the background.

**PHOTO 2**
**Date**: 11/7/12
**Direction**: East
**Photographer**:
M. Schwennesen, START
**Description**: Erosion running through OFS-111 property.

**PHOTO 3**
**Date**: 11/7/12
**Direction**: Northeast
**Photographer**:
M. Schwennesen, START
**Description**: Erosion damage leading from OFS-118 onto OFS-260.

**PHOTO 4**
**Date**: 11/09/12
**Direction**: West
**Photographer**:
M. Schwennesen, START
**Description**: Erosion damage leading from Iron King Mine property at spillway in area of former STP.

**PHOTO 5**
**Date**: 11/10/12
**Direction**: Northeast
**Photographer**:
M. Schwennesen, START
**Description**: French drain installation in progress at OFS-118.

**PHOTO 6**
**Date**: 11/10/12
**Direction**: Northeast
**Photographer**: M. Schwennesen, START
**Description**: French drain installation continued, OFS-118.

**PHOTO 7**
**Date**: 11/10/12
**Direction**: Northeast
**Photographer**:
M. Schwennesen, START
**Description**: Pea gravel being spread over completed French drain at OFS-118.

**PHOTO 8**
**Date**: 11/13/12
**Direction**: South east
**Photographer**:
M. Schwennesen, START
**Description**: Swale construction in progress at OFS-111.

**PHOTO 9**
**Date**: 11/14/12
**Direction**: Southeast
**Photographer**:
M. Schwennesen, START
**Description**: Compacted soil berm placed on the southwest perimeter of OFS-306. OFS-260 (on the right) has been regraded.

**PHOTO 10**
**Date**: 11/16/12
**Direction**: South
**Photographer**:
M. Schwennesen, START
**Description**: Rebuilt spillways leading onto OFS-260.

# ATTACHMENT B
# Laboratory Data Sheets

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

4625 East Cotton Center Blvd. Ste 189 Phoenix, AZ 85040 * (602) 437-3340 * Fax (602) 454-9303

| | | | |
|---|---|---|---|
| Ecology and Environment - Lakewood<br>3700 Industry Ave, Suite 102<br>Lakewood, CA 90712<br>Mindy Song | Work Order: PVK1217<br><br>Project: Iron King Mine - Humboldt Smelter Removal<br>Project Number: 002693.2155.01RF06 | Received: 11/16/12<br>Reported: 11/26/12 16:20 | |

## ANALYTICAL REPORT

| Analyte | Result | | | Qual | Date Analyzed | Analyst | Rpt Limit ug, Total | Method |
|---|---|---|---|---|---|---|---|---|
| **Metals using ICP-AES by NIOSH 7300 (Modified)** | | | | | | | | |
| **Sample ID: PVK1217-01 (IKMHSR-11/13/12-AIR 1)** | | **Filter** | | **Sample Air Volume: 1041L** | | | **Sampled: 11/13/12** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/21/12 09:26** | |
| Arsenic | <2.50 | <0.00240 | <0.000784 | | 11/21/2012 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | <0.000300 | <0.0000354 | | 11/21/2012 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PVK1217-02 (IKMHSR-11/13/12-AIR 2)** | | **Filter** | | **Sample Air Volume: 1041L** | | | **Sampled: 11/13/12** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/21/12 09:26** | |
| Arsenic | <2.50 | <0.00240 | <0.000784 | | 11/21/2012 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | <0.000300 | <0.0000354 | | 11/21/2012 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PVK1217-03 (IKMHSR-11/13/12-AIR 3)** | | **Filter** | | **Sample Air Volume: 1064L** | | | **Sampled: 11/13/12** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/21/12 09:26** | |
| Arsenic | <2.50 | <0.00235 | <0.000767 | | 11/21/2012 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | <0.000293 | <0.0000346 | | 11/21/2012 | bb | 0.312 | NIOSH 7300 |
| **Sample ID: PVK1217-04 (IKMHSR-11/13/12-AIR FB)** | | **Filter** | | **Sample Air Volume: L** | | | **Sampled: 11/13/12** | |
| | ug, Total | mg/m3 | ppm | | | | **Prepared: 11/21/12 09:26** | |
| Arsenic | <2.50 | -- | -- | | 11/21/2012 | bb | 2.50 | NIOSH 7300 |
| Lead | <0.312 | -- | -- | | 11/21/2012 | bb | 0.312 | NIOSH 7300 |

1/4/2013

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

4625 East Cotton Center Blvd. Ste 189, Phoenix, AZ 85040 (602) 437-3340 Fax:(602) 454-9303

Ecology and Environment - Lakewood
3700 Industry Ave, Suite 102
Lakewood, CA 90712
Attention: Mike Schwennesen

Project ID: 002693.2155.01RF

Report Number: PVK1212

Sampled: 11/15/12
Received: 11/16/12

## TOTAL METALS

| Analyte | Method | Batch | Reporting Limit | Sample Result | Dilution Factor | Date Extracted | Date Analyzed | Data Qualifiers |
|---|---|---|---|---|---|---|---|---|
| **Sample ID: PVK1212-01 (IKMHSR-OFS-260-RB-2 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 12K0880 | 5.0 | **13** | 0.99 | 11/23/2012 | 11/26/2012 | |
| **Lead** | EPA 6010B | 12K0880 | 5.0 | **9.0** | 0.99 | 11/23/2012 | 11/26/2012 | |
| **Sample ID: PVK1212-02 (IKMHSR-OFS-260-RB-4 - Soil)** | | | | | | | | |
| **Reporting Units: mg/kg** | | | | | | | | |
| **Arsenic** | EPA 6010B | 12K0880 | 5.0 | **12** | 0.991 | 11/23/2012 | 11/26/2012 | |
| **Lead** | EPA 6010B | 12K0880 | 5.0 | **10** | 0.991 | 11/23/2012 | 11/26/2012 | |

1/4/2013

**TestAmerica Phoenix**

Carlene McCutcheon For Denise Harrington
Project Manager

# D5. Technical Memorandum: Accelerated Residential Sampling (Lockheed Martin SERAS, 2013c)

Lockheed Martin Information Systems & Global Solutions (IS&GS – Civil)
Environmental Services SERAS
2890 Woodbridge Avenue, Building 209 Annex
Edison, NJ 08837-3679
Telephone 732-321-4200, Facsimile 732-494-4021

DATE: October 30, 2013

TO: Terrence Johnson, Ph.D., U.S. EPA/ERT Work Assignment Manager

THROUGH: Rick Leuser, SERAS Deputy Program Manager
David Aloysius, SERAS Task Leader

FROM: Scott Grossman, SERAS Subtask Leader

SUBJECT: **ACCELERATED RESIDENTIAL SAMPLING**
**IRON KING MINE AND HUMBOLDT SMELTER SUPERFUND SITE**
**DEWEY-HUMBOLDT, ARIZONA**
**WORK ASSIGNMENT SERAS 0-146: TECHNICAL MEMORANDUM**

## INTRODUCTION

This technical memorandum presents the results of a field portable x-ray fluorescence (XRF) screening assessment for lead and arsenic in soil samples collected at the Site: a cluster of ten residential properties in the vicinity of the Jones Street -Wells Street intersection in the Dewey-Humboldt district. Eight of the properties are single dwelling, however two of the properties have multiple dwellings—13300 Wells Street has four homes and 13330 Wells Street has two homes (Figure 1). The samples were collected between 13 and 15 August, 2013. The Site action levels or removal criteria set by the US EPA Region 9 (Region) were 400 and 150 milligrams per kilogram (mg/kg) for lead and arsenic, respectively. In this report, XRF soil concentrations exceeding the lead and/or arsenic site action levels are referred to as elevated; areas with elevated concentrations are referred to as impacted. The objectives of this assessment were:

(1) Delineate the area with elevated lead and arsenic concentrations.
(2) Estimate the volume of contaminated soil to be removed and replaced with “clean” fill in a follow-up, time-critical removal.

A minimum of 10 percent (%) of the XRF screened soil samples were shipped by SERAS to a Contract Laboratory Program (CLP) laboratory for confirmation analysis (Target Analyte List [TAL] metals). Soil samples from yards exceeding the action limits were composited and submitted for Toxicity Characteristic Leaching Procedure (TCLP) extraction and analysis for Resource Conservation and Recovery Act (RCRA) eight metals (arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury).

## SITE BACKGROUND

The Iron King-Humboldt-Smelter Superfund site is located in Dewey Humboldt, Yavapai County, Arizona. The Iron King-Humboldt-Smelter Superfund site is a combination of sources and releases from two areas: the Iron King Mine and the Humboldt Smelter. A portion of the Town of Dewey-Humboldt is situated between the Mine and the Smelter. Three waterways (Chaparral Gulch, Galena Gulch, and Agua Fria River) also transect the Iron King-Humboldt-Smelter Superfund site. The Iron King Mine occupies approximately 153 acres. The Iron King Mine is bordered by Chaparral Gulch to the north, Galena Gulch to the south, Highway 69 to the east, and undeveloped land to the west. The Main Tailing Pile on the Mine covers over 55 acres, is over 100-feet high and contains over 6,000,000 cubic yards of tailings. The Humboldt Smelter occupies approximately 182 acres. This area is covered in approximately 763,800 square feet of yellow-orange tailings, over 1 million square feet of grey smelter ash, and 456,000 square feet of slag. These mine and smelter wastes are sources of lead and arsenic contamination to neighboring residential soils through air transport, surface deposition, and in some cases was used as yard fill material. The Region has tasked the ERT to conduct a data gap assessment in support of the Site remedial investigation.

In August 2013, the Region requested that ERT/SERAS conduct a removal action assessment of lead and arsenic concentrations in soil in a cluster of residential properties located near the intersection of Wells Street and Jones Street in the district of Dewey Humboldt.

## METHODS

### Soil Sampling

Soil sample locations provided by the Region were located in the field and a pin flag with a unique identifier was placed at each location. Sample location identifiers consisted of an alphanumeric string, the first part of which was the truncated property address with a trailing sample location number: for example, sample location number 10 at 13330 Wells Street was designated 30W-010. Soil sample identifiers consisted of the location identifier followed by a trailing integer for the sampling depth (1=> 0” to 2”, 2 => 10” to 14”, 3 = >22” to 26” and 4 => 34” to 38”). For example sample 30W-002-1, was collected at sample location two at 13330 Wells Street at a depth of 0 to 2” (surface).

A surface soil sample was collected at each location using a decontaminated stainless steel trowel. At a subset of locations with elevated lead and arsenic concentrations, follow-up subsurface sampling was done at one-, two- and three-foot depths. These deeper samples were collected with a decontaminated hand-held soil auger, transferred to a dedicated aluminum pan and homogenized. All soil samples were placed in a self-sealing plastic bag and labeled with the sample identifier and date and time of collection.

The position of all sample locations and that of several discrete suspected mine tailings piles were obtained using differentially corrected global positioning system (GPS) (Figure 1).

### XRF Field Analysis

A NITON XLt792YW XRF (S/N 8262) analyzer was used to analyze soil samples for lead and arsenic. The NITON XLt792YW XRF measurement times (instrument live-time) were 120 seconds for measurement condition 1 (Filt1 for lead, arsenic) and 30 seconds for measurement condition 2 (Filt2).

Sample preparation, analysis, and quality assurance/quality control (QA/QC) procedures used in this study conform to those described in the SERAS Standard Operating Procedure (SOP) #1720, *Operation of the NITON XLt792YW Field Portable X-ray Fluorescence Unit*.

All samples were brought to a central location for XRF screening. Soil samples were received in labeled plastic bags and were mixed well prior to analysis. Each sample, including the plastic bag, was placed in the NITON portable test stand above the NITON XLt792YW analyzer, the safety shield was closed, and analysis was initiated with the measurement times previously noted. Initially, all sample bags were analyzed twice (front and back of the bag). But later, to expedite the sample analysis and based on the consistency between the two analyses, only samples containing lead concentrations exceeding 200 mg/kg were analyzed twice. For samples where two XRF measurements were collected, the summary data contains the average of both readings. If one measurement was below the reporting limit (RL), the RL was used to calculate the average.

XRF analysis results for each sample were saved in the NITON XLt792YW internal data logger memory and the data were downloaded and archived on a USB drive on a daily basis. Target element (arsenic and lead) results for each analyzed sample and standard were logged into the NITON XLt792YW field logbook. Target element results were qualified using the field method detection limits (MDLs) and RLs; the results are considered preliminary or screening data (SD) data only.

The reliability of the NITON XLt792YW XRF unit and application model was evaluated during the site visit. The Detector Calibration (energy calibration and detector resolution check) was performed at the beginning of the day to ensure that proper instrument calibration was maintained and that the detector resolution was adequate for producing reliable X-ray intensity measurements. The NITON XLt792YW Standard Soil application was verified at the beginning of the day for the target elements. This was accomplished by analyzing Sand and silicon dioxide ($SiO_2$) blanks, and National Institute of Standards and Technology (NIST) Standard Reference Materials (SRMs) #2709A, #2710A, #2711A, and #2586. Energy calibration checks, detector resolution checks, and application verification results were recorded in the NITON XLt792YW field logbook (SERAS-L-0359). All values were within specification for all target elements.

A low concentration standard, NIST SRM #2709A, was analyzed at the beginning of the day and periodically during sample analysis to establish statistically-derived MDLs for the target elements. The certified concentrations for the target elements in SRM 2709A were: arsenic=10.5, and lead =17.3 mg/kg. The sample standard deviation for these analyses was used to calculate the NITON XLt792YW MDL for each target element. The MDL was calculated as:

$$MDL = t(n-1,99) * \Phi s$$

where:

$t(n-1,99)$ = student's t-value for a 99% confidence level and a standard deviation estimate with n–1 degrees of freedom

$\Phi s$ = sample standard deviation (n–1 degrees of freedom).

Typically the RL is 2-5 times the statistical MDL. The project specific XRF RLs were 50 mg/kg for lead and 35 mg/kg for arsenic; results below the RL were qualified as non-detect (U). Due to severe spectral overlap between lead and arsenic, the arsenic RL was raised to 1/10 of the lead concentrations in samples where the lead concentration exceeded 350 mg/kg.

Samples for Laboratory Analysis

A minimum of 10% the samples were selected for confirmation of the XRF results at a fixed laboratory. These samples were transferred to 8-ounce glass jars and sent to a CLP laboratory for TAL metals analyses.

Three composite samples for TCLP analysis were made from soil samples collected in the impacted areas: composite B contained all the surface samples from along the fence line at 13330 Wells Street; composite C contained all the subsurface samples along the fence line at 13330 Wells Street; and composite D contained surface samples from the front yard and side of the yard at 13336 Wells Street (Figure 1). Composite samples were homogenized prior to being placed in a 32-ounce glass jar. Samples were submitted to the EPA Region 9 laboratory for TCLP extraction and analysis for eight RCRA metals (arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury).

**RESULTS**

Field XRF Soil Concentrations

A total of 254 surface soil samples and 27 subsurface samples were collected between 13 and 15 August 2013 from the ten residential properties (Table 1). Figure 1 shows the sample locations and also outlines five discrete suspected mine tailings piles on 2698 Old Black Canyon Highway.

Table 2 and Figures 2 & 3 summarize the surface XRF soil lead and arsenic concentrations. Overall, approximately 7% of the surface soil samples contained elevated lead and arsenic concentrations. Most of the elevated lead and arsenic samples were clustered at a contiguous area at 13330 and 13336 Wells Street (Figures 2 and 3). The highest XRF soil concentrations were found at 13336 Well Street: 2,095 and 654 mg/kg for lead and arsenic, respectively. With exception of three localized hot spots at 2655 and 2670 Jones Street, all other surface samples were below the action levels for lead and arsenic (Figures 2 and 3).

A subset of the elevated sample locations were resampled for subsurface samples. Subsurface samples were collected at approximately one-, two-, and three-foot depth. A total of nine locations were sampled for subsurface soils: three locations at 13330 Wells Street and six locations at 13336 Wells Street. Note that the isolated sample locations with elevated concentrations were not resampled. Soil XRF results for the nine locations with subsurface sampling are summarized in Table 3 and Figure 4. Two of the three sample locations at 13330 Wells Street had elevated subsurface lead and arsenic concentrations (Figure 4). For the six locations sampled in the subsurface at 13336 Wells Street, all had lead and arsenic concentrations below the MDL.

Laboratory Confirmation of XRF

Table 4 contains TAL metal results for the 30 samples submitted to a CLP laboratory for laboratory confirmation of the XRF data. There was a strong correlation between lead (coefficient of determination of 0.86) and arsenic (coefficient of determination of 0.87) for the XRF and fixed laboratory analytical results. Both coefficients of determination far exceeded the criteria (coefficient of determination greater than 0.70) for XRF confirmation analysis, identified in SERAS SOP #1720, *Operation of the Niton XLt792YW Field Portable X-Ray Fluorescence Unit.* To achieve a coefficient of determination for arsenic greater than 0.7, one outlier data point had to be removed (Appendix A). Table 5 provides a comparison of the laboratory confirmation data with the XRF screening data. Appendix A contains the details of the statistical validation of the XRF lead and arsenic data, Appendix B contains the XRF field data report and Appendix C contains the CLP Analytical Report for TAL metals.

TCLP Analytical Results

Three composite samples collected from 13330 Wells Street and 13336 Wells Street were submitted for TCLP analysis through the EPA Region 9 laboratory. As summarized in Table 6, concentrations for all eight metals were below the RCRA levels for disposal. The TCLP laboratory analytical report is in Appendix D.

**REMOVAL ASSESSMENT**

Since the XRF soil lead concentrations are higher than those of arsenic--relative to their respective site action levels-- removal areas were delineated using the XRF soil lead concentration data. Removal areas were conservatively defined as XRF soil concentrations above 300 mg/kg lead. Five removal areas were delineated (Figure 5). One primary removal area (P1) was delineated at a relatively large contiguous contaminated area at 13330 and 13336 Wells Street.; four secondary removal areas (P2 to P5) were delineated at the isolated hot spots: three at 2670 Jones Street (P2, P4 and P5) and one at 2655 Jones Street (P3).

For removal volume estimation, area P1 was divided into two areas: P1A and P1B (Figure 5). Elevated lead and arsenic concentrations were found down to the three-foot depth at P1B - 13330 Wells Street, however, elevated concentrations were found in only surface samples at P1A - 13336 Wells St (Figures 4 and 5). During a conversation with occupants at 13330 Wells Street, they told EPA personnel that the original surface fill material in that yard was removed and replaced. The removed fill was subsequently deposited against the western and northern property fence forming an elongated, approximately two-foot high, L-shaped mound (Figure 5). A three-foot depth was used to estimate the removal volume at P1B; a one-foot depth was used everywhere else. Table 7 is a breakdown of the removal volumes by areas; the total removal volume of 341 cubic yards is estimated. Soil should be excavated down to the target depth and replaced with “clean fill”. For Area P1B (the L-shaped mound), the two-foot mound should be removed first, followed by excavating down to one-foot depth. Post excavation confirmation sampling is recommended to support the removal action. To accommodate the removal, the western segments of property fences at 13330 and 13336 Wells Street the dividing fence between the two properties will need to be removed and replaced.

cc: Central Files, Work Assignment No. SERAS-146
Electronic File I:\Archive\SERAS-146\D\TM\103013
Dennis Miller, SERAS Program Manager

# TABLES
# Iron King Mine Site
# Technical Memorandum
# October 2013

TABLE 1
Property IDs and Sample Numbers
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

| Property ID | Address | Number of Surficial Soil Samples | Number of Subsurface Soil Samples | Number Exceeding Removal Criteria (300 mg/kg for Pb and 150 mg/kg for As) | |
|---|---|---|---|---|---|
| | | | | Lead | Arsenic |
| 00W | 13300 Wells Street, Dewey, AZ 86327 | 28 | 0 | 1 | 0 |
| 30W | 13330 Wells Street, Dewey, AZ 86327 | 24 | 9 | 5 | 3 |
| 36W | 13336 Wells Street, Dewey, AZ 86327 | 27 | 18 | 15 | 11 |
| 40W | 13340 Wells Street, Dewey, AZ 86327 | 15 | 0 | 0 | 0 |
| 45J | 2645 Jones Street, Dewey, AZ 86327 | 21 | 0 | 0 | 0 |
| 55J | 2655 Jones Street, Dewey, AZ 86327 | 18 | 0 | 1 | 0 |
| 60J | 2660 Jones Street, Dewey, AZ 86327 | 20 | 0 | 0 | 0 |
| 70J | 2670 Jones Street, Dewey, AZ 86327 | 31 | 0 | 4 | 3 |
| 80J | 2680 Jones Street, Dewey, AZ 86327 | 33 | 0 | 0 | 0 |
| 85J | 2685 Jones Street, Dewey, AZ 86327 | 37 | 0 | 0 | 0 |
| Total Samples | | 254 | 27 | 26 | 17 |

Table 2
XRF Lead and Arsenic Surface (0 to 2 inches) Data
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

| Sample Number | Sample Location | Lead (mg/kg) | | Arsenic (mg/kg) | |
|---|---|---|---|---|---|
| | | Concentration | RL | Concentration | RL |
| 00W-001-1 | 00W-001 | 128 | 50 | 42 | 35 |
| 00W-002-1 | 00W-002 | 188 | 50 | 82 | 35 |
| 00W-003-1 | 00W-003 | 138 | 50 | 64 | 35 |
| 00W-004-1 | 00W-004 | 167 | 50 | 41 | 35 |
| 00W-005-1 | 00W-005 | **468** | 50 | 111 | 46.8 |
| 00W-006-1 | 00W-006 | 88 | 50 | 63 | 35 |
| 00W-007-1 | 00W-007 | 88 | 50 | 49 | 35 |
| 00W-008-1 | 00W-008 | 81 | 50 | 40 | 35 |
| 00W-009-1 | 00W-009 | 134 | 50 | 35 U | 35 |
| 00W-010-1 | 00W-010 | 114 | 50 | 38 | 35 |
| 00W-011-1 | 00W-011 | 63 | 50 | 35 U | 35 |
| 00W-012-1 | 00W-012 | 52 | 50 | 35 U | 35 |
| 00W-013-1 | 00W-013 | 79 | 50 | 35 U | 35 |
| 00W-014-1 | 00W-014 | 79 | 50 | 35 U | 35 |
| 00W-015-1 | 00W-015 | 50 U | 50 | 35 | 35 |
| 00W-016-1 | 00W-016 | 70 | 50 | 35 U | 35 |
| 00W-017-1 | 00W-017 | 54 | 50 | 35 U | 35 |
| 00W-018-1 | 00W-018 | 71 | 50 | 35 U | 35 |
| 00W-019-1 | 00W-019 | 80 | 50 | 35 U | 35 |
| 00W-020-1 | 00W-020 | 52 | 50 | 35 U | 35 |
| 00W-021-1 | 00W-021 | 65 | 50 | 35 U | 35 |
| 00W-022-1 | 00W-022 | 272 | 50 | 94 | 35 |
| 00W-023-1 | 00W-023 | 68 | 50 | 35 U | 35 |
| 00W-024-1 | 00W-024 | 88 | 50 | 35 U | 35 |
| 00W-025-1 | 00W-025 | 61 | 50 | 35 U | 35 |
| 00W-026-1 | 00W-026 | 85 | 50 | 35 U | 35 |
| 00W-027-1 | 00W-027 | 56 | 50 | 35 U | 35 |
| 00W-028-1 | 00W-028 | 74 | 50 | 45 | 35 |
| 30W-001-1 | 30W-001 | 279 | 50 | 84 | 35 |
| 30W-002-1 | 30W-002 | 143 | 50 | 35 U | 35 |
| 30W-003-1 | 30W-003 | 146 | 50 | 35 U | 35 |
| 30W-004-1 | 30W-004 | 91 | 50 | 35 U | 35 |
| 30W-005-1 | 30W-005 | 90 | 50 | 35 U | 35 |
| 30W-006-1 | 30W-006 | 137 | 50 | 39 | 35 |
| 30W-007-1 | 30W-007 | 96 | 50 | 35 | 35 |

RL = Reporting Limit; U = Not detected above the Reporting Limit
mg/kg = milligram per kilogram

Table 2 (Cont'd)
XRF Lead and Arsenic Surface (0 to 2 inches) Data
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

| Sample | Sample | Lead (mg/kg) | | Arsenic (mg/kg) | |
|---|---|---|---|---|---|
| **Number** | **Location** | **Concentration** | **RL** | **Concentration** | **RL** |
| 30W-008-1 | 30W-008 | 123 | 50 | 38 | 35 |
| 30W-009-1 | 30W-009 | 161 | 50 | 35 U | 35 |
| 30W-010-1 | 30W-010 | 69 | 50 | 35 U | 35 |
| 30W-011-1 | 30W-011 | 167 | 50 | 49 | 35 |
| 30W-012-1 | 30W-012 | 197 | 50 | 60 | 35 |
| 30W-013-1 | 30W-013 | 151 | 50 | 44 | 35 |
| 30W-014-1 | 30W-014 | 188 | 50 | 64 | 35 |
| 30W-015-1 | 30W-015 | 175 | 50 | 59 | 35 |
| 30W-016-1 | 30W-016 | 231 | 50 | 66 | 35 |
| 30W-017-1 | 30W-017 | **355** | 50 | 143 | 35.5 |
| 30W-018-1 | 30W-018 | 105 | 50 | 35 U | 35 |
| 30W-019-1 | 30W-019 | **523** | 50 | 137 | 52.3 |
| 30W-020-1 | 30W-020 | **540** | 50 | **210** | 54.0 |
| 30W-021-1 | 30W-021 | **1,165** | 50 | **245** | 117 |
| 30W-022-1 | 30W-022 | 173 | 50 | 51 | 35 |
| 30W-023-1 | 30W-023 | 210 | 50 | 78 | 35 |
| 30W-024-1 | 30W-024 | **617** | 50 | **231** | 61.7 |
| 36W-001-1 | 36W-001 | 148 | 50 | 35 U | 35 |
| 36W-002-1 | 36W-002 | 122 | 50 | 35 U | 35 |
| 36W-003-1 | 36W-003 | **312** | 50 | 39 | 35 |
| 36W-004-1 | 36W-004 | 75 | 50 | 37 | 35 |
| 36W-005-1 | 36W-005 | 65 | 50 | 35 U | 35 |
| 36W-006-1 | 36W-006 | 114 | 50 | 35 U | 35 |
| 36W-007-1 | 36W-007 | 145 | 50 | 35 U | 35 |
| 36W-008-1 | 36W-008 | **333** | 50 | 43 | 35 |
| 36W-009-1 | 36W-009 | **738** | 50 | **208** | 73.8 |
| 36W-010-1 | 36W-010 | 202 | 50 | 35 U | 35 |
| 36W-011-1 | 36W-011 | 109 | 50 | 73 | 35 |
| 36W-012-1 | 36W-012 | 180 | 50 | 35 U | 35 |
| 36W-013-1 | 36W-013 | **313** | 50 | 111 | 35 |
| 36W-014-1 | 36W-014 | **853** | 50 | **218** | 85.3 |
| 36W-015-1 | 36W-015 | **1,180** | 50 | **259** | 118 |
| 36W-016-1 | 36W-016 | 138 | 50 | 35 U | 35 |
| 36W-017-1 | 36W-017 | **1,505** | 50 | **396** | 151 |
| 36W-018-1 | 36W-018 | **820** | 50 | **475** | 82.0 |

RL = Reporting Limit; U = Not detected above the Reporting Limit
mg/kg = milligram per kilogram

Table 2 (Cont'd)
XRF Lead and Arsenic Surface (0 to 2 inches) Data
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

| Sample | Sample | Lead (mg/kg) | | Arsenic (mg/kg) | |
|---|---|---|---|---|---|
| **Number** | **Location** | **Concentration** | **RL** | **Concentration** | **RL** |
| 36W-019-1 | 36W-019 | **1,226** | 50 | **362** | 123 |
| 36W-020-1 | 36W-020 | **2,095** | 50 | **654** | 210 |
| 36W-021-1 | 36W-021 | **1,360** | 50 | **372** | 136 |
| 36W-022-1 | 36W-022 | **538** | 50 | **155** | 53.8 |
| 36W-023-1 | 36W-023 | **938** | 50 | **279** | 93.8 |
| 36W-024-1 | 36W-024 | 219 | 50 | 43 | 35 |
| 36W-025-1 | 36W-025 | **387** | 50 | 122 | 38.7 |
| 36W-026-1 | 36W-026 | **1,135** | 50 | **366** | 114 |
| 36W-027-1 | 36W-027 | 169 | 50 | 35 U | 35 |
| 40W-001-1 | 40W-001 | 50 | 50 | 35 U | 35 |
| 40W-002-1 | 40W-002 | 53 | 50 | 51 | 35 |
| 40W-003-1 | 40W-003 | 55 | 50 | 35 U | 35 |
| 40W-004-1 | 40W-004 | 50 U | 50 | 35 U | 35 |
| 40W-005-1 | 40W-005 | 50 U | 50 | 35 U | 35 |
| 40W-006-1 | 40W-006 | 50 U | 50 | 35 U | 35 |
| 40W-007-1 | 40W-007 | 50 U | 50 | 35 U | 35 |
| 40W-008-1 | 40W-008 | 88 | 50 | 35 U | 35 |
| 40W-009-1 | 40W-009 | 61 | 50 | 35 U | 35 |
| 40W-010-1 | 40W-010 | 84 | 50 | 35 U | 35 |
| 40W-011-1 | 40W-011 | 105 | 50 | 35 U | 35 |
| 40W-012-1 | 40W-012 | 87 | 50 | 38 | 35 |
| 40W-013-1 | 40W-013 | 50 U | 50 | 35 U | 35 |
| 40W-014-1 | 40W-014 | 54 | 50 | 44 | 35 |
| 40W-015-1 | 40W-015 | 75 | 50 | 37 | 35 |
| 45J-001-1 | 45J-001 | 85 | 50 | 35 U | 35 |
| 45J-002-1 | 45J-002 | 65 | 50 | 35 U | 35 |
| 45J-003-1 | 45J-003 | 66 | 50 | 35 U | 35 |
| 45J-004-1 | 45J-004 | 84 | 50 | 35 U | 35 |
| 45J-005-1 | 45J-005 | 56 | 50 | 35 U | 35 |
| 45J-006-1 | 45J-006 | 52 | 50 | 35 U | 35 |
| 45J-007-1 | 45J-007 | 83 | 50 | 35 U | 35 |
| 45J-008-1 | 45J-008 | 67 | 50 | 35 U | 35 |
| 45J-009-1 | 45J-009 | 84 | 50 | 35 U | 35 |
| 45J-010-1 | 45J-010 | 94 | 50 | 35 U | 35 |
| 45J-011-1 | 45J-011 | 65 | 50 | 35 U | 35 |

RL = Reporting Limit; U = Not detected above the Reporting Limit
mg/kg = milligram per kilogram

Table 2 (Cont'd)
XRF Lead and Arsenic Surface (0 to 2 inches) Data
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

| Sample | Sample | Lead (mg/kg) | | Arsenic (mg/kg) | |
|---|---|---|---|---|---|
| Number | Location | Concentration | RL | Concentration | RL |
| 45J-012-1 | 45J-012 | 68 | 50 | 35 U | 35 |
| 45J-013-1 | 45J-013 | 62 | 50 | 35 U | 35 |
| 45J-014-1 | 45J-014 | 63 | 50 | 35 U | 35 |
| 45J-015-1 | 45J-015 | 94 | 50 | 35 U | 35 |
| 45J-016-1 | 45J-016 | 70 | 50 | 35 U | 35 |
| 45J-017-1 | 45J-017 | 65 | 50 | 35 U | 35 |
| 45J-018-1 | 45J-018 | 104 | 50 | 35 U | 35 |
| 45J-019-1 | 45J-019 | 121 | 50 | 35 U | 35 |
| 45J-020-1 | 45J-020 | 114 | 50 | 35 U | 35 |
| 45J-021-1 | 45J-021 | 98 | 50 | 35 U | 35 |
| 55J-001-1 | 55J-001 | 95 | 50 | 35 U | 35 |
| 55J-002-1 | 55J-002 | 91 | 50 | 35 U | 35 |
| 55J-003-1 | 55J-003 | 84 | 50 | 35 U | 35 |
| 55J-004-1 | 55J-004 | 101 | 50 | 35 U | 35 |
| 55J-005-1 | 55J-005 | 124 | 50 | 35 U | 35 |
| 55J-006-1 | 55J-006 | 97 | 50 | 35 U | 35 |
| 55J-007-1 | 55J-007 | 95 | 50 | 35 U | 35 |
| 55J-008-1 | 55J-008 | 50 U | 50 | 35 U | 35 |
| 55J-009-1 | 55J-009 | 156 | 50 | 35 U | 35 |
| 55J-010-1 | 55J-010 | 68 | 50 | 35 U | 35 |
| 55J-011-1 | 55J-011 | 57 | 50 | 35 U | 35 |
| 55J-012-1 | 55J-012 | 135 | 50 | 43 | 35 |
| 55J-013-1 | 55J-013 | 77 | 50 | 35 U | 35 |
| 55J-014-1 | 55J-014 | 116 | 50 | 35 U | 35 |
| 55J-015-1 | 55J-015 | 91 | 50 | 35 U | 35 |
| 55J-016-1 | 55J-016 | 50 U | 50 | 35 U | 35 |
| 55J-017-1 | 55J-017 | **410** | 50 | 109 | 41.0 |
| 55J-018-1 | 55J-018 | 85 | 50 | 35 U | 35 |
| 60J-001-1 | 60J-001 | 98 | 50 | 35 U | 35 |
| 60J-002-1 | 60J-002 | 74 | 50 | 35 U | 35 |
| 60J-003-1 | 60J-003 | 71 | 50 | 35 U | 35 |
| 60J-004-1 | 60J-004 | 56 | 50 | 35 U | 35 |
| 60J-005-1 | 60J-005 | 100 | 50 | 35 U | 35 |
| 60J-006-1 | 60J-006 | 108 | 50 | 35 U | 35 |
| 60J-007-1 | 60J-007 | 99 | 50 | 35 U | 35 |

RL = Reporting Limit; U = Not detected above the Reporting Limit
mg/kg = milligram per kilogram

Table 2 (Cont'd)
XRF Lead and Arsenic Surface (0 to 2 inches) Data
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

| Sample | Sample | Lead (mg/kg) | | Arsenic (mg/kg) | |
|---|---|---|---|---|---|
| Number | Location | Concentration | RL | Concentration | RL |
| 60J-008-1 | 60J-008 | 50 U | 50 | 35 U | 35 |
| 60J-009-1 | 60J-009 | 62 | 50 | 35 U | 35 |
| 60J-010-1 | 60J-010 | 92 | 50 | 35 U | 35 |
| 60J-011-1 | 60J-011 | 189 | 50 | 41 | 35 |
| 60J-012-1 | 60J-012 | 139 | 50 | 35 U | 35 |
| 60J-013-1 | 60J-013 | 93 | 50 | 35 U | 35 |
| 60J-014-1 | 60J-014 | 164 | 50 | 50 | 35 |
| 60J-015-1 | 60J-015 | 125 | 50 | 35 U | 35 |
| 60J-016-1 | 60J-016 | 112 | 50 | 35 U | 35 |
| 60J-017-1 | 60J-017 | 78 | 50 | 35 U | 35 |
| 60J-018-1 | 60J-018 | 165 | 50 | 67 | 35 |
| 60J-019-1 | 60J-019 | 134 | 50 | 35 U | 35 |
| 60J-020-1 | 60J-020 | 96 | 50 | 35 U | 35 |
| 70J-001-1 | 70J-001 | 149 | 50 | 38 | 35 |
| 70J-002-1 | 70J-002 | 94 | 50 | 45 | 35 |
| 70J-003-1 | 70J-003 | 86 | 50 | 65 | 35 |
| 70J-004-1 | 70J-004 | 126 | 50 | 82 | 35 |
| 70J-005-1 | 70J-005 | **369** | 50 | **440** | 36.9 |
| 70J-006-1 | 70J-006 | 180 | 50 | 124 | 35 |
| 70J-007-1 | 70J-007 | 126 | 50 | 74 | 35 |
| 70J-008-1 | 70J-008 | 58 | 50 | 35 U | 35 |
| 70J-009-1 | 70J-009 | 67 | 50 | 39 | 35 |
| 70J-010-1 | 70J-010 | 114 | 50 | 50 | 35 |
| 70J-011-1 | 70J-011 | 78 | 50 | 35 U | 35 |
| 70J-012-1 | 70J-012 | 73 | 50 | 41 | 35 |
| 70J-013-1 | 70J-013 | 111 | 50 | 35 U | 35 |
| 70J-014-1 | 70J-014 | 89 | 50 | 35 U | 35 |
| 70J-015-1 | 70J-015 | **399** | 50 | **392** | 39.9 |
| 70J-016-1 | 70J-016 | 67 | 50 | 49 | 35 |
| 70J-017-1 | 70J-017 | 92 | 50 | 35 U | 35 |
| 70J-018-1 | 70J-018 | 161 | 50 | 45 | 35 |
| 70J-019-1 | 70J-019 | 50 U | 50 | 35 U | 35 |
| 70J-020-1 | 70J-020 | **484** | 50 | **442** | 48.4 |
| 70J-021-1 | 70J-021 | 78 | 50 | 48 | 35 |
| 70J-022-1 | 70J-022 | 51 | 50 | 35 U | 35 |

RL = Reporting Limit; U = Not detected above the Reporting Limit
mg/kg = milligram per kilogram

Table 2 (Cont'd)
XRF Lead and Arsenic Surface (0 to 2 inches) Data
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

| Sample | Sample | Lead (mg/kg) | | Arsenic (mg/kg) | |
|---|---|---|---|---|---|
| Number | Location | Concentration | RL | Concentration | RL |
| 70J-023-1 | 70J-023 | 50 U | 50 | 35 U | 35 |
| 70J-024-1 | 70J-024 | 118 | 50 | 52 | 35 |
| 70J-025-1 | 70J-025 | 170 | 50 | 96 | 35 |
| 70J-026-1 | 70J-026 | 70 | 50 | 35 U | 35 |
| 70J-027-1 | 70J-027 | 72 | 50 | 35 U | 35 |
| 70J-028-1 | 70J-028 | 69 | 50 | 35 U | 35 |
| 70J-029-1 | 70J-029 | **311** | 50 | 41 | 35 |
| 70J-030-1 | 70J-030 | 99 | 50 | 35 U | 35 |
| 70J-031-1 | 70J-031 | 142 | 50 | 36 | 35 |
| 80J-001-1 | 80J-001 | 50 U | 50 | 35 U | 35 |
| 80J-002-1 | 80J-002 | 101 | 50 | 35 U | 35 |
| 80J-003-1 | 80J-003 | 109 | 50 | 35 U | 35 |
| 80J-004-1 | 80J-004 | 93 | 50 | 35 U | 35 |
| 80J-005-1 | 80J-005 | 78 | 50 | 35 U | 35 |
| 80J-006-1 | 80J-006 | 75 | 50 | 35 U | 35 |
| 80J-007-1 | 80J-007 | 83 | 50 | 35 U | 35 |
| 80J-008-1 | 80J-008 | 110 | 50 | 35 U | 35 |
| 80J-009-1 | 80J-009 | 86 | 50 | 35 U | 35 |
| 80J-010-1 | 80J-010 | 58 | 50 | 35 U | 35 |
| 80J-011-1 | 80J-011 | 65 | 50 | 35 U | 35 |
| 80J-012-1 | 80J-012 | 50 U | 50 | 35 U | 35 |
| 80J-013-1 | 80J-013 | 129 | 50 | 42 | 35 |
| 80J-014-1 | 80J-014 | 65 | 50 | 35 U | 35 |
| 80J-015-1 | 80J-015 | 50 U | 50 | 35 U | 35 |
| 80J-016-1 | 80J-016 | 115 | 50 | 35 U | 35 |
| 80J-017-1 | 80J-017 | 52 | 50 | 35 U | 35 |
| 80J-018-1 | 80J-018 | 53 | 50 | 35 U | 35 |
| 80J-019-1 | 80J-019 | 127 | 50 | 36 | 35 |
| 80J-020-1 | 80J-020 | 144 | 50 | 45 | 35 |
| 80J-021-1 | 80J-021 | 92 | 50 | 40 | 35 |
| 80J-022-1 | 80J-022 | 50 U | 50 | 35 U | 35 |
| 80J-023-1 | 80J-023 | 146 | 50 | 46 | 35 |
| 80J-024-1 | 80J-024 | 50 U | 50 | 35 U | 35 |
| 80J-025-1 | 80J-025 | 84 | 50 | 35 U | 35 |
| 80J-026-1 | 80J-026 | 62 | 50 | 35 U | 35 |

RL = Reporting Limit; U = Not detected above the Reporting Limit
mg/kg = milligram per kilogram

Table 2 (Cont'd)
XRF Lead and Arsenic Surface (0 to 2 inches) Data
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

| Sample | Sample | Lead (mg/kg) | | Arsenic (mg/kg) | |
|---|---|---|---|---|---|
| Number | Location | Concentration | RL | Concentration | RL |
| 80J-027-1 | 80J-027 | 62 | 50 | 35 U | 35 |
| 80J-028-1 | 80J-028 | 50 | 50 | 35 U | 35 |
| 80J-029-1 | 80J-029 | 104 | 50 | 35 U | 35 |
| 80J-030-1 | 80J-030 | 66 | 50 | 35 U | 35 |
| 80J-031-1 | 80J-031 | 56 | 50 | 35 U | 35 |
| 80J-032-1 | 80J-032 | 75 | 50 | 35 U | 35 |
| 80J-033-1 | 80J-033 | 74 | 50 | 35 U | 35 |
| 85J-001-1 | 85J-001 | 50 U | 50 | 35 U | 35 |
| 85J-002-1 | 85J-002 | 87 | 50 | 35 U | 35 |
| 85J-003-1 | 85J-003 | 90 | 50 | 35 U | 35 |
| 85J-004-1 | 85J-004 | 114 | 50 | 35 U | 35 |
| 85J-005-1 | 85J-005 | 114 | 50 | 35 U | 35 |
| 85J-006-1 | 85J-006 | 103 | 50 | 37 | 35 |
| 85J-007-1 | 85J-007 | 94 | 50 | 35 U | 35 |
| 85J-008-1 | 85J-008 | 80 | 50 | 35 U | 35 |
| 85J-009-1 | 85J-009 | 101 | 50 | 35 U | 35 |
| 85J-010-1 | 85J-010 | 92 | 50 | 35 U | 35 |
| 85J-011-1 | 85J-011 | 97 | 50 | 35 U | 35 |
| 85J-012-1 | 85J-012 | 108 | 50 | 35 U | 35 |
| 85J-013-1 | 85J-013 | 97 | 50 | 35 U | 35 |
| 85J-014-1 | 85J-014 | 115 | 50 | 35 U | 35 |
| 85J-015-1 | 85J-015 | 53 | 50 | 35 U | 35 |
| 85J-016-1 | 85J-016 | 55 | 50 | 35 U | 35 |
| 85J-017-1 | 85J-017 | 74 | 50 | 35 U | 35 |
| 85J-018-1 | 85J-018 | 117 | 50 | 35 U | 35 |
| 85J-019-1 | 85J-019 | 108 | 50 | 40 | 35 |
| 85J-020-1 | 85J-020 | 93 | 50 | 35 U | 35 |
| 85J-021-1 | 85J-021 | 117 | 50 | 35 U | 35 |
| 85J-022-1 | 85J-022 | 114 | 50 | 35 U | 35 |
| 85J-023-1 | 85J-023 | 118 | 50 | 35 U | 35 |
| 85J-024-1 | 85J-024 | 97 | 50 | 35 U | 35 |
| 85J-025-1 | 85J-025 | 86 | 50 | 35 U | 35 |
| 85J-026-1 | 85J-026 | 115 | 50 | 35 U | 35 |
| 85J-027-1 | 85J-027 | 125 | 50 | 35 U | 35 |
| 85J-028-1 | 85J-028 | 94 | 50 | 35 U | 35 |

RL = Reporting Limit; U = Not detected above the Reporting Limit
mg/kg = milligram per kilogram

Table 2 (Cont'd)
XRF Lead and Arsenic Surface (0 to 2 inches) Data
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

| Sample | Sample | Lead (mg/kg) | | Arsenic (mg/kg) | |
|---|---|---|---|---|---|
| **Number** | **Location** | **Concentration** | **RL** | **Concentration** | **RL** |
| 85J-029-1 | 85J-029 | 112 | 50 | 35 U | 35 |
| 85J-030-1 | 85J-030 | 92 | 50 | 35 U | 35 |
| 85J-031-1 | 85J-031 | 106 | 50 | 35 U | 35 |
| 85J-032-1 | 85J-032 | 112 | 50 | 35 U | 35 |
| 85J-033-1 | 85J-033 | 118 | 50 | 35 U | 35 |
| 85J-034-1 | 85J-034 | 154 | 50 | 42 | 35 |
| 85J-035-1 | 85J-035 | 104 | 50 | 37 | 35 |
| 85J-036-1 | 85J-036 | 78 | 50 | 35 U | 35 |
| 85J-037-1 | 85J-037 | 115 | 50 | 35 U | 35 |

RL = Reporting Limit; U = Not detected above the Reporting Limit
mg/kg = milligram per kilogram

TABLE 3
XRF Lead and Arsenic Subsurface Data
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

| Sample Number | Sample Location | Depth | Lead (mg/kg) | | Arsenic (mg/kg) | |
|---|---|---|---|---|---|---|
| | | | Concentration | RL | Concentration | RL |
| 30W-020-1 | 30W-020 | 0 to 2 inches | **540** | 50 | **210** | 54.0 |
| 30W-020-2 | 30W-020 | 10 to 14 inches | **435** | 50 | **171** | 43.5 |
| 30W-020-3 | 30W-020 | 22 to 24 inches | **1,115** | 50 | **393** | 112 |
| 30W-020-4 | 30W-020 | 34 to 38 inches | 225 | 50 | **663** | 35 |
| 30W-021-1 | 30W-021 | 0 to 2 inches | **1,165** | 50 | **245** | 117 |
| 30W-021-2 | 30W-021 | 10 to 14 inches | 84 | 50 | 54 | 35 |
| 30W-021-3 | 30W-021 | 22 to 24 inches | 69 | 50 | 35 U | 35 |
| 30W-021-4 | 30W-021 | 34 to 38 inches | 50 U | 50 | 35 U | 35 |
| 30W-024-1 | 30W-024 | 0 to 2 inches | **617** | 50 | **231** | 61.7 |
| 30W-024-2 | 30W-024 | 10 to 14 inches | 145 | 50 | **443** | 35 |
| 30W-024-3 | 30W-024 | 22 to 24 inches | 51 | 50 | 35 U | 35 |
| 30W-024-4 | 30W-024 | 34 to 38 inches | 50 U | 50 | 35 U | 35 |
| 36W-015-1 | 36W-015 | 0 to 2 inches | **1,180** | 50 | **259** | 118 |
| 36W-015-2 | 36W-015 | 10 to 14 inches | 51 | 50 | 35 U | 35 |
| 36W-015-3 | 36W-015 | 22 to 24 inches | 50 U | 50 | 35 U | 35 |
| 36W-015-4 | 36W-015 | 34 to 38 inches | 50 U | 50 | 35 U | 35 |
| 36W-017-1 | 36W-017 | 0 to 2 inches | **1,505** | 50 | **396** | 151 |
| 36W-017-2 | 36W-017 | 10 to 14 inches | 50 U | 50 | 35 U | 35 |
| 36W-017-3 | 36W-017 | 22 to 24 inches | 50 U | 50 | 35 U | 35 |
| 36W-017-4 | 36W-017 | 34 to 38 inches | 50 U | 50 | 35 U | 35 |
| 36W-020-1 | 36W-020 | 0 to 2 inches | **2,095** | 50 | **654** | 210 |
| 36W-020-2 | 36W-020 | 10 to 14 inches | 50 U | 50 | 35 U | 35 |
| 36W-020-3 | 36W-020 | 22 to 24 inches | 50 U | 50 | 35 U | 35 |
| 36W-020-4 | 36W-020 | 34 to 38 inches | 66 | 50 | 45 | 35 |
| 36W-021-1 | 36W-021 | 0 to 2 inches | **1,360** | 50 | **372** | 136 |
| 36W-021-2 | 36W-021 | 10 to 14 inches | 50 U | 50 | 35 U | 35 |
| 36W-021-3 | 36W-021 | 22 to 24 inches | 50 U | 50 | 35 U | 35 |
| 36W-021-4 | 36W-021 | 34 to 38 inches | 50 U | 50 | 35 U | 35 |
| 36W-023-1 | 36W-023 | 0 to 2 inches | **938** | 50 | **279** | 93.8 |
| 36W-023-2 | 36W-023 | 10 to 14 inches | 50 U | 50 | 35 U | 35 |
| 36W-023-3 | 36W-023 | 22 to 24 inches | 50 U | 50 | 35 U | 35 |
| 36W-023-4 | 36W-023 | 34 to 38 inches | 50 U | 50 | 35 U | 35 |
| 36W-026-1 | 36W-026 | 0 to 2 inches | **1,135** | 50 | **366** | 114 |
| 36W-026-2 | 36W-026 | 10 to 14 inches | 50 U | 50 | 35 U | 35 |
| 36W-026-3 | 36W-026 | 22 to 24 inches | 50 U | 50 | 35 U | 35 |
| 36W-026-4 | 36W-026 | 34 to 38 inches | 50 U | 50 | 35 U | 35 |

RL = Reporting Limit; U = Not detected above the Reporting Limit
mg/kg = milligrams per kilogram

TABLE 4
TAL Metal Results for Confirmation Samples
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

All Concentrations are in milligram per kilogram (mg/kg)

| Location | 30W-019-1 | | 30W-020-1 | | 30W-024-1 | | 146-0004 | | 146-0005 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample # | 146-0001 | | 146-0002 | | 146-0003 | | 36W-002-1 | | 45J-007-1 | |
| ANALYTE | Concentration | RL | Concentration | RL | Concentration | RL | Concentration | RL | Concentration | RL |
| Aluminum | 17600 | 15.9 | 11200 | 15.5 | 12000 | 15.1 | 15700 | 15.4 | 10200 | 14.9 |
| Antimony | 16 J- | 4.80 | 11.3 J- | 4.60 | 11.5 J- | 4.50 | 2.1 J- | 4.60 | 2.2 J- | 4.50 |
| Arsenic | 174 | 0.790 | 252 | 0.770 | 276 | 0.760 | 24.6 | 0.770 | 23.5 | 0.750 |
| Barium | 237 | 15.9 | 160 | 15.5 | 166 | 15.1 | 183 | 15.4 | 109 | 14.9 |
| Beryllium | 1 | 0.400 | 0.75 | 0.390 | 0.82 | 0.380 | 0.87 | 0.380 | 0.65 | 0.370 |
| Cadmium | 3.9 | 0.400 | 5 | 0.390 | 4.4 | 0.380 | 2.6 | 0.380 | 1 | 0.370 |
| Calcium | 12500 | 397 | 8650 | 387 | 9020 | 378 | 8390 | 384 | 11400 | 374 |
| Chromium | 28.9 | 0.790 | 21.7 | 0.770 | 25 | 0.760 | 26.1 | 0.770 | 24 | 0.750 |
| Cobalt | 16.3 | 4.00 | 10.1 | 3.90 | 11.8 | 3.80 | 14.8 | 3.80 | 16.3 | 3.70 |
| Copper | 116 | 2.00 | 191 | 1.90 | 185 | 1.90 | 183 | 1.90 | 93 | 1.90 |
| Iron | 42900 J | 7.90 | 33200 J | 7.70 | 37200 J | 7.60 | 29100 J | 7.70 | 30200 J | 7.50 |
| Lead | 955 | 0.790 | 761 | 0.770 | 737 | 0.760 | 139 | 0.770 | 73.2 | 0.750 |
| Magnesium | 7660 | 397 | 4460 | 387 | 4880 | 378 | 5920 | 384 | 5110 | 374 |
| Manganese | 1120 | 1.20 | 501 | 1.20 | 511 | 1.10 | 872 | 1.20 | 607 | 1.10 |
| Mercury | 1.9 | 0.095 | 1.8 | 0.170 | 1.9 | 0.190 | 0.78 | 0.098 | 0.058 J | 0.086 |
| Nickel | 30 | 3.20 | 19.8 | 3.10 | 22.3 | 3.00 | 24 | 3.10 | 22.2 | 3.00 |
| Potassium | 3430 | 397 | 3650 | 387 | 3490 | 378 | 5380 | 384 | 2530 | 374 |
| Selenium | 0.77 J | 2.80 | 0.9 J | 2.70 | 0.39 J | 2.60 | 2.7 U | 2.70 | 2.6 U | 2.60 |
| Silver | 9.7 | 0.790 | 7.9 | 0.770 | 8 | 0.760 | 3.4 | 0.770 | 3.1 | 0.750 |
| Sodium | 441 | 397 | 387 U | 387 | 471 | 378 | 393 | 384 | 383 | 374 |
| Thallium | 2 U | 2.00 | 1.9 U | 1.90 | 1.9 U | 1.90 | 1.9 U | 1.90 | 1.9 U | 1.90 |
| Vanadium | 67.1 J | 4.00 | 41.2 J | 3.90 | 47.1 J | 3.80 | 46 J | 3.80 | 60.2 J | 3.70 |
| Zinc | 778 J | 4.80 | 937 J | 4.60 | 791 J | 4.50 | 396 J | 4.60 | 178 J | 4.50 |

J = The result should be considered an estimated value
J- = Estimated value biased low
U = Analyte was not detected above the Detection Limit
RL = Reporting Limit

TABLE 4 (Cont'd)
TAL Metal Results for Confirmation Samples
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

All Concentrations are in milligram per kilogram (mg/kg)

| Location | 45J-019-1 | | 55J-010-1 | | 30W-020-2 | | 146-0009 | | 146-0010 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample # | 146-0006 | | 146-0007 | | 146-0008 | | 30W-020-3 | | 30W-021-1 | |
| ANALYTE | Concentration | RL | Concentration | RL | Concentration | RL | Concentration | RL | Concentration | RL |
| Aluminum | 13200 | 14.1 | 13200 | 15.3 | 14900 | 16.6 | 10100 | 17.2 | 11200 | 14.4 |
| Antimony | 2.1 J- | 4.20 | 1.7 J- | 4.60 | 7.7 J- | 5.00 | 46.3 J- | 5.20 | 15.8 J- | 4.30 |
| Arsenic | 25.4 | 0.700 | 23.1 | 0.770 | 204 | 0.830 | 1630 | 8.600 | 283 | 0.720 |
| Barium | 158 | 14.1 | 186 | 15.3 | 172 | 16.6 | 180 | 17.2 | 167 | 14.4 |
| Beryllium | 0.83 | 0.350 | 0.96 | 0.380 | 0.97 | 0.410 | 0.85 | 0.430 | 0.87 | 0.360 |
| Cadmium | 1.2 | 0.350 | 1.4 | 0.380 | 4.2 | 0.410 | 3.5 | 0.430 | 5 | 0.360 |
| Calcium | 6110 | 352 | 7870 | 383 | 10900 | 415 | 4610 | 430 | 9140 | 360 |
| Chromium | 25.6 | 0.700 | 24.4 | 0.770 | 21.2 | 0.830 | 16.8 | 0.860 | 21.4 | 0.720 |
| Cobalt | 12.8 | 3.50 | 15 | 3.80 | 12.8 | 4.10 | 7.2 | 4.30 | 10.7 | 3.60 |
| Copper | 148 | 1.80 | 126 | 1.90 | 174 | 2.10 | 167 | 2.10 | 177 | 1.80 |
| Iron | 28300 J | 7.00 | 30900 J | 7.70 | 36700 J | 8.30 | 51600 J | 8.60 | 34100 J | 7.20 |
| Lead | 122 | 0.700 | 59.5 | 0.770 | 599 | 0.830 | 1470 | 0.860 | 1080 | 0.720 |
| Magnesium | 5490 | 352 | 5380 | 383 | 4980 | 415 | 3640 | 430 | 4300 | 360 |
| Manganese | 669 | 1.10 | 837 | 1.20 | 597 | 1.20 | 314 | 1.30 | 534 | 1.10 |
| Mercury | 0.19 | 0.098 | 0.084 J | 0.094 | 1.1 | 0.110 | 3.2 | 0.200 | 3.1 | 0.190 |
| Nickel | 28.7 | 2.80 | 26.6 | 3.10 | 17.7 | 3.30 | 11.7 | 3.40 | 20.3 | 2.90 |
| Potassium | 4030 | 352 | 3780 | 383 | 4150 | 415 | 3420 | 430 | 3340 | 360 |
| Selenium | 2.5 U | 2.50 | 2.7 U | 2.70 | 2.9 U | 2.90 | 6.5 | 3.00 | 1.1 J | 2.50 |
| Silver | 3.2 | 0.700 | 3.3 | 0.770 | 6.5 | 0.830 | 15.9 | 0.860 | 10.2 | 0.720 |
| Sodium | 411 | 352 | 451 | 383 | 599 | 415 | 602 | 430 | 443 | 360 |
| Thallium | 1.8 U | 1.80 | 1.9 U | 1.90 | 2.1 U | 2.10 | 2.1 U | 2.10 | 1.8 U | 1.80 |
| Vanadium | 46.1 J | 3.50 | 53.7 J | 3.80 | 45.3 J | 4.10 | 47.3 J | 4.30 | 42.3 J | 3.60 |
| Zinc | 252 J | 4.20 | 157 J | 4.60 | 745 J | 5.00 | 735 J | 5.20 | 957 J | 4.30 |

J = The result should be considered an estimated value
J- = Estimated value biased low
U = Analyte was not detected above the Detection Limit
RL = Reporting Limit

TABLE 4 (Cont'd)
TAL Metal Results for Confirmation Samples
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

All Concentrations are in milligram per kilogram (mg/kg)

| Location | 30W-024-2 | | 36W-008-1 | | 36W-009-1 | | 146-0014 | | 146-0015 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample # | 146-0011 | | 146-0012 | | 146-0013 | | 36W-013-1 | | 36W-014-1 | |
| ANALYTE | Concentration | RL | Concentration | RL | Concentration | RL | Concentration | RL | Concentration | RL |
| Aluminum | 11800 | 17.6 | 13000 | 15.7 | 12000 | 15.8 | 11200 | 15.4 | 11300 | 14.4 |
| Antimony | 4.6 J- | 5.30 | 3.7 J- | 4.70 | 2.1 J- | 4.80 | 6.9 J- | 4.60 | 10.3 J- | 4.30 |
| Arsenic | 474 | 0.880 | 101 | 0.780 | 40.1 | 0.790 | 113 | 0.770 | 196 | 0.720 |
| Barium | 168 | 17.6 | 243 | 15.7 | 149 | 15.8 | 147 | 15.4 | 165 | 14.4 |
| Beryllium | 0.77 | 0.440 | 0.83 | 0.390 | 0.8 | 0.400 | 0.75 | 0.390 | 0.86 | 0.360 |
| Cadmium | 2.8 | 0.440 | 3.9 | 0.390 | 2 | 0.400 | 6 | 0.390 | 7.2 | 0.360 |
| Calcium | 4430 | 439 | 9510 | 391 | 9270 | 396 | 9580 | 385 | 7190 | 359 |
| Chromium | 20.8 | 0.880 | 22 | 0.780 | 57 | 0.790 | 24.6 | 0.770 | 22.9 | 0.720 |
| Cobalt | 9.2 | 4.40 | 11.8 | 3.90 | 12.5 | 4.00 | 14.4 | 3.90 | 16 | 3.60 |
| Copper | 264 | 2.20 | 165 | 2.00 | 118 | 2.00 | 113 | 1.90 | 143 | 1.80 |
| Iron | 36400 J | 8.80 | 28200 J | 7.80 | 25900 J | 7.90 | 34100 J | 7.70 | 40300 J | 7.20 |
| Lead | 152 | 0.880 | 434 | 0.780 | 142 | 0.790 | 742 | 0.770 | 754 | 0.720 |
| Magnesium | 4260 | 439 | 5140 | 391 | 5040 | 396 | 5780 | 385 | 5480 | 359 |
| Manganese | 329 | 1.30 | 673 | 1.20 | 652 | 1.20 | 836 | 1.20 | 994 | 1.10 |
| Mercury | 0.35 | 0.098 | 0.49 | 0.090 | 0.29 | 0.086 | 0.73 | 0.091 | 1.7 | 0.093 |
| Nickel | 16 | 3.50 | 20.8 | 3.10 | 36.3 | 3.20 | 27.2 | 3.10 | 26.7 | 2.90 |
| Potassium | 3240 | 439 | 4330 | 391 | 3530 | 396 | 2530 | 385 | 3080 | 359 |
| Selenium | 0.47 J | 3.10 | 2.7 U | 2.70 | 2.8 U | 2.80 | 1.7 J | 2.70 | 2.5 U | 2.50 |
| Silver | 5.1 | 0.880 | 5.1 | 0.780 | 3.2 | 0.790 | 6.4 | 0.770 | 7.8 | 0.720 |
| Sodium | 439 U | 439 | 391 U | 391 | 396 U | 396 | 385 U | 385 | 518 | 359 |
| Thallium | 2.2 U | 2.20 | 2 U | 2.00 | 2 U | 2.00 | 1.9 U | 1.90 | 1.8 U | 1.80 |
| Vanadium | 43.1 J | 4.40 | 39.9 J | 3.90 | 42.8 J | 4.00 | 53 J | 3.90 | 53.3 J | 3.60 |
| Zinc | 478 J | 5.30 | 700 J | 4.70 | 317 J | 4.80 | 1260 J | 4.60 | 1480 J | 4.30 |

J = The result should be considered an estimated value
J- = Estimated value biased low
U = Analyte was not detected above the Detection Limit
RL = Reporting Limit

TABLE 4 (Cont'd)
TAL Metal Results for Confirmation Samples
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

All Concentrations are in milligram per kilogram (mg/kg)

| Location | 36W-015-1 | | 36W-017-1 | | 36W-018-1 | | 146-0019 | | 146-0020 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample # | 146-0016 | | 146-0017 | | 146-0018 | | 36W-019-1 | | 36W-020-1 | |
| ANALYTE | Concentration | RL | Concentration | RL | Concentration | RL | Concentration | RL | Concentration | RL |
| Aluminum | 12700 | 15.8 | 9460 | 14.0 | 14200 | 14.9 | 11900 | 15.9 | 7460 | 15.1 |
| Antimony | 13.6 J- | 4.70 | 33.1 J- | 4.20 | 17.2 J- | 4.50 | 13.6 J- | 4.80 | 48.6 J- | 4.50 |
| Arsenic | 233 | 0.790 | 390 | 0.700 | 452 | 0.740 | 271 | 0.790 | 905 | 7.500 |
| Barium | 148 | 15.8 | 124 | 14.0 | 124 | 14.9 | 103 | 15.9 | 123 | 15.1 |
| Beryllium | 0.83 | 0.390 | 0.68 | 0.350 | 1 | 0.370 | 0.72 | 0.400 | 0.82 | 0.380 |
| Cadmium | 10.1 | 0.390 | 10.1 | 0.350 | 21.2 | 0.370 | 11.9 | 0.400 | 18.7 J | 0.380 |
| Calcium | 11600 | 394 | 7320 | 351 | 9060 | 372 | 5960 | 397 | 5800 | 377 |
| Chromium | 19.6 | 0.790 | 20.5 | 0.700 | 22.8 | 0.740 | 25.7 | 0.790 | 14.7 | 0.750 |
| Cobalt | 13.5 | 3.90 | 9.7 | 3.50 | 11 | 3.70 | 12.3 | 4.00 | 8.4 J | 3.80 |
| Copper | 162 | 2.00 | 222 | 1.80 | 270 | 1.90 | 142 | 2.00 | 296 | 1.90 |
| Iron | 38900 J | 7.90 | 35100 J | 7.00 | 42000 J | 7.40 | 35500 J | 7.90 | 48800 | 7.50 |
| Lead | 1110 | 0.790 | 2050 | 0.700 | 1120 | 0.740 | 1150 | 0.790 | 3330 | 0.750 |
| Magnesium | 5870 | 394 | 3790 | 351 | 5060 | 372 | 5100 | 397 | 3140 | 377 |
| Manganese | 658 | 1.20 | 428 | 1.10 | 367 | 1.10 | 569 | 1.20 | 447 | 1.10 |
| Mercury | 2.5 | 0.200 | 4.8 | 0.490 | 2.2 | 0.180 | 3.8 | 0.440 | 9.5 | 1.000 |
| Nickel | 21.3 | 3.20 | 17.7 | 2.80 | 24.9 | 3.00 | 21.9 | 3.20 | 12.5 | 3.00 |
| Potassium | 3760 | 394 | 3520 | 351 | 3840 | 372 | 2170 | 397 | 3250 | 377 |
| Selenium | 0.6 J | 2.80 | 2.7 | 2.50 | 0.96 J | 2.60 | 0.88 J | 2.80 | 6.6 | 2.60 |
| Silver | 11.2 | 0.790 | 18.3 | 0.700 | 9.4 | 0.740 | 10.3 | 0.790 | 24.7 | 0.750 |
| Sodium | 405 | 394 | 359 | 351 | 677 | 372 | 397 U | 397 | 502 | 377 |
| Thallium | 2 U | 2.00 | 1.8 U | 1.80 | 1.9 U | 1.90 | 2 U | 2.00 | 1.9 U | 1.90 |
| Vanadium | 44.8 J | 3.90 | 38.7 J | 3.50 | 50.6 J | 3.70 | 61.5 J | 4.00 | 34.5 | 3.80 |
| Zinc | 2180 J | 4.70 | 1960 J | 4.20 | 6000 J | 44.60 | 2160 J | 4.80 | 4370 | 45.30 |

J = The result should be considered an estimated value
J- = Estimated value biased low
U = Analyte was not detected above the Detection Limit
RL = Reporting Limit

TABLE 4 (Cont'd)
TAL Metal Results for Confirmation Samples
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

All Concentrations are in milligram per kilogram (mg/kg)

| Location | 146-0021 | | 146-0022 | | 146-0023 | | 146-0024 | | 146-0025 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample # | 36W-020-4 | | 36W-021-1 | | 36W-022-1 | | 36W-023-1 | | 36W-025-1 | |
| ANALYTE | Concentration | RL | Concentration | RL | Concentration | RL | Concentration | RL | Concentration | RL |
| Aluminum | 24500 | 17.2 | 8340 | 15.3 | 9040 | 15.2 | 9640 | 15.3 | 9970 | 15.0 |
| Antimony | 1.2 J- | 5.20 | 18.8 J- | 4.60 | 9.5 J- | 4.60 | 12.4 J- | 4.60 | 5.2 J- | 4.50 |
| Arsenic | 33.4 | 0.860 | 468 | 0.770 | 337 | 0.760 | 249 | 0.760 | 106 | 0.750 |
| Barium | 121 | 17.2 | 102 | 15.3 | 158 | 15.2 | 142 | 15.3 | 137 | 15.0 |
| Beryllium | 1.2 | 0.430 | 0.73 | 0.380 | 0.77 | 0.380 | 0.78 | 0.380 | 0.78 | 0.380 |
| Cadmium | 0.62 | 0.430 | 14.5 J | 0.380 | 6.5 J | 0.380 | 11.4 J | 0.380 | 5.6 J | 0.380 |
| Calcium | 15600 | 431 | 5250 | 384 | 6340 | 381 | 6570 | 381 | 7130 | 376 |
| Chromium | 27.7 | 0.860 | 18.6 | 0.770 | 19.4 | 0.760 | 21.3 | 0.760 | 20.6 | 0.750 |
| Cobalt | 10.9 | 4.30 | 9.8 J | 3.80 | 11.9 J | 3.80 | 12.3 J | 3.80 | 12.4 J | 3.80 |
| Copper | 28.6 | 2.20 | 182 | 1.90 | 140 | 1.90 | 168 | 1.90 | 146 | 1.90 |
| Iron | 31500 J | 8.60 | 37000 | 7.70 | 33800 | 7.60 | 34600 | 7.60 | 32700 | 7.50 |
| Lead | 27.8 | 0.860 | 1440 | 0.770 | 535 | 0.760 | 1020 | 0.760 | 351 | 0.750 |
| Magnesium | 5930 | 431 | 4050 | 384 | 4360 | 381 | 5020 | 381 | 5110 | 376 |
| Manganese | 538 | 1.30 | 492 | 1.20 | 1520 | 1.10 | 666 | 1.10 | 699 | 1.10 |
| Mercury | 0.073 J | 0.100 | 3.7 | 0.470 | 1.4 | 0.091 | 2.4 | 0.170 | 0.68 | 0.087 |
| Nickel | 21.9 | 3.40 | 15.9 | 3.10 | 18.7 | 3.00 | 20.6 | 3.10 | 21.8 | 3.00 |
| Potassium | 2120 | 431 | 2430 | 384 | 2910 | 381 | 3260 | 381 | 3370 | 376 |
| Selenium | 3 U | 3.00 | 2.8 | 2.70 | 0.4 J | 2.70 | 1.7 J | 2.70 | 2.6 U | 2.60 |
| Silver | 2.9 | 0.860 | 12.4 | 0.770 | 6.6 | 0.760 | 8.7 | 0.760 | 4.9 | 0.750 |
| Sodium | 431 U | 431 | 384 U | 384 | 381 U | 381 | 430 | 381 | 376 U | 376 |
| Thallium | 2.2 U | 2.20 | 1.9 U | 1.90 | 1.9 U | 1.90 | 1.9 U | 1.90 | 1.9 U | 1.90 |
| Vanadium | 64.9 J | 4.30 | 36.9 | 3.80 | 48.1 | 3.80 | 44.1 | 3.80 | 43.5 | 3.80 |
| Zinc | 124 J | 5.20 | 4230 | 46.00 | 1480 | 4.60 | 2860 | 45.80 | 883 | 4.50 |

J = The result should be considered an estimated value
J- = Estimated value biased low
U = Analyte was not detected above the Detection Limit
RL = Reporting Limit

TABLE 4 (Cont'd)
TAL Metal Results for Confirmation Samples
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

All Concentrations are in milligram per kilogram (mg/kg)

| Location | 146-0026 | | 146-0027 | | 146-0028 | | 146-0029 | | 146-0030 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample # | 36W-026-1 | | 40W-014-1 | | 80J-013-1 | | 80J-113-1 | | 55J-110-1 | |
| ANALYTE | Concentration | RL | Concentration | RL | Concentration | RL | Concentration | RL | Concentration | RL |
| Aluminum | 8490 | 15.2 | 11500 | 16.1 | 14300 | 16.1 | 13500 | 15.1 | 10900 | 16.2 |
| Antimony | 25.4 J- | 4.50 | 1.9 J- | 4.80 | 3.1 J- | 4.80 | 2.6 J- | 4.50 | 1.3 J- | 4.90 |
| Arsenic | 377 | 0.760 | 44.5 | 0.810 | 46.8 | 0.800 | 40.9 | 0.760 | 21.3 | 0.810 |
| Barium | 118 | 15.2 | 150 | 16.1 | 269 | 16.1 | 236 | 15.1 | 187 | 16.2 |
| Beryllium | 0.83 | 0.380 | 0.74 | 0.400 | 1 | 0.400 | 0.95 | 0.380 | 0.77 | 0.410 |
| Cadmium | 17.9 J | 0.380 | 1 J | 0.400 | 2.8 J | 0.400 | 2.6 J | 0.380 | 1.2 J | 0.410 |
| Calcium | 6060 | 379 | 10800 | 404 | 7760 | 402 | 7850 | 378 | 7170 | 406 |
| Chromium | 22.9 | 0.760 | 34.8 | 0.810 | 33.5 | 0.800 | 33.2 | 0.760 | 20.6 | 0.810 |
| Cobalt | 12.8 J | 3.80 | 13.9 J | 4.00 | 21.4 J | 4.00 | 20 J | 3.80 | 13.5 J | 4.10 |
| Copper | 229 | 1.90 | 119 | 2.00 | 301 | 2.00 | 265 | 1.90 | 110 | 2.00 |
| Iron | 39700 | 7.60 | 25400 | 8.10 | 42400 | 8.00 | 38600 | 7.60 | 26000 | 8.10 |
| Lead | 1240 | 0.760 | 39.2 | 0.810 | 140 | 0.800 | 306 | 0.760 | 51.5 | 0.810 |
| Magnesium | 3890 | 379 | 6190 | 404 | 7480 | 402 | 7150 | 378 | 4830 | 406 |
| Manganese | 599 | 1.10 | 881 | 1.20 | 1640 | 1.20 | 1250 | 1.10 | 907 | 1.20 |
| Mercury | 3 | 0.180 | 0.09 J | 0.093 | 0.21 | 0.094 | 0.18 | 0.099 | 0.083 J | 0.089 |
| Nickel | 21.8 | 3.00 | 32.2 | 3.20 | 38.8 | 3.20 | 35.9 | 3.00 | 21.3 | 3.20 |
| Potassium | 2400 | 379 | 3830 | 404 | 3320 | 402 | 3220 | 378 | 3390 | 406 |
| Selenium | 1.1 J | 2.70 | 2.8 U | 2.80 | 2.8 U | 2.80 | 2.6 U | 2.60 | 2.8 U | 2.80 |
| Silver | 11.7 | 0.760 | 2.7 | 0.810 | 4.8 | 0.800 | 4.4 | 0.760 | 2.8 | 0.810 |
| Sodium | 390 | 379 | 404 U | 404 | 1060 | 402 | 1040 | 378 | 406 U | 406 |
| Thallium | 1.9 U | 1.90 | 2 U | 2.00 | 2 U | 2.00 | 1.9 U | 1.90 | 2 U | 2.00 |
| Vanadium | 42.6 | 3.80 | 42.1 | 4.00 | 73.7 | 4.00 | 67.4 | 3.80 | 46.2 | 4.10 |
| Zinc | 3110 | 45.50 | 139 | 4.80 | 432 | 4.80 | 389 | 4.50 | 145 | 4.90 |

J = The result should be considered an estimated value
J- = Estimated value biased low
U = Analyte was not detected above the Detection Limit
RL = Reporting Limit

TABLE 5
Comparison of Laboratory ICP Data and Field XRF Data
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

| Sample # | Location | Sample Date | Sample Time | **Lead (mg/kg)** | | **Arsenic (mg/kg)** | |
|---|---|---|---|---|---|---|---|
| | | | | Lab | XRF | Lab | XRF |
| 146-0001 | 30W-019-1 | 8/13/2013 | 11:32 | 955 | 523 | 174 | 137 |
| 146-0002 | 30W-020-1 | 8/13/2013 | 11:38 | 761 | 540 | 252 | 210 |
| 146-0003 | 30W-024-1 | 8/13/2013 | 13:35 | 737 | 617 | 276 | 231 |
| 146-0004 | 36W-002-1 | 8/13/2013 | 13:51 | 139 | 122 | 24.6 | 35 U |
| 146-0005 | 45J-007-1 | 8/13/2013 | 10:33 | 73.2 | 83 | 23.5 | 35 U |
| 146-0006 | 45J-019-1 | 8/13/2013 | 11:15 | 122 | 121 | 25.4 | 35 U |
| 146-0007 | 55J-010-1 | 8/13/2013 | 9:50 | 59.5 | 68 | 23.1 | 35 U |
| 146-0030 | 55J-010-1 (DUP) | 8/13/2013 | 9:50 | 51.5 | 68 | 21.3 | 35 U |
| 146-0008 | 30W-020-2 | 8/14/2013 | 11:42 | 599 | 435 | 204 | 171 |
| 146-0008 (Dup) | 30W-020-2 | 8/14/2013 | 11:42 | 592 | 435 | 200 | 171 |
| 146-0009 | 30W-020-3 | 8/14/2013 | 11:52 | 1470 | 1,115 | 1630 | 393 |
| 146-0010 | 30W-021-1 | 8/13/2013 | 11:39 | 1080 | 1,165 | 283 | 245 |
| 146-0011 | 30W-024-2 | 8/14/2013 | 11:46 | 152 | 145 | 474 | 443 |
| 146-0012 | 36W-008-1 | 8/13/2013 | 14:18 | 434 | 333 | 101 | 43 |
| 146-0013 | 36W-009-1 | 8/13/2013 | 14:20 | 142 | 738 | 40.1 | 208 |
| 146-0014 | 36W-013-1 | 8/13/2013 | 14:32 | 742 | 313 | 113 | 111 |
| 146-0015 | 36W-014-1 | 8/13/2013 | 14:36 | 754 | 853 | 196 | 218 |
| 146-0016 | 36W-015-1 | 8/13/2013 | 14:45 | 1110 | 1,180 | 233 | 259 |
| 146-0017 | 36W-017-1 | 8/13/2013 | 14:50 | 2050 | 1,505 | 390 | 396 |
| 146-0018 | 36W-018-1 | 8/13/2013 | 14:53 | 1120 | 820 | 452 | 475 |
| 146-0019 | 36W-019-1 | 8/13/2013 | 14:54 | 1150 | 1,226 | 271 | 362 |
| 146-0020 | 36W-020-1 | 8/13/2013 | 14:56 | 3330 | 2,095 | 905 | 654 |
| 146-0021 | 36W-020-4 | 8/14/2013 | 12:35 | 27.8 | 66 | 33.4 | 45 |
| 146-0022 | 36W-021-1 | 8/13/2013 | 15:02 | 1440 | 1,360 | 468 | 372 |
| 146-0023 | 36W-022-1 | 8/13/2013 | 15:01 | 535 | 538 | 337 | 155 |
| 146-0024 | 36W-023-1 | 8/13/2013 | 15:05 | 1020 | 938 | 249 | 279 |
| 146-0025 | 36W-025-1 | 8/13/2013 | 14:42 | 351 | 387 | 106 | 122 |
| 146-0026 | 36W-026-1 | 8/13/2013 | 14:47 | 1240 | 1,135 | 377 | 366 |
| 146-0027 | 40W-014-1 | 8/13/2013 | 17:34 | 39.2 | 54 | 44.5 | 44 |
| 146-0028 | 80J-013-1 | 8/13/2013 | 16:12 | 140 | 129 | 46.8 | 42 |
| 146-0029 | 80J-013-1 (DUP) | 8/13/2013 | 16:12 | 306 | 129 | 40.9 | 42 |
| $R^2$ Correlation Between XRF and Laboratory Confirmation Data | | | | 0.8617 | | 0.8669 | |

RL = Reporting Limit; U = Not detected above the Reporting Limit
mg/kg = milligram per kilogram
Outlying Data Point; Not Included in Correlation

TABLE 6
TCLP Results for RCRA 8 Metals
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

All Concentrations are in milligram per liter (mg/L)

| ANALYTE | RCRA Limit | 146-0101 | | 146-0102 | | 146-0103 | |
|---|---|---|---|---|---|---|---|
| | | Result | RL | Result | RL | Result | RL |
| Mercury | **0.2** | 0.00028 J | 0.00030 | 0.00020 J | 0.00030 | 0.00022 J | 0.00030 |
| Chromium | **5.0** | ND | 0.10 | ND | 0.10 | ND | 0.10 |
| Lead | **5.0** | ND | 0.30 | ND | 0.30 | ND | 0.30 |
| Selenium | **1.0** | ND | 0.20 | ND | 0.20 | ND | 0.20 |
| Silver | **5.0** | ND | 0.10 | ND | 0.10 | ND | 0.10 |
| Arsenic | **5.0** | 0.66 | 0.20 | 0.43 | 0.20 | 0.40 | 0.20 |
| Barium | **100** | ND | 0.50 | ND | 0.50 | 0.33 J | 0.50 |
| Cadmium | **1.0** | 0.026 J | 0.050 | 0.088 | 0.050 | 0.033 J | 0.050 |

J = The result should be considered an estimated value.
ND = Analyte was not detected above the Detection Limit

TABLE 7
Removal Volumes by Property and Total Volumes
Iron King Mine Site - Accelerated Residential Sampling
Dewey-Humboldt, Arizona

| Property ID | Address | Removal Area (square feet) | Removal Depth (feet) | Removal Volume (cubic feet) | Removal Volume (cubic yards) |
|---|---|---|---|---|---|
| Area P1A | 13336 Wells Street | 3,074 | 1 | 3,074 | 114 |
| Area P1B | 13330 Wells Street | 1,638 | 3 | 4,914 | 182 |
| Area P2 | 2660 Jones Street | 284 | 1 | 284 | 11 |
| Area P3 | 2655 Jones Street | 411 | 1 | 180 | 7 |
| Area P4 | 2670 Jones Street | 545 | 1 | 545 | 20 |
| Area P5 | | 202 | 1 | 202 | 7 |
| Totals | | 6,154 | - | 9,199 | 341 |

# FIGURES
# Iron King Mine Site
# Technical Memorandum
# October 2013


Base map created using 2010 orthoimagery, sample location from 2013 GPS survey and sample result data from 2013.

Map Creation Date: 01 September 2013

Coordinate system: Arizona State Plane Central
FIPS: 0202
Datum: NAD83
Units: Feet

Data: g:\arcviewprojects\SERAS01\00-146
MXD file: g:\arcinfoprojects\SERAS01\SER00146_IronKingMineSite\ARS_WJ\146_ARS_WJ_Sample_Location_Map_f1

Legend
- Sampling Location
- Tailing Piles
- Property Boundary

0 36 72
Feet

U.S. EPA Environmental Response Team
Scientific Engineering Response and Analytical Services
EP-W-09-031
W.A.# 0-146

Figure 1
Sample Location Map
Iron King Mine Site
Dewey-Humboldt, Arizona


Base map created using 2010 orthoimagery, sample location from 2013 GPS survey and sample result data from 2013.

Map Creation Date: 02 September 2013

Coordinate system: Arizona State Plane Central
FIPS: 0202
Datum: NAD83
Units: Feet

Data: g:\arcviewprojects\SERAS01\00-146
MXD file: g:\arcinfoprojects\SERAS01\SER00146_IronKingMineSite\ARS_WJ\146_ARS_WJ_Lead_Concentration_f2

0 44 88 Feet

U.S. EPA Environmental Response Team
Scientific Engineering Response and Analytical Services
EP-W-09-031
W.A.# 0-146

Figure 2
Lead Concentration
Iron King Mine Site
Dewey-Humboldt, Arizona


Base map created using 2010 orthoimagery, sample location from 2013 GPS survey and sample result data from 2013.

Map Creation Date: 02 September 2013

Coordinate system: Arizona State Plane Central
FIPS: 0202
Datum: NAD83
Units: Feet

0 44 88 Feet

Data: g:\arcviewprojects\SERAS01\00-146
MXD file: g:\arcinfoprojects\SERAS01\SER00146_IronKingMineSite\ARS_WJ\146_ARS_WJ_Arsenic_Concentration_f3

U.S. EPA Environmental Response Team
Scientific Engineering Response and Analytical Services
EP-W-09-031
W.A.# 0-146

Figure 3
Arsenic Concentration
Iron King Mine Site
Dewey-Humboldt, Arizona


| Sample Number | Depth | Lead (mg/kg) Concentration | Arsenic (mg/kg) Concentration |
|---|---|---|---|
| 36W-021-1 | 0 to 2 inches | 1,360 | 372 |
| 36W-021-2 | 10 to 14 inches | 50 U | 35 U |
| 36W-021-3 | 22 to 26 inches | 50 U | 35 U |
| 36W-021-4 | 34 to 38 inches | 50 U | 35 U |

| Sample Number | Depth | Lead (mg/kg) Concentration | Arsenic (mg/kg) Concentration |
|---|---|---|---|
| 36W-020-1 | 0 to 2 inches | 2,095 | 654 |
| 36W-020-2 | 10 to 14 inches | 50 U | 35 U |
| 36W-020-3 | 22 to 26 inches | 50 U | 35 U |
| 36W-020-4 | 34 to 38 inches | 66 | 45 |

| Sample Number | Depth | Lead (mg/kg) Concentration | Arsenic (mg/kg) Concentration |
|---|---|---|---|
| 30W-021-1 | 0 to 2 inches | 1,165 | 245 |
| 30W-021-2 | 10 to 14 inches | 84 | 54 |
| 30W-021-3 | 22 to 26 inches | 69 | 35 U |
| 30W-021-4 | 34 to 38 inches | 50 U | 35 U |

| Sample Number | Depth | Lead (mg/kg) Concentration | Arsenic (mg/kg) Concentration |
|---|---|---|---|
| 30W-024-1 | 0 to 2 inches | 617 | 231 |
| 30W-024-2 | 10 to 14 inches | 145 | 443 |
| 30W-024-3 | 22 to 26 inches | 51 | 35 U |
| 30W-024-4 | 34 to 38 inches | 50 U | 35 U |

| Sample Number | Depth | Lead (mg/kg) Concentration | Arsenic (mg/kg) Concentration |
|---|---|---|---|
| 30W-020-1 | 0 to 2 inches | 540 | 210 |
| 30W-020-2 | 10 to 14 inches | 435 | 171 |
| 30W-020-3 | 22 to 26 inches | 1,115 | 393 |
| 30W-020-4 | 34 to 38 inches | 225 | 663 |

| Sample Number | Depth | Lead (mg/kg) Concentration | Arsenic (mg/kg) Concentration |
|---|---|---|---|
| 36W-023-1 | 0 to 2 inches | 938 | 279 |
| 36W-023-2 | 10 to 14 inches | 50 U | 35 U |
| 36W-023-3 | 22 to 26 inches | 50 U | 35 U |
| 36W-023-4 | 34 to 38 inches | 50 U | 35 U |

| Sample Number | Depth | Lead (mg/kg) Concentration | Arsenic (mg/kg) Concentration |
|---|---|---|---|
| 36W-015-1 | 0 to 2 inches | 1,180 | 259 |
| 36W-015-2 | 10 to 14 inches | 51 | 35 U |
| 36W-015-3 | 22 to 26 inches | 50 U | 35 U |
| 36W-015-4 | 34 to 38 inches | 50 U | 35 U |

| Sample Number | Depth | Lead (mg/kg) Concentration | Arsenic (mg/kg) Concentration |
|---|---|---|---|
| 36W-026-1 | 0 to 2 inches | 1,135 | 366 |
| 36W-026-2 | 10 to 14 inches | 50 U | 35 U |
| 36W-026-3 | 22 to 26 inches | 50 U | 35 U |
| 36W-026-4 | 34 to 38 inches | 50 U | 35 U |

| Sample Number | Depth | Lead (mg/kg) Concentration | Arsenic (mg/kg) Concentration |
|---|---|---|---|
| 36W-017-1 | 0 to 2 inches | 1,505 | 396 |
| 36W-017-2 | 10 to 14 inches | 50 U | 35 U |
| 36W-017-3 | 22 to 26 inches | 50 U | 35 U |
| 36W-017-4 | 34 to 38 inches | 50 U | 35 U |

Base map created using 2010 orthoimagery, sample location from 2013 GPS survey and sample result data from 2013.

Map Creation Date: 02 September 2013

Coordinate system: Arizona State Plane Central
FIPS: 0202
Datum: NAD83
Units: Feet

Data: g:\arcviewprojects\SERAS01\00-146
MXD file: g:\arcinfoprojects\SERAS01\SER00146_IronKingMineSite\ARS_WJ\146_ASR_WJ_Subsurface_Concentration_Map_f4

**Legend**

Lead Concentration (mg/kg)
- < 300
- >= 300

Arsenic Concentration (mg/kg)
- < 150
- >= 150

0 48 96 Feet

U.S. EPA Environmental Response Team
Scientific Engineering Response and Analytical Services
EP-W-09-031
W.A.# 0-146

Figure 4
Subsurface Concentration Map
Iron King Mine Site
Dewey-Humboldt, Arizona


Base map created using 2010 orthoimagery, sample location from 2013 GPS survey and sample result data from 2013.

Map Creation Date: 02 September 2013

Coordinate system: Arizona State Plane Central
FIPS: 0202
Datum: NAD83
Units: Feet

0 48 96 Feet

RL = Reporting Limit
mg/kg = micrograms per kilogram
sqft = Square feet

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EP-W-09-031
W.A.# 0-146

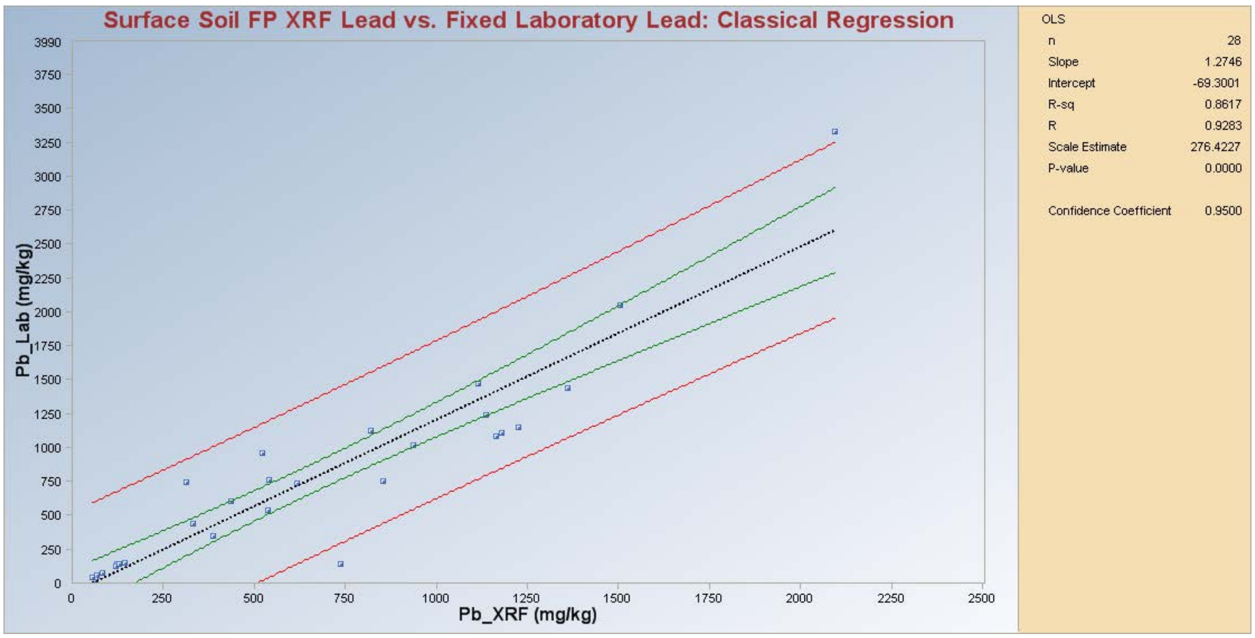
Figure 5
Removal Area
Iron King Mine Site
Dewey-Humboldt, Arizona

Data: g:\arcviewprojects\SERAS01\00-146
MXD file: g:\arcinfoprojects\SERAS01\SER00146_IronKingMineSite\ARS_WJ\146_ARS_WJ_Removal_Area_f5

# APPENDIX A
# XRF Statistical Summary Report
# Iron King Mine Site
# Technical Memorandum
# October 2013

Statistical confirmation analysis was conducted on 28 samples collected during the August 2013 Accelerated Residential Lead Sampling Event. Data included in the statistical analysis can be found in Table 5. Field Portable X-Ray Fluorescence (XRF) readings for lead and arsenic were compared to the corresponding EPA Region 9 laboratory confirmation results using ordinary least squares (OLS) regression analyses. Analyses were conducted using ProUCL version 4.0 EPA software and Excel.

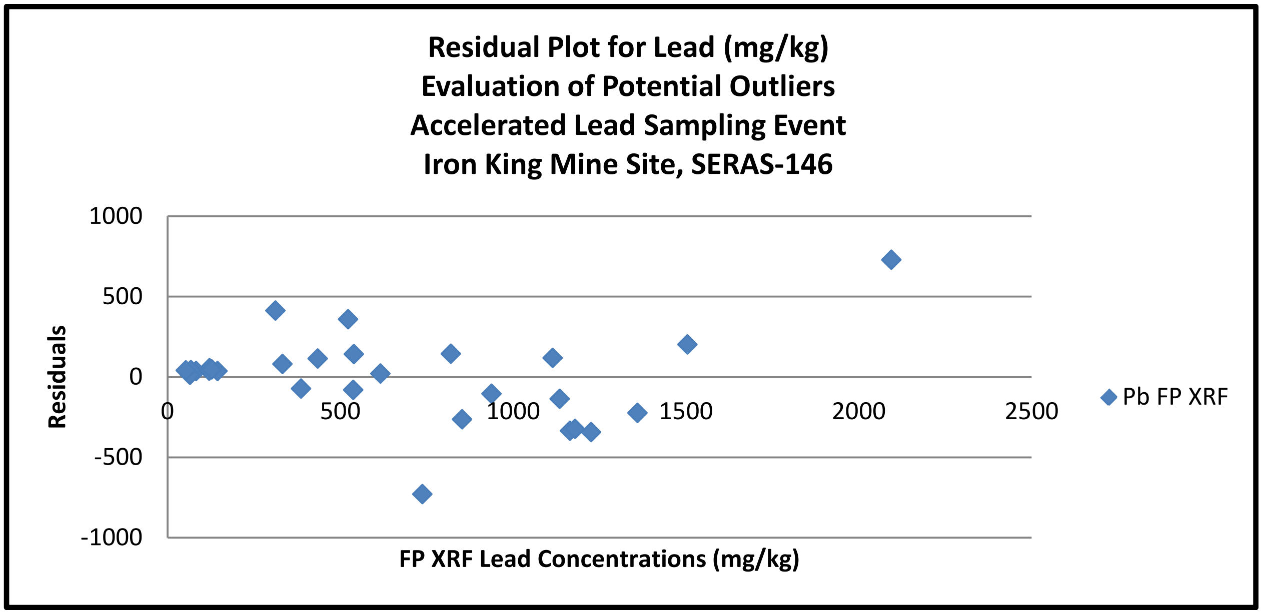
**Lead.** FP XRF readings for lead which were included in the statistical analyses ranged from 54 mg/kg to 2,095 mg/kg. Corresponding laboratory results ranged from 39.2 mg/kg to 3,330 mg/kg. A classical OLS regression analysis was conducted on these measurements with the XRF readings as the independent variable and the laboratory results as the dependent variable. The resulting coefficient of determination ($R^2$) was 0.8617 which met the criteria, $R^2$>0.70 for XRF confirmation analysis, identified in SERAS Standard Operating Procedure (SOP) #1720, *Operation of the NITON XLt792YW Field Portable X-ray Fluorescence Unit*. The figure below depicts the regression analysis with associated statistics listed to the right of the graph.



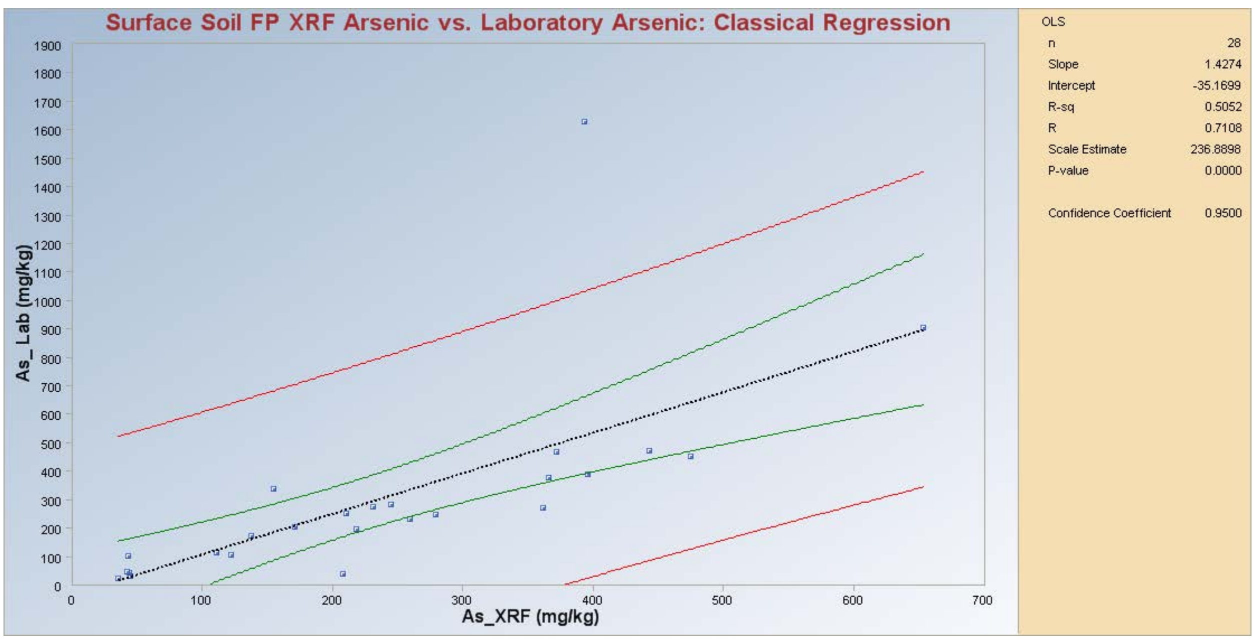

Detailed statistical output can be found in Table A. The regression analysis was performed with the confidence level set at 95% percent. The resulting OLS equation was:

Laboratory Lead = 1.2746 (FP XRF Lead) -69.3001

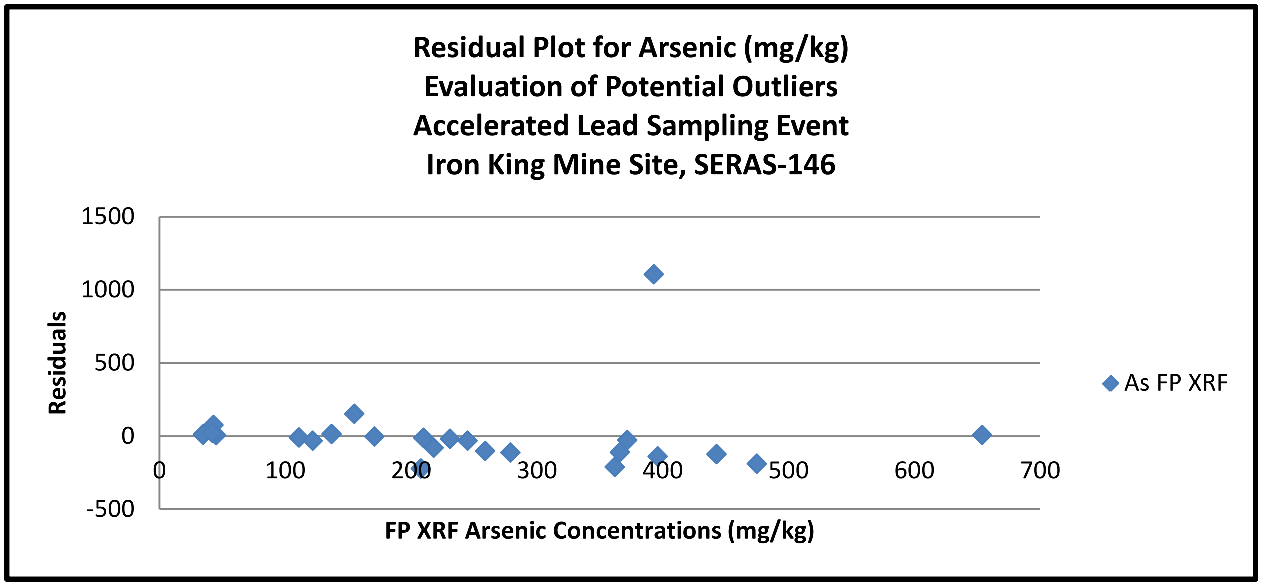
Diagnostic testing was performed on the regression analysis to determine if any potential outliers existed within the data set which may be overly-influencing the computation of the regression equation. This included examination of the residuals in relation to the independent variable XRF readings). When plotted, the data points should be distributed uniformly (with no obvious patterns) above and below the x-axis (y=0). Visual inspection of the plot below and the supporting diagnostic tests [res/scale (Student Residual); Table A] did not indicate the presence of outliers.




**Arsenic.** XRF As measurements ranged from not detected, at a reporting limit of 35 mg/kg, to 654 mg/kg. Corresponding laboratory analytical results ranged from 21.3 mg/kg to 1630 mg/kg. A regression analysis was conducted with the confidence level set at 95%. The computed $R^2$ was 0.505.




Examination of the residuals (Table B) and the associated plot (depicted below) indicated one potential outlier existed within the data: arsenic XRF = 393 mg/kg, arsenic _Lab=1630. In a regression analysis, no single data point should exercise more influence on the placement of the OLS regression line than any other point. In this case, it appeared that the potential outlier had much greater influence over the placement of the regression line than the other points. The relatively high Student Residual (highlighted in Table B) supported this conclusion.




The regression analysis was computed again with the outlying data point removed. The resulting coefficient of determination ($R^2$) was 0.8669 which met the criteria, $R^2$>0.70 for XRF confirmation analysis, identified in SERAS SOP #1720, *Operation of the NITON XLt792YW Field Portable X-ray Fluorescence Unit*. The figure below depicts the regression analysis with associated statistics listed to the right of the graph. The resulting regression equation was:

Laboratory As = 1.1419 (XRF arsenic) -15.5025

Detailed statistical output can be found in Table C.

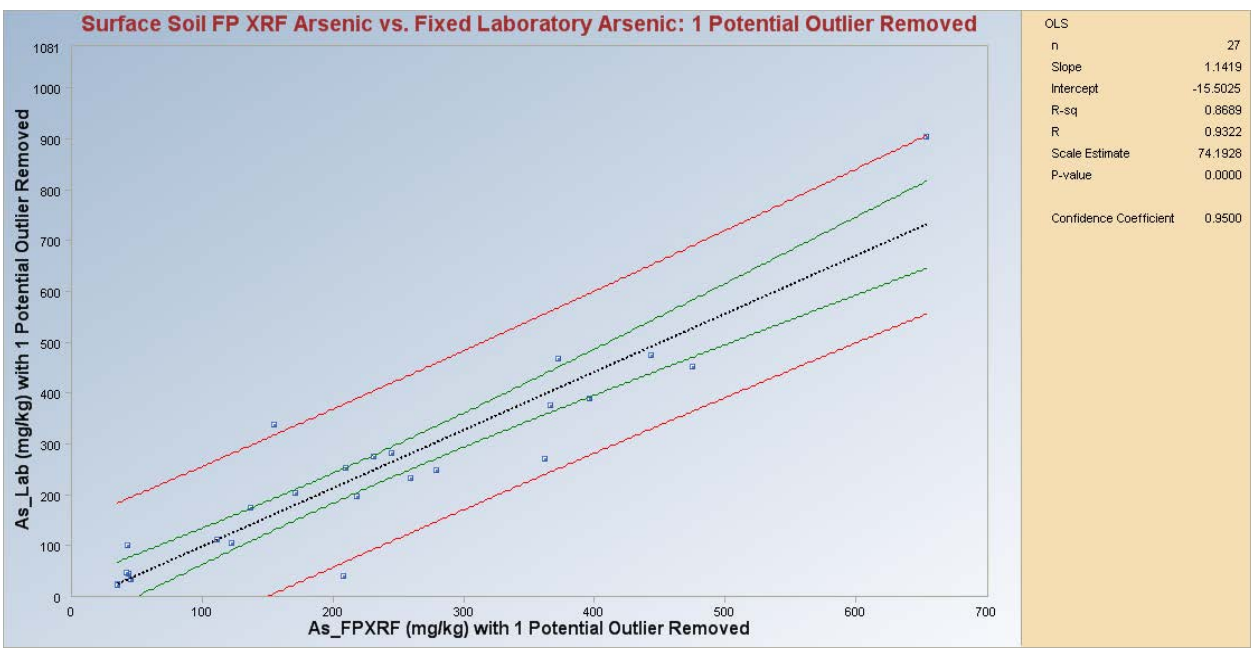


Table A. ProUCL Statistical Output for Classical Regression on Lead Results
FP XRF Lead Measurements (mg/kg) versus EPA Region 9 Confirmation Results (mg/kg)
Accelerated Residential Lead Sampling Event
Iron King Mine Site

**FP XRF Lead (mg/kg) vs. Fixed Laboratory Asrenic (mg/kg): OLS Regression**

| | |
|---|---|
| Date/Time of Computation | 10/18/2013 9:11:47 AM |
| From File | C:\Documents and Settings\dgetty\My Documents\SERAS\IronKing (146)\AcceleratedLeadSamplingResults\Lead_As_Resident.wst |
| Full Precision | OFF |
| Display Limits | True |
| Confidence Level for Intervals | 0.95 |
| Display Regresion Diagnostics | True |
| Display Regresion Tables | True |
| Title For Y vs X Plots | Classical Regression |
| Confidence Level for Regression Line | 0.95 |
| Display Confidence Band | True |
| Display Prediction Band | True |

**Regression Estimates and Inference Table**

| Paramater | Estimates | Std. Error | T-values | p-values |
|---|---|---|---|---|
| intercept | -69.3 | 84.59 | -0.819 | 0.42 |
| Lead_XRF | 1.275 | 0.1 | 12.73 | 1.122E-12 |

**OLS ANOVA Table**

| Source of Variation | SS | DOF | MS | F-Value | P-Value |
|---|---|---|---|---|---|
| **Regression** | 12380538 | 1 | 12380538 | 162 | 0 |
| **Error** | 1986647 | 26 | 76410 | | |
| **Total** | 14367185 | 27 | | | |

| | |
|---|---|
| R Square | 0.862 |
| Adjusted R Square | 0.856 |
| Sqrt(MSE) = Scale | 276.4 |

Table A (continued). ProUCL Statistical Output for Classical Regression on Lead Results
FP XRF Lead Measurements (mg/kg) versus EPA Region 9 Confirmation Results (mg/kg)
Accelerated Residential Lead Sampling Event
Iron King Mine Site

**Regression Table**

| Obs | Y Vector | Yhat | Residuals | Res/Scale |
|---|---|---|---|---|
| 1 | 955 | 597.3 | 357.7 | 1.294 |
| 2 | 761 | 619 | 142 | 0.514 |
| 3 | 737 | 717.1 | 19.86 | 0.0718 |
| 4 | 139 | 86.2 | 52.8 | 0.191 |
| 5 | 73.2 | 36.49 | 36.71 | 0.133 |
| 6 | 122 | 84.93 | 37.07 | 0.134 |
| 7 | 59.5 | 17.37 | 42.13 | 0.152 |
| 8 | 599 | 485.2 | 113.8 | 0.412 |
| 9 | 1470 | 1352 | 118.1 | 0.427 |
| 10 | 1080 | 1416 | -335.6 | -1.214 |
| 11 | 152 | 115.5 | 36.48 | 0.132 |
| 12 | 434 | 355.1 | 78.85 | 0.285 |
| 13 | 142 | 871.4 | -729.4 | -2.639 |
| 14 | 742 | 329.7 | 412.3 | 1.492 |
| 15 | 754 | 1018 | -264 | -0.955 |
| 16 | 1110 | 1435 | -324.8 | -1.175 |
| 17 | 2050 | 1849 | 201 | 0.727 |
| 18 | 1120 | 975.9 | 144.1 | 0.521 |
| 19 | 1150 | 1493 | -343.4 | -1.242 |
| 20 | 3330 | 2601 | 729 | 2.637 |
| 21 | 27.8 | 14.83 | 12.97 | 0.0469 |
| 22 | 1440 | 1664 | -224.2 | -0.811 |
| 23 | 535 | 616.4 | -81.45 | -0.295 |
| 24 | 1020 | 1126 | -106.3 | -0.385 |
| 25 | 351 | 424 | -72.98 | -0.264 |
| 26 | 1240 | 1377 | -137.4 | -0.497 |
| 27 | 39.2 | -0.47 | 39.67 | 0.144 |
| 28 | 140 | 95.13 | 44.87 | 0.162 |

Table A (continued). ProUCL Statistical Output for Classical Regression on Lead Results
FP XRF Lead Measurements (mg/kg) versus EPA Region 9 Confirmation Results (mg/kg)
Accelerated Residential Lead Sampling Event
Iron King Mine Site

**Summary Table for Prediction and Confidence Limits**

| Obs | X Vector | Y Vector | Yhat | s(Yhat) | s(pred) | LCL | UCL | LPL | UPL | Residuals |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 523 | 955 | 597.3 | 54.12 | 281.7 | -630.5 | 1825 | 486.1 | 708.6 | 357.7 |
| 2 | 540 | 761 | 619 | 53.7 | 281.6 | -653.4 | 1891 | 508.6 | 729.4 | 142 |
| 3 | 617 | 737 | 717.1 | 52.45 | 281.4 | -757 | 2191 | 609.3 | 825 | 19.86 |
| 4 | 122 | 139 | 86.2 | 75.36 | 286.5 | -90.99 | 263.4 | -68.7 | 241.1 | 52.8 |
| 5 | 83 | 73.2 | 36.49 | 78.22 | 287.3 | -38.52 | 111.5 | -124.3 | 197.3 | 36.71 |
| 6 | 121 | 122 | 84.93 | 75.43 | 286.5 | -89.65 | 259.5 | -70.12 | 240 | 37.07 |
| 7 | 68 | 59.5 | 17.37 | 79.35 | 287.6 | -18.34 | 53.09 | -145.7 | 180.5 | 42.13 |
| 8 | 435 | 599 | 485.2 | 57.07 | 282.3 | -512.1 | 1482 | 367.9 | 602.5 | 113.8 |
| 9 | 1115 | 1470 | 1352 | 69.03 | 284.9 | -1427 | 4131 | 1210 | 1494 | 118.1 |
| 10 | 1165 | 1080 | 1416 | 72.4 | 285.7 | -1494 | 4326 | 1267 | 1564 | -335.6 |
| 11 | 145 | 152 | 115.5 | 73.72 | 286.1 | -121.9 | 353 | -36.01 | 267 | 36.48 |
| 12 | 333 | 434 | 355.1 | 61.89 | 283.3 | -374.9 | 1085 | 227.9 | 482.4 | 78.85 |
| 13 | 738 | 142 | 871.4 | 52.76 | 281.4 | -919.8 | 2663 | 762.9 | 979.8 | -729.4 |
| 14 | 313 | 742 | 329.7 | 62.99 | 283.5 | -348 | 1007 | 200.2 | 459.1 | 412.3 |
| 15 | 853 | 754 | 1018 | 55.55 | 281.9 | -1074 | 3110 | 903.8 | 1132 | -264 |
| 16 | 1180 | 1110 | 1435 | 73.45 | 286 | -1514 | 4384 | 1284 | 1586 | -324.8 |
| 17 | 1505 | 2050 | 1849 | 99.06 | 293.6 | -1952 | 5650 | 1645 | 2053 | 201 |
| 18 | 820 | 1120 | 975.9 | 54.51 | 281.7 | -1030 | 2982 | 863.8 | 1088 | 144.1 |
| 19 | 1226 | 1150 | 1493 | 76.75 | 286.9 | -1576 | 4563 | 1336 | 1651 | -343.4 |
| 20 | 2095 | 3330 | 2601 | 152.5 | 315.7 | -2745 | 7948 | 2288 | 2914 | 729 |
| 21 | 66 | 27.8 | 14.83 | 79.5 | 287.6 | -15.65 | 45.3 | -148.6 | 178.2 | 12.97 |
| 22 | 1360 | 1440 | 1664 | 87.06 | 289.8 | -1757 | 5085 | 1485 | 1843 | -224.2 |
| 23 | 538 | 535 | 616.4 | 53.75 | 281.6 | -650.7 | 1884 | 506 | 726.9 | -81.45 |
| 24 | 938 | 1020 | 1126 | 58.99 | 282.6 | -1189 | 3441 | 1005 | 1248 | -106.3 |
| 25 | 387 | 351 | 424 | 59.17 | 282.7 | -447.5 | 1295 | 302.4 | 545.6 | -72.98 |
| 26 | 1135 | 1240 | 1377 | 70.35 | 285.2 | -1454 | 4209 | 1233 | 1522 | -137.4 |
| 27 | 54 | 39.2 | -0.47 | 80.41 | 287.9 | 0.497 | -1.437 | -165.7 | 164.8 | 39.67 |
| 28 | 129 | 140 | 95.13 | 74.86 | 286.4 | -100.4 | 290.7 | -58.74 | 249 | 44.87 |

Table B. ProUCL Statistical Output for Classical Regression on Arsenic Results
XRF Arsenic Measurements (mg/kg) versus EPA Region 9 Confirmation Results (mg/kg)
Accelerated Residential Lead Sampling Event
Iron King Mine Site

**FP XRF Arsenic (mg/kg) vs. Fixed Laboratory Arsenic (mg/kg): OLS Regression**

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | 10/18/2013 8:48:00 AM |
| From File | C:\Documents and Settings\dgetty\My Documents\SERAS\IronKing (146)\AcceleratedLeadSamplingResults\Lead_As_Resident.wst |
| Full Precision | OFF |
| Display Limits | True |
| Confidence Level for Intervals | 0.95 |
| Display Regresion Diagnostics | True |
| Display Regresion Tables | True |
| Title For Y vs X Plots | Classical Regression |
| Confidence Level for Regression Line | 0.95 |
| Display Confidence Band | True |
| Display Prediction Band | True |

**Regression Estimates and Inference Table**

| Paramater | Estimates | Std. Error | T-values | p-values |
|---|---|---|---|---|
| intercept | -35.17 | 75.32 | -0.467 | 0.644 |
| As_XRF | 1.427 | 0.277 | 5.152 | 2.25E-05 |

**OLS ANOVA Table**

| Source of Variation | SS | DOF | MS | F-Value | P-Value |
|---|---|---|---|---|---|
| **Regression** | 1489517 | 1 | 1489517 | 26.54 | 0 |
| **Error** | 1459037 | 26 | 56117 | | |
| **Total** | 2948553 | 27 | | | |

| | |
|---|---|
| R Square | 0.505 |
| Adjusted R Square | 0.486 |
| Sqrt(MSE) = Scale | 236.9 |

Table B (continued). ProUCL Statistical Output for Classical Regression on Arsenic Results
FP XRF Arsenic Measurements (mg/kg) versus EPA Region 9 Confirmation Results (mg/kg)
Accelerated Residential Lead Sampling Event
Iron King Mine Site

**Regression Table**

| Obs | Y Vector | Yhat | Residuals | Res/Scale |
|---|---|---|---|---|
| 1 | 174 | 160.4 | 13.62 | 0.0575 |
| 2 | 252 | 264.6 | -12.59 | -0.0531 |
| 3 | 276 | 294.6 | -18.56 | -0.0784 |
| 4 | 24.6 | 14.79 | 9.811 | 0.0414 |
| 5 | 23.5 | 14.79 | 8.711 | 0.0368 |
| 6 | 25.4 | 14.79 | 10.61 | 0.0448 |
| 7 | 23.1 | 14.79 | 8.311 | 0.0351 |
| 8 | 204 | 208.9 | -4.917 | -0.0208 |
| 9 | 1630 | 525.8 | 1104 | 4.661 |
| 10 | 283 | 314.5 | -31.54 | -0.133 |
| 11 | 474 | 597.2 | -123.2 | -0.52 |
| 12 | 101 | 26.21 | 74.79 | 0.316 |
| 13 | 40.1 | 261.7 | -221.6 | -0.936 |
| 14 | 113 | 123.3 | -10.27 | -0.0434 |
| 15 | 196 | 276 | -80 | -0.338 |
| 16 | 233 | 334.5 | -101.5 | -0.429 |
| 17 | 390 | 530.1 | -140.1 | -0.591 |
| 18 | 452 | 642.8 | -190.8 | -0.806 |
| 19 | 271 | 481.6 | -210.6 | -0.889 |
| 20 | 905 | 898.4 | 6.646 | 0.0281 |
| 21 | 33.4 | 29.06 | 4.337 | 0.0183 |
| 22 | 468 | 495.8 | -27.83 | -0.117 |
| 23 | 337 | 186.1 | 150.9 | 0.637 |
| 24 | 249 | 363.1 | -114.1 | -0.482 |
| 25 | 106 | 139 | -32.97 | -0.139 |
| 26 | 377 | 487.3 | -110.3 | -0.465 |
| 27 | 44.5 | 27.64 | 16.86 | 0.0712 |
| 28 | 46.8 | 24.78 | 22.02 | 0.0929 |

Table B (continued). ProUCL Statistical Output for Classical Regression on Arsenic Results
FP XRF Arsenic Measurements (mg/kg) versus EPA Region 9 Confirmation Results (mg/kg)
Accelerated Residential Lead Sampling Event
Iron King Mine Site

**Summary Table for Prediction and Confidence Limits**

| Obs | X Vector | Y Vector | Yhat | s(Yhat) | s(pred) | LCL | UCL | LPL | UPL | Residuals |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 137 | 174 | 160.4 | 50.15 | 242.1 | -169.3 | 490.1 | 57.29 | 263.5 | 13.62 |
| 2 | 210 | 252 | 264.6 | 44.83 | 241.1 | -279.3 | 808.4 | 172.4 | 356.7 | -12.59 |
| 3 | 231 | 276 | 294.6 | 44.9 | 241.1 | -310.9 | 900 | 202.3 | 386.9 | -18.56 |
| 4 | 35 | 24.6 | 14.79 | 67.76 | 246.4 | -15.61 | 45.19 | -124.5 | 154.1 | 9.811 |
| 5 | 35 | 23.5 | 14.79 | 67.76 | 246.4 | -15.61 | 45.19 | -124.5 | 154.1 | 8.711 |
| 6 | 35 | 25.4 | 14.79 | 67.76 | 246.4 | -15.61 | 45.19 | -124.5 | 154.1 | 10.61 |
| 7 | 35 | 23.1 | 14.79 | 67.76 | 246.4 | -15.61 | 45.19 | -124.5 | 154.1 | 8.311 |
| 8 | 171 | 204 | 208.9 | 46.67 | 241.4 | -220.5 | 638.4 | 113 | 304.8 | -4.917 |
| 9 | 393 | 1630 | 525.8 | 65.87 | 245.9 | -555 | 1607 | 390.4 | 661.2 | 1104 |
| 10 | 245 | 283 | 314.5 | 45.36 | 241.2 | -332 | 961.1 | 221.3 | 407.8 | -31.54 |
| 11 | 443 | 474 | 597.2 | 76.61 | 249 | -630.3 | 1825 | 439.7 | 754.6 | -123.2 |
| 12 | 43 | 101 | 26.21 | 66.12 | 245.9 | -27.66 | 80.08 | -109.7 | 162.1 | 74.79 |
| 13 | 208 | 40.1 | 261.7 | 44.86 | 241.1 | -276.3 | 799.7 | 169.5 | 354 | -221.6 |
| 14 | 111 | 113 | 123.3 | 53.79 | 242.9 | -130.1 | 376.7 | 12.71 | 233.8 | -10.27 |
| 15 | 218 | 196 | 276 | 44.77 | 241.1 | -291.3 | 843.3 | 184 | 368 | -80 |
| 16 | 259 | 233 | 334.5 | 46.15 | 241.3 | -353.1 | 1022 | 239.7 | 429.4 | -101.5 |
| 17 | 396 | 390 | 530.1 | 66.48 | 246 | -559.5 | 1620 | 393.4 | 666.7 | -140.1 |
| 18 | 475 | 452 | 642.8 | 83.97 | 251.3 | -678.5 | 1964 | 470.3 | 815.4 | -190.8 |
| 19 | 362 | 271 | 481.6 | 59.85 | 244.3 | -508.3 | 1471 | 358.5 | 604.6 | -210.6 |
| 20 | 654 | 905 | 898.4 | 128.7 | 269.6 | -948.2 | 2745 | 633.9 | 1163 | 6.646 |
| 21 | 45 | 33.4 | 29.06 | 65.71 | 245.8 | -30.68 | 88.8 | -106 | 164.1 | 4.337 |
| 22 | 372 | 468 | 495.8 | 61.73 | 244.8 | -523.4 | 1515 | 368.9 | 622.7 | -27.83 |
| 23 | 155 | 337 | 186.1 | 48.11 | 241.7 | -196.4 | 568.6 | 87.18 | 285 | 150.9 |
| 24 | 279 | 249 | 363.1 | 47.79 | 241.7 | -383.2 | 1109 | 264.8 | 461.3 | -114.1 |
| 25 | 122 | 106 | 139 | 52.16 | 242.6 | -146.7 | 424.6 | 31.76 | 246.2 | -32.97 |
| 26 | 366 | 377 | 487.3 | 60.6 | 244.5 | -514.3 | 1489 | 362.7 | 611.8 | -110.3 |
| 27 | 44 | 44.5 | 27.64 | 65.91 | 245.9 | -29.17 | 84.44 | -107.8 | 163.1 | 16.86 |
| 28 | 42 | 46.8 | 24.78 | 66.32 | 246 | -26.16 | 75.72 | -111.5 | 161.1 | 22.02 |

Table C. ProUCL Statistical Output for Classical Regression on Arsenic Results – Potential Outlier Excluded
XRF Arsenic Measurements (mg/kg) versus EPA Region 9 Confirmation Results (mg/kg)
Accelerated Residential Lead Sampling Event
Iron King Mine Site

**Arsenic (mg/kg) with One Outlier Removed: FP XRF vs. Laboratory OLS Regresion**

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | 10/18/2013 1:47:40 PM |
| From File | C:\Documents and Settings\dgetty\My Documents\SERAS\IronKing (146)\AcceleratedLeadSamplingResults\Lead_Aresenic_Resident.wst |
| Full Precision | OFF |
| Display Limits | True |
| Confidence Level for Intervals | 0.95 |
| Display Regresion Diagnostics | True |
| Display Regresion Tables | True |
| Title For Y vs X Plots | Claresenicsical Regression |
| Confidence Level for Regression Line | 0.95 |
| Display Confidence Band | True |
| Display Prediction Band | True |

**Regression Estimates and Inference Table**

| Paramater | Estimates | Std. Error | T-values | p-values |
|---|---|---|---|---|
| intercept | -15.5 | 23.62 | -0.656 | 0.518 |
| Arsenic_XRFNoOut | 1.142 | 0.0887 | 12.87 | 1.57E-12 |

**OLS ANOVA Table**

| Source of Variation | SS | DOF | MS | F-Value | P-Value |
|---|---|---|---|---|---|
| **Regression** | 912169 | 1 | 912169 | 165.7 | 0 |
| **Error** | 137614 | 25 | 5505 | | |
| **Total** | 1049783 | 26 | | | |

| | |
|---|---|
| R Square | 0.869 |
| Adjusted R Square | 0.864 |
| Sqrt(MSE) = Scale | 74.19 |

Table C (continued). ProUCL Statistical Output for Claresenicsical Regression on Arsenic Results – Potential Outlier Excluded
XRF Arsenic Mearesenicurements (mg/kg) versus SERARESENIC Laboratory Arsenic Results (mg/kg)
Accelerated Residential Lead Sampling Event
Iron King Mine Site

**Regression Table**

| Obs | Y Vector | Yhat | Residuals | Res/Scale |
|---|---|---|---|---|
| 1 | 174 | 140.9 | 33.06 | 0.446 |
| 2 | 252 | 224.3 | 27.7 | 0.373 |
| 3 | 276 | 248.3 | 27.72 | 0.374 |
| 4 | 24.6 | 24.47 | 0.135 | 0.00182 |
| 5 | 23.5 | 24.47 | -0.965 | -0.013 |
| 6 | 25.4 | 24.47 | 0.935 | 0.0126 |
| 7 | 23.1 | 24.47 | -1.365 | -0.0184 |
| 8 | 204 | 179.8 | 24.23 | 0.327 |
| 9 | 283 | 264.3 | 18.73 | 0.252 |
| 10 | 474 | 490.4 | -16.37 | -0.221 |
| 11 | 101 | 33.6 | 67.4 | 0.908 |
| 12 | 40.1 | 222 | -181.9 | -2.452 |
| 13 | 113 | 111.3 | 1.748 | 0.0236 |
| 14 | 196 | 233.4 | -37.44 | -0.505 |
| 15 | 233 | 280.3 | -47.26 | -0.637 |
| 16 | 390 | 436.7 | -46.7 | -0.629 |
| 17 | 452 | 526.9 | -74.91 | -1.01 |
| 18 | 271 | 397.9 | -126.9 | -1.71 |
| 19 | 905 | 731.3 | 173.7 | 2.341 |
| 20 | 33.4 | 35.88 | -2.484 | -0.0335 |
| 21 | 468 | 409.3 | 58.71 | 0.791 |
| 22 | 337 | 161.5 | 175.5 | 2.366 |
| 23 | 249 | 303.1 | -54.1 | -0.729 |
| 24 | 106 | 123.8 | -17.81 | -0.24 |
| 25 | 377 | 402.4 | -25.44 | -0.343 |
| 26 | 44.5 | 34.74 | 9.758 | 0.132 |
| 27 | 46.8 | 32.46 | 14.34 | 0.193 |

Table C (continued). ProUCL Statistical Output for Claresenicsical Regression on Arsenic Results – Potential Outlier Excluded
FP XRF Arsenic Mearesenicurements (mg/kg) versus SERARESENIC Laboratory Arsenic Results (mg/kg)
Accelerated Residential Lead Sampling Event
Iron King Mine Site

**Summary Table for Prediction and Confidence Limits**

| Obs | X Vector | Y Vector | Yhat | s(Yhat) | s(pred) | LCL | UCL | LPL | UPL | Residuals |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 137 | 174 | 140.9 | 15.76 | 75.85 | -149.3 | 431.2 | 108.5 | 173.4 | 33.06 |
| 2 | 210 | 252 | 224.3 | 14.28 | 75.55 | -237.7 | 686.3 | 194.9 | 253.7 | 27.7 |
| 3 | 231 | 276 | 248.3 | 14.38 | 75.57 | -263.1 | 759.6 | 218.7 | 277.9 | 27.72 |
| 4 | 35 | 24.6 | 24.47 | 21.23 | 77.17 | -25.92 | 74.85 | -19.26 | 68.19 | 0.135 |
| 5 | 35 | 23.5 | 24.47 | 21.23 | 77.17 | -25.92 | 74.85 | -19.26 | 68.19 | -0.965 |
| 6 | 35 | 25.4 | 24.47 | 21.23 | 77.17 | -25.92 | 74.85 | -19.26 | 68.19 | 0.935 |
| 7 | 35 | 23.1 | 24.47 | 21.23 | 77.17 | -25.92 | 74.85 | -19.26 | 68.19 | -1.365 |
| 8 | 171 | 204 | 179.8 | 14.74 | 75.64 | -190.5 | 550 | 149.4 | 210.1 | 24.23 |
| 9 | 245 | 283 | 264.3 | 14.57 | 75.61 | -280 | 808.5 | 234.3 | 294.3 | 18.73 |
| 10 | 443 | 474 | 490.4 | 24.96 | 78.28 | -519.6 | 1500 | 439 | 541.8 | -16.37 |
| 11 | 43 | 101 | 33.6 | 20.71 | 77.03 | -35.6 | 102.8 | -9.058 | 76.26 | 67.4 |
| 12 | 208 | 40.1 | 222 | 14.28 | 75.56 | -235.2 | 679.3 | 192.6 | 251.4 | -181.9 |
| 13 | 111 | 113 | 111.3 | 16.86 | 76.09 | -117.9 | 340.4 | 76.52 | 146 | 1.748 |
| 14 | 218 | 196 | 233.4 | 14.29 | 75.56 | -247.3 | 714.2 | 204 | 262.9 | -37.44 |
| 15 | 259 | 233 | 280.3 | 14.87 | 75.67 | -296.9 | 857.5 | 249.6 | 310.9 | -47.26 |
| 16 | 396 | 390 | 436.7 | 21.68 | 77.29 | -462.7 | 1336 | 392.1 | 481.3 | -46.7 |
| 17 | 475 | 452 | 526.9 | 27.34 | 79.07 | -558.3 | 1612 | 470.6 | 583.2 | -74.91 |
| 18 | 362 | 271 | 397.9 | 19.51 | 76.71 | -421.6 | 1217 | 357.7 | 438.1 | -126.9 |
| 19 | 654 | 905 | 731.3 | 41.72 | 85.12 | -774.9 | 2237 | 645.4 | 817.2 | 173.7 |
| 20 | 45 | 33.4 | 35.88 | 20.58 | 77 | -38.02 | 109.8 | -6.51 | 78.28 | -2.484 |
| 21 | 372 | 468 | 409.3 | 20.12 | 76.87 | -433.7 | 1252 | 367.9 | 450.7 | 58.71 |
| 22 | 155 | 337 | 161.5 | 15.15 | 75.72 | -171.1 | 494.1 | 130.3 | 192.7 | 175.5 |
| 23 | 279 | 249 | 303.1 | 15.46 | 75.79 | -321.1 | 927.3 | 271.3 | 334.9 | -54.1 |
| 24 | 122 | 106 | 123.8 | 16.37 | 75.98 | -131.2 | 378.8 | 90.11 | 157.5 | -17.81 |
| 25 | 366 | 377 | 402.4 | 19.75 | 76.78 | -426.4 | 1231 | 361.8 | 443.1 | -25.44 |
| 26 | 44 | 44.5 | 34.74 | 20.65 | 77.01 | -36.81 | 106.3 | -7.784 | 77.27 | 9.758 |
| 27 | 42 | 46.8 | 32.46 | 20.78 | 77.05 | -34.39 | 99.31 | -10.33 | 75.25 | 14.34 |

# APPENDIX B
# Field XRF Results
# Iron King Mine Site
# Technical Memorandum
# October 2013

**Lockheed Martin Information Systems and Global Services**
**Environmental Services/SERAS**
**2890 Woodbridge Ave, Building 209 Annex**
**Edison, NJ 08837-3679**
**Telephone: 732-321-4200 Facsimile: 732-494-4021**

LOCKHEED MARTIN

**DATE:** 08/22/2013

**TO:** Terrence Johnson, U. S. EPA/ERT

**FROM:** Jay Patel, Analytical Support Leader, SERAS Jay Patel

**SUBJECT:** Preliminary Results of Project: **IRON KING MINE SITE** WA# SER00146

Attached please find the preliminary results of the above referenced project for the following samples.

**NO QC EVALUATION/VALIDATION HAS BEEN PERFORMED**
**DATA VALIDITY IS UNSUBSTANTIATED**
**AND THE DATA SHOULD BE USED WITH DISCRETION**

| Chain of Custody No. | # of samples | Matrix | Analyses |
|---|---|---|---|
| NA | 204 | Soil | Pb & As by XRF (**on-site** analysis on 08/13-15/13) |
| 06617, 06618, 06619 006620, 06621 | 77 | Soil | Pb & As by XRF (analysis at SERAS lab on 08/19-20/13) |

CC: Central File # SER00146

S. Grossman Task Leader, SERAS
D. Aloysius

L. Martin, Hazardous Waste Coordinator, SERAS

# SERAS XRF DAILY PRELIMINARY ANALYSIS REPORT
# (PRELIMINARY SCREENING DATA, NO QA/QC)

**Site:** Iron King Mine Site

**SERAS WA#:** SER00146

**XRF used:** NITON XLt792YW

**XRF S/N:** 8262

**Matrix type:** Soil

**XRF Operator:** Jay Patel

**Conc. Units:** mg/Kg

| Date Analyzed | SAMPLE ID | Location | Lead | | Arsenic | | |
|---|---|---|---|---|---|---|---|
| | | | Conc. | RL | Conc. | RL | |
| 15-Aug-13 | 00W-001-1F | 00W-001-1F | 128 | 50 | 42 | 35 | |
| 15-Aug-13 | 00W-002-1F | 00W-002-1F | 188 | 50 | 82 | 35 | |
| 15-Aug-13 | 00W-003-1F | 00W-003-1F | 138 | 50 | 64 | 35 | |
| 15-Aug-13 | 00W-004-1F | 00W-004-1F | 167 | 50 | 41 | 35 | |
| 15-Aug-13 | 00W-005-1B | 00W-005-1B | 546 | 50 | 114 | 54.6 | |
| 15-Aug-13 | 00W-005-1F | 00W-005-1F | 390 | 50 | 107 | 39 | |
| 15-Aug-13 | 00W-006-1F | 00W-006-1F | 88 | 50 | 63 | 35 | |
| 15-Aug-13 | 00W-007-1F | 00W-007-1F | 88 | 50 | 49 | 35 | |
| 15-Aug-13 | 00W-008-1F | 00W-008-1F | 81 | 50 | 40 | 35 | |
| 15-Aug-13 | 00W-009-1F | 00W-009-1F | 134 | 50 | U | 35 | |
| 15-Aug-13 | 00W-010-1F | 00W-010-1F | 114 | 50 | 38 | 35 | |
| 15-Aug-13 | 00W-011-1F | 00W-011-1F | 63 | 50 | U | 35 | |
| 15-Aug-13 | 00W-012-1F | 00W-012-1F | 52 | 50 | U | 35 | |
| 15-Aug-13 | 00W-013-1F | 00W-013-1F | 79 | 50 | U | 35 | |
| 15-Aug-13 | 00W-014-1F | 00W-014-1F | 79 | 50 | U | 35 | |
| 15-Aug-13 | 00W-015-1F | 00W-015-1F | U | 50 | 35 | 35 | |
| 15-Aug-13 | 00W-016-1F | 00W-016-1F | 70 | 50 | U | 35 | |
| 15-Aug-13 | 00W-017-1F | 00W-017-1F | 54 | 50 | U | 35 | |
| 15-Aug-13 | 00W-018-1F | 00W-018-1F | 71 | 50 | U | 35 | |
| 15-Aug-13 | 00W-019-1F | 00W-019-1F | 80 | 50 | U | 35 | |
| 15-Aug-13 | 00W-020-1F | 00W-020-1F | 52 | 50 | U | 35 | |
| 15-Aug-13 | 00W-021-1F | 00W-021-1F | 65 | 50 | U | 35 | |
| 15-Aug-13 | 00W-022-1B | 00W-022-1B | 265 | 50 | 91 | 35 | |
| 15-Aug-13 | 00W-022-1F | 00W-022-1F | 278 | 50 | 97 | 35 | |
| 15-Aug-13 | 00W-023-1F | 00W-023-1F | 68 | 50 | U | 35 | |
| 15-Aug-13 | 00W-024-1F | 00W-024-1F | 88 | 50 | U | 35 | |
| 15-Aug-13 | 00W-025-1F | 00W-025-1F | 61 | 50 | U | 35 | |
| 15-Aug-13 | 00W-026-1F | 00W-026-1F | 85 | 50 | U | 35 | |
| 15-Aug-13 | 00W-027-1F | 00W-027-1F | 56 | 50 | U | 35 | |
| 15-Aug-13 | 00W-028-1F | 00W-028-1F | 74 | 50 | 45 | 35 | |
| 14-Aug-13 | 30W-001-1B | 30W-001-1B | 270 | 50 | 91 | 35 | |
| 14-Aug-13 | 30W-001-1F | 30W-001-1F | 287 | 50 | 76 | 35 | |
| 14-Aug-13 | 30W-002-1F | 30W-002-1F | 143 | 50 | U | 35 | |
| 14-Aug-13 | 30W-003-1F | 30W-003-1F | 146 | 50 | U | 35 | |
| 14-Aug-13 | 30W-004-1B | 30W-004-1B | 103 | 50 | U | 35 | |
| 14-Aug-13 | 30W-004-1F | 30W-004-1F | 78 | 50 | U | 35 | |
| 14-Aug-13 | 30W-005-1B | 30W-005-1B | 86 | 50 | U | 35 | |

# SERAS XRF DAILY PRELIMINARY ANALYSIS REPORT
# (PRELIMINARY SCREENING DATA, NO QA/QC)

**Site:** Iron King Mine Site
**SERAS WA#:** SER00146
**XRF used:** NITON XLt792YW
**XRF S/N:** 8262
**Matrix type:** Soil
**XRF Operator:** Jay Patel
**Conc. Units:** mg/Kg

| Date Analyzed | SAMPLE ID | Location | Lead | | Arsenic | | |
|---|---|---|---|---|---|---|---|
| | | | Conc. | RL | Conc. | RL | |
| 14-Aug-13 | 30W-005-1F | 30W-005-1F | 93 | 50 | U | 35 | |
| 14-Aug-13 | 30W-006-1B | 30W-006-1B | 143 | 50 | 42 | 35 | |
| 14-Aug-13 | 30W-006-1F | 30W-006-1F | 131 | 50 | U | 35 | |
| 14-Aug-13 | 30W-007-1B | 30W-007-1B | 93 | 50 | 35 | 35 | |
| 14-Aug-13 | 30W-007-1F | 30W-007-1F | 99 | 50 | U | 35 | |
| 14-Aug-13 | 30W-008-1F | 30W-008-1F | 123 | 50 | 38 | 35 | |
| 14-Aug-13 | 30W-009-1F | 30W-009-1F | 161 | 50 | U | 35 | |
| 14-Aug-13 | 30W-010-1F | 30W-010-1F | 69 | 50 | U | 35 | |
| 13-Aug-13 | 30W-011-1B | 30W-011-1B | 170 | 50 | 39 | 35 | |
| 13-Aug-13 | 30W-011-1F | 30W-011-1F | 163 | 50 | 59 | 35 | |
| 13-Aug-13 | 30W-012-1B | 30W-012-1B | 183 | 50 | 63 | 35 | |
| 13-Aug-13 | 30W-012-1F | 30W-012-1F | 211 | 50 | 56 | 35 | |
| 13-Aug-13 | 30W-013-1B | 30W-013-1B | 152 | 50 | 44 | 35 | |
| 13-Aug-13 | 30W-013-1F | 30W-013-1F | 150 | 50 | 44 | 35 | |
| 13-Aug-13 | 30W-014-1B | 30W-014-1B | 202 | 50 | 64 | 35 | |
| 13-Aug-13 | 30W-014-1F | 30W-014-1F | 174 | 50 | 64 | 35 | |
| 13-Aug-13 | 30W-015-1B | 30W-015-1B | 174 | 50 | 54 | 35 | |
| 13-Aug-13 | 30W-015-1F | 30W-015-1F | 175 | 50 | 64 | 35 | |
| 13-Aug-13 | 30W-016-1B | 30W-016-1B | 215 | 50 | 70 | 35 | |
| 13-Aug-13 | 30W-016-1F | 30W-016-1F | 246 | 50 | 62 | 35 | |
| 14-Aug-13 | 30W-017-1B | 30W-017-1B | 369 | 50 | 159 | 36.9 | |
| 14-Aug-13 | 30W-017-1F | 30W-017-1F | 340 | 50 | 126 | 35 | |
| 14-Aug-13 | 30W-018-1F | 30W-018-1F | 105 | 50 | U | 35 | |
| 13-Aug-13 | 30W-019-1B | 30W-019-1B | 569 | 50 | 127 | 56.9 | |
| 13-Aug-13 | 30W-019-1F | 30W-019-1F | 477 | 50 | 147 | 47.7 | |
| 13-Aug-13 | 30W-020-1B | 30W-020-1B | 471 | 50 | 182 | 47.1 | |
| 13-Aug-13 | 30W-020-1F | 30W-020-1F | 609 | 50 | 237 | 60.9 | |
| 14-Aug-13 | 30W-020-2B | 30W-020-2B | 500 | 50 | 180 | 50 | |
| 14-Aug-13 | 30W-020-2F | 30W-020-2F | 369 | 50 | 161 | 36.9 | |
| 14-Aug-13 | 30W-020-3B | 30W-020-3B | 1090 | 50 | 420 | 109 | |
| 14-Aug-13 | 30W-020-3F | 30W-020-3F | 1140 | 50 | 365 | 114 | |
| 14-Aug-13 | 30W-020-4B | 30W-020-4B | 254 | 50 | 669 | 35 | |
| 14-Aug-13 | 30W-020-4F | 30W-020-4F | 196 | 50 | 656 | 35 | |
| 14-Aug-13 | 30W-021-1B | 30W-021-1B | 1100 | 50 | 236 | 110 | |
| 14-Aug-13 | 30W-021-1F | 30W-021-1F | 1230 | 50 | 253 | 123 | |
| 14-Aug-13 | 30W-021-2F | 30W-021-2F | 84 | 50 | 54 | 35 | |
| 14-Aug-13 | 30W-021-3F | 30W-021-3F | 69 | 50 | U | 35 | |

# SERAS XRF DAILY PRELIMINARY ANALYSIS REPORT
## (PRELIMINARY SCREENING DATA, NO QA/QC)

**Site:** Iron King Mine Site
**SERAS WA#:** SER00146
**XRF used:** NITON XLt792YW
**XRF S/N:** 8262
**Matrix type:** Soil
**XRF Operator:** Jay Patel
**Conc. Units:** mg/Kg

| Date Analyzed | SAMPLE ID | Location | Lead | | Arsenic | | |
|---|---|---|---|---|---|---|---|
| | | | Conc. | RL | Conc. | RL | |
| 14-Aug-13 | 30W-021-4F | 30W-021-4F | U | 50 | U | 35 | |
| 13-Aug-13 | 30W-022-1B | 30W-022-1B | 154 | 50 | 55 | 35 | |
| 13-Aug-13 | 30W-022-1F | 30W-022-1F | 191 | 50 | 46 | 35 | |
| 13-Aug-13 | 30W-023-1B | 30W-023-1B | 217 | 50 | 85 | 35 | |
| 13-Aug-13 | 30W-023-1F | 30W-023-1F | 203 | 50 | 70 | 35 | |
| 13-Aug-13 | 30W-024-1B | 30W-024-1B | 645 | 50 | 238 | 64.5 | |
| 13-Aug-13 | 30W-024-1F | 30W-024-1F | 589 | 50 | 223 | 58.9 | |
| 14-Aug-13 | 30W-024-2B | 30W-024-2B | 140 | 50 | 458 | 35 | |
| 14-Aug-13 | 30W-024-2F | 30W-024-2F | 149 | 50 | 428 | 35 | |
| 14-Aug-13 | 30W-024-3F | 30W-024-3F | 51 | 50 | U | 35 | |
| 14-Aug-13 | 30W-024-4F | 30W-024-4F | U | 50 | U | 35 | |
| 13-Aug-13 | 36W-001-1B | 36W-001-1B | 147 | 50 | U | 35 | |
| 13-Aug-13 | 36W-001-1F | 36W-001-1F | 148 | 50 | U | 35 | |
| 13-Aug-13 | 36W-002-1B | 36W-002-1B | 127 | 50 | U | 35 | |
| 13-Aug-13 | 36W-002-1F | 36W-002-1F | 117 | 50 | U | 35 | |
| 13-Aug-13 | 36W-003-1B | 36W-003-1B | 318 | 50 | 43 | 35 | |
| 13-Aug-13 | 36W-003-1F | 36W-003-1F | 305 | 50 | U | 35 | |
| 13-Aug-13 | 36W-004-1B | 36W-004-1B | 73 | 50 | 38 | 35 | |
| 13-Aug-13 | 36W-004-1F | 36W-004-1F | 76 | 50 | U | 35 | |
| 13-Aug-13 | 36W-005-1B | 36W-005-1B | 63 | 50 | U | 35 | |
| 13-Aug-13 | 36W-005-1F | 36W-005-1F | 67 | 50 | U | 35 | |
| 13-Aug-13 | 36W-006-1B | 36W-006-1B | 120 | 50 | U | 35 | |
| 13-Aug-13 | 36W-006-1F | 36W-006-1F | 107 | 50 | U | 35 | |
| 14-Aug-13 | 36W-007-1F | 36W-007-1F | 145 | 50 | U | 35 | |
| 14-Aug-13 | 36W-008-1B | 36W-008-1B | 315 | 50 | 51 | 35 | |
| 14-Aug-13 | 36W-008-1F | 36W-008-1F | 350 | 50 | U | 35 | |
| 14-Aug-13 | 36W-009-1B | 36W-009-1B | 776 | 50 | 213 | 77.6 | |
| 14-Aug-13 | 36W-009-1F | 36W-009-1F | 699 | 50 | 202 | 69.9 | |
| 14-Aug-13 | 36W-010-1B | 36W-010-1B | 176 | 50 | U | 35 | |
| 14-Aug-13 | 36W-010-1F | 36W-010-1F | 227 | 50 | U | 35 | |
| 14-Aug-13 | 36W-011-1F | 36W-011-1F | 109 | 50 | 73 | 35 | |
| 14-Aug-13 | 36W-012-1B | 36W-012-1B | 185 | 50 | U | 35 | |
| 14-Aug-13 | 36W-012-1F | 36W-012-1F | 174 | 50 | U | 35 | |
| 14-Aug-13 | 36W-013-1B | 36W-013-1B | 301 | 50 | 111 | 35 | |
| 14-Aug-13 | 36W-013-1F | 36W-013-1F | 324 | 50 | 110 | 35 | |
| 14-Aug-13 | 36W-014-1B | 36W-014-1B | 799 | 50 | 206 | 79.9 | |
| 14-Aug-13 | 36W-014-1F | 36W-014-1F | 907 | 50 | 230 | 90.7 | |

# SERAS XRF DAILY PRELIMINARY ANALYSIS REPORT
# (PRELIMINARY SCREENING DATA, NO QA/QC)

**Site:** Iron King Mine Site
**SERAS WA#:** SER00146
**XRF used:** NITON XLt792YW
**XRF S/N:** 8262
**Matrix type:** Soil
**XRF Operator:** Jay Patel
**Conc. Units:** mg/Kg

| Date Analyzed | SAMPLE ID | Location | Lead | | Arsenic | | |
|---|---|---|---|---|---|---|---|
| | | | Conc. | RL | Conc. | RL | |
| 14-Aug-13 | 36W-015-1B | 36W-015-1B | 1270 | 50 | 279 | 127 | |
| 14-Aug-13 | 36W-015-1F | 36W-015-1F | 1090 | 50 | 239 | 109 | |
| 14-Aug-13 | 36W-015-2F | 36W-015-2F | 51 | 50 | U | 35 | |
| 14-Aug-13 | 36W-015-3F | 36W-015-3F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-015-4F | 36W-015-4F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-016-1F | 36W-016-1F | 138 | 50 | U | 35 | |
| 14-Aug-13 | 36W-017-1B | 36W-017-1B | 1630 | 50 | 391 | 163 | |
| 14-Aug-13 | 36W-017-1F | 36W-017-1F | 1380 | 50 | 400 | 138 | |
| 14-Aug-13 | 36W-017-2F | 36W-017-2F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-017-3F | 36W-017-3F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-017-4F | 36W-017-4F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-018-1B | 36W-018-1B | 921 | 50 | 453 | 92.1 | |
| 14-Aug-13 | 36W-018-1F | 36W-018-1F | 718 | 50 | 497 | 71.8 | |
| 14-Aug-13 | 36W-019-1B | 36W-019-1B | 971 | 50 | 299 | 97.1 | |
| 14-Aug-13 | 36W-019-1F | 36W-019-1F | 1480 | 50 | 424 | 148 | |
| 14-Aug-13 | 36W-020-1B | 36W-020-1B | 2070 | 50 | 652 | 207 | |
| 14-Aug-13 | 36W-020-1F | 36W-020-1F | 2120 | 50 | 655 | 212 | |
| 14-Aug-13 | 36W-020-2F | 36W-020-2F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-020-3F | 36W-020-3F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-020-4F | 36W-020-4F | 66 | 50 | 45 | 35 | |
| 14-Aug-13 | 36W-021-1B | 36W-021-1B | 1310 | 50 | 358 | 131 | |
| 14-Aug-13 | 36W-021-1F | 36W-021-1F | 1410 | 50 | 386 | 141 | |
| 14-Aug-13 | 36W-021-2F | 36W-021-2F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-021-3F | 36W-021-3F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-021-4F | 36W-021-4F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-022-1B | 36W-022-1B | 520 | 50 | 139 | 52 | |
| 14-Aug-13 | 36W-022-1F | 36W-022-1F | 555 | 50 | 171 | 55.5 | |
| 14-Aug-13 | 36W-023-1B | 36W-023-1B | 878 | 50 | 249 | 87.8 | |
| 14-Aug-13 | 36W-023-1F | 36W-023-1F | 997 | 50 | 309 | 99.7 | |
| 14-Aug-13 | 36W-023-2F | 36W-023-2F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-023-3F | 36W-023-3F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-023-4F | 36W-023-4F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-024-1B | 36W-024-1B | 199 | 50 | U | 35 | |
| 14-Aug-13 | 36W-024-1F | 36W-024-1F | 238 | 50 | 50 | 35 | |
| 14-Aug-13 | 36W-025-1B | 36W-025-1B | 400 | 50 | 107 | 40 | |
| 14-Aug-13 | 36W-025-1F | 36W-025-1F | 374 | 50 | 136 | 37.4 | |
| 14-Aug-13 | 36W-026-1B | 36W-026-1B | 1090 | 50 | 358 | 109 | |

# SERAS XRF DAILY PRELIMINARY ANALYSIS REPORT
# (PRELIMINARY SCREENING DATA, NO QA/QC)

**Site:** Iron King Mine Site **SERAS WA#:** SER00146
**XRF used:** NITON XLt792YW
**XRF S/N:** 8262 **Matrix type:** Soil
**XRF Operator:** Jay Patel **Conc. Units:** mg/Kg

| Date Analyzed | SAMPLE ID | Location | Lead Conc. | Lead RL | Arsenic Conc. | Arsenic RL | |
|---|---|---|---|---|---|---|---|
| 14-Aug-13 | 36W-026-1F | 36W-026-1F | 1180 | 50 | 374 | 118 | |
| 14-Aug-13 | 36W-026-2F | 36W-026-2F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-026-3F | 36W-026-3F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-026-4F | 36W-026-4F | U | 50 | U | 35 | |
| 14-Aug-13 | 36W-027-1B | 36W-027-1B | 180 | 50 | U | 35 | |
| 14-Aug-13 | 36W-027-1F | 36W-027-1F | 157 | 50 | U | 35 | |
| 15-Aug-13 | 40W-001-1F | 40W-001-1F | 50 | 50 | U | 35 | |
| 14-Aug-13 | 40W-002-1F | 40W-002-1F | 53 | 50 | 51 | 35 | |
| 14-Aug-13 | 40W-003-1F | 40W-003-1F | 55 | 50 | U | 35 | |
| 14-Aug-13 | 40W-004-1F | 40W-004-1F | U | 50 | U | 35 | |
| 14-Aug-13 | 40W-005-1F | 40W-005-1F | U | 50 | U | 35 | |
| 15-Aug-13 | 40W-006-1F | 40W-006-1F | U | 50 | U | 35 | |
| 15-Aug-13 | 40W-007-1F | 40W-007-1F | U | 50 | U | 35 | |
| 14-Aug-13 | 40W-008-1F | 40W-008-1F | 88 | 50 | U | 35 | |
| 14-Aug-13 | 40W-009-1F | 40W-009-1F | 61 | 50 | U | 35 | |
| 14-Aug-13 | 40W-010-1F | 40W-010-1F | 84 | 50 | U | 35 | |
| 15-Aug-13 | 40W-011-1F | 40W-011-1F | 105 | 50 | U | 35 | |
| 14-Aug-13 | 40W-012-1F | 40W-012-1F | 87 | 50 | 38 | 35 | |
| 14-Aug-13 | 40W-013-1F | 40W-013-1F | U | 50 | U | 35 | |
| 14-Aug-13 | 40W-014-1F | 40W-014-1F | 54 | 50 | 44 | 35 | |
| 15-Aug-13 | 40W-015-1F | 40W-015-1F | 75 | 50 | 37 | 35 | |
| 13-Aug-13 | 45J-001-1B | 45J-001-1B | 79 | 50 | U | 35 | |
| 13-Aug-13 | 45J-001-1F | 45J-001-1F | 90 | 50 | U | 35 | |
| 13-Aug-13 | 45J-002-1B | 45J-002-1B | 60 | 50 | U | 35 | |
| 13-Aug-13 | 45J-002-1F | 45J-002-1F | 70 | 50 | U | 35 | |
| 13-Aug-13 | 45J-003-1B | 45J-003-1B | 65 | 50 | U | 35 | |
| 13-Aug-13 | 45J-003-1F | 45J-003-1F | 67 | 50 | U | 35 | |
| 13-Aug-13 | 45J-004-1B | 45J-004-1B | 77 | 50 | U | 35 | |
| 13-Aug-13 | 45J-004-1F | 45J-004-1F | 91 | 50 | U | 35 | |
| 13-Aug-13 | 45J-005-1B | 45J-005-1B | 61 | 50 | U | 35 | |
| 13-Aug-13 | 45J-005-1F | 45J-005-1F | U | 50 | U | 35 | |
| 13-Aug-13 | 45J-006-1B | 45J-006-1B | U | 50 | U | 35 | |
| 13-Aug-13 | 45J-006-1F | 45J-006-1F | 53 | 50 | U | 35 | |
| 13-Aug-13 | 45J-007-1B | 45J-007-1B | 84 | 50 | U | 35 | |
| 13-Aug-13 | 45J-007-1F | 45J-007-1F | 82 | 50 | U | 35 | |
| 13-Aug-13 | 45J-008-1B | 45J-008-1B | 70 | 50 | U | 35 | |
| 13-Aug-13 | 45J-008-1F | 45J-008-1F | 63 | 50 | U | 35 | |

# SERAS XRF DAILY PRELIMINARY ANALYSIS REPORT
# (PRELIMINARY SCREENING DATA, NO QA/QC)

**Site:** Iron King Mine Site
**SERAS WA#:** SER00146
**XRF used:** NITON XLt792YW
**XRF S/N:** 8262
**Matrix type:** Soil
**XRF Operator:** Jay Patel
**Conc. Units:** mg/Kg

| Date Analyzed | SAMPLE ID | Location | Lead | | Arsenic | | |
|---|---|---|---|---|---|---|---|
| | | | Conc. | RL | Conc. | RL | |
| 13-Aug-13 | 45J-009-1B | 45J-009-1B | 84 | 50 | U | 35 | |
| 13-Aug-13 | 45J-009-1F | 45J-009-1F | 83 | 50 | U | 35 | |
| 13-Aug-13 | 45J-010-1B | 45J-010-1B | 102 | 50 | U | 35 | |
| 13-Aug-13 | 45J-010-1F | 45J-010-1F | 85 | 50 | U | 35 | |
| 13-Aug-13 | 45J-011-1B | 45J-011-1B | 69 | 50 | U | 35 | |
| 13-Aug-13 | 45J-011-1F | 45J-011-1F | 60 | 50 | U | 35 | |
| 13-Aug-13 | 45J-012-1B | 45J-012-1B | 66 | 50 | U | 35 | |
| 13-Aug-13 | 45J-012-1F | 45J-012-1F | 70 | 50 | U | 35 | |
| 13-Aug-13 | 45J-013-1B | 45J-013-1B | 50 | 50 | U | 35 | |
| 13-Aug-13 | 45J-013-1F | 45J-013-1F | 73 | 50 | U | 35 | |
| 13-Aug-13 | 45J-014-1B | 45J-014-1B | 58 | 50 | U | 35 | |
| 13-Aug-13 | 45J-014-1F | 45J-014-1F | 67 | 50 | U | 35 | |
| 13-Aug-13 | 45J-015-1B | 45J-015-1B | 95 | 50 | U | 35 | |
| 13-Aug-13 | 45J-015-1F | 45J-015-1F | 92 | 50 | U | 35 | |
| 13-Aug-13 | 45J-016-1B | 45J-016-1B | 73 | 50 | U | 35 | |
| 13-Aug-13 | 45J-016-1F | 45J-016-1F | 67 | 50 | U | 35 | |
| 15-Aug-13 | 45J-017-1F | 45J-017-1F | 65 | 50 | U | 35 | |
| 13-Aug-13 | 45J-018-1B | 45J-018-1B | 103 | 50 | U | 35 | |
| 13-Aug-13 | 45J-018-1F | 45J-018-1F | 105 | 50 | U | 35 | |
| 13-Aug-13 | 45J-019-1B | 45J-019-1B | 119 | 50 | U | 35 | |
| 13-Aug-13 | 45J-019-1F | 45J-019-1F | 122 | 50 | U | 35 | |
| 13-Aug-13 | 45J-020-1B | 45J-020-1B | 120 | 50 | U | 35 | |
| 13-Aug-13 | 45J-020-1F | 45J-020-1F | 108 | 50 | U | 35 | |
| 13-Aug-13 | 45J-021-1B | 45J-021-1B | 104 | 50 | U | 35 | |
| 13-Aug-13 | 45J-021-1F | 45J-021-1F | 91 | 50 | U | 35 | |
| 13-Aug-13 | 55J-001-1B | 55J-001-1B | 78 | 50 | U | 35 | |
| 13-Aug-13 | 55J-001-1F | 55J-001-1F | 111 | 50 | U | 35 | |
| 19-Aug-13 | 55J-002-1F | 55J-002-1F | 91 | 50 | U | 35 | |
| 19-Aug-13 | 55J-003-1F | 55J-003-1F | 84 | 50 | U | 35 | |
| 19-Aug-13 | 55J-004-1F | 55J-004-1F | 101 | 50 | U | 35 | |
| 19-Aug-13 | 55J-005-1F | 55J-005-1F | 124 | 50 | U | 35 | |
| 19-Aug-13 | 55J-006-1F | 55J-006-1F | 97 | 50 | U | 35 | |
| 13-Aug-13 | 55J-007-1B | 55J-007-1B | 89 | 50 | U | 35 | |
| 13-Aug-13 | 55J-007-1F | 55J-007-1F | 101 | 50 | U | 35 | |
| 19-Aug-13 | 55J-008-1F | 55J-008-1F | U | 50 | U | 35 | |
| 19-Aug-13 | 55J-009-1F | 55J-009-1F | 156 | 50 | U | 35 | |
| 13-Aug-13 | 55J-010-1B | 55J-010-1B | 68 | 50 | U | 35 | |

# SERAS XRF DAILY PRELIMINARY ANALYSIS REPORT
# (PRELIMINARY SCREENING DATA, NO QA/QC)

**Site:** Iron King Mine Site **SERAS WA#:** SER00146

**XRF used:** NITON XLt792YW

**XRF S/N:** 8262 **Matrix type:** Soil

**XRF Operator:** Jay Patel **Conc. Units:** mg/Kg

| | | | Lead | | Arsenic | | |
|---|---|---|---|---|---|---|---|
| Date Analyzed | SAMPLE ID | Location | Conc. | RL | Conc. | RL | |
| 13-Aug-13 | 55J-010-1F | 55J-010-1F | 68 | 50 | U | 35 | |
| 19-Aug-13 | 55J-011-1F | 55J-011-1F | 57 | 50 | U | 35 | |
| 13-Aug-13 | 55J-012-1B | 55J-012-1B | 156 | 50 | 51 | 35 | |
| 13-Aug-13 | 55J-012-1F | 55J-012-1F | 113 | 50 | U | 35 | |
| 13-Aug-13 | 55J-013-1B | 55J-013-1B | 71 | 50 | U | 35 | |
| 13-Aug-13 | 55J-013-1F | 55J-013-1F | 83 | 50 | U | 35 | |
| 13-Aug-13 | 55J-014-1B | 55J-014-1B | 117 | 50 | U | 35 | |
| 13-Aug-13 | 55J-014-1F | 55J-014-1F | 114 | 50 | U | 35 | |
| 19-Aug-13 | 55J-015-1F | 55J-015-1F | 91 | 50 | U | 35 | |
| 13-Aug-13 | 55J-016-1B | 55J-016-1B | U | 50 | U | 35 | |
| 13-Aug-13 | 55J-016-1F | 55J-016-1F | U | 50 | U | 35 | |
| 19-Aug-13 | 55J-017-1B | 55J-017-1B | 404 | 50 | 97 | 40.4 | |
| 19-Aug-13 | 55J-017-1F | 55J-017-1F | 415 | 50 | 120 | 41.5 | |
| 13-Aug-13 | 55J-018-1B | 55J-018-1B | 89 | 50 | U | 35 | |
| 13-Aug-13 | 55J-018-1F | 55J-018-1F | 80 | 50 | U | 35 | |
| 19-Aug-13 | 60J-001-1F | 60J-001-1F | 98 | 50 | U | 35 | |
| 19-Aug-13 | 60J-002-1F | 60J-002-1F | 74 | 50 | U | 35 | |
| 19-Aug-13 | 60J-003-1F | 60J-003-1F | 71 | 50 | U | 35 | |
| 19-Aug-13 | 60J-004-1F | 60J-004-1F | 56 | 50 | U | 35 | |
| 19-Aug-13 | 60J-005-1F | 60J-005-1F | 100 | 50 | U | 35 | |
| 19-Aug-13 | 60J-006-1F | 60J-006-1F | 108 | 50 | U | 35 | |
| 19-Aug-13 | 60J-007-1F | 60J-007-1F | 99 | 50 | U | 35 | |
| 19-Aug-13 | 60J-008-1F | 60J-008-1F | U | 50 | U | 35 | |
| 19-Aug-13 | 60J-009-1F | 60J-009-1F | 62 | 50 | U | 35 | |
| 19-Aug-13 | 60J-010-1F | 60J-010-1F | 92 | 50 | U | 35 | |
| 15-Aug-13 | 60J-011-1F | 60J-011-1F | 189 | 50 | 41 | 35 | |
| 15-Aug-13 | 60J-012-1F | 60J-012-1F | 139 | 50 | U | 35 | |
| 19-Aug-13 | 60J-013-1F | 60J-013-1F | 93 | 50 | U | 35 | |
| 15-Aug-13 | 60J-014-1F | 60J-014-1F | 164 | 50 | 50 | 35 | |
| 14-Aug-13 | 60J-015-1F | 60J-015-1F | 125 | 50 | U | 35 | |
| 14-Aug-13 | 60J-016-1F | 60J-016-1F | 112 | 50 | U | 35 | |
| 14-Aug-13 | 60J-017-1F | 60J-017-1F | 78 | 50 | U | 35 | |
| 14-Aug-13 | 60J-018-1F | 60J-018-1F | 165 | 50 | 67 | 35 | |
| 19-Aug-13 | 60J-019-1F | 60J-019-1F | 134 | 50 | U | 35 | |
| 19-Aug-13 | 60J-020-1F | 60J-020-1F | 96 | 50 | U | 35 | |
| 19-Aug-13 | 70J-001-1F | 70J-001-1F | 149 | 50 | 38 | 35 | |
| 19-Aug-13 | 70J-002-1F | 70J-002-1F | 94 | 50 | 45 | 35 | |

# SERAS XRF DAILY PRELIMINARY ANALYSIS REPORT
# (PRELIMINARY SCREENING DATA, NO QA/QC)

**Site:** Iron King Mine Site

**SERAS WA#:** SER00146

**XRF used:** NITON XLt792YW

**XRF S/N:** 8262

**Matrix type:** Soil

**XRF Operator:** Jay Patel

**Conc. Units:** mg/Kg

| Date Analyzed | SAMPLE ID | Location | Lead | | Arsenic | | |
|---|---|---|---|---|---|---|---|
| | | | Conc. | RL | Conc. | RL | |
| 19-Aug-13 | 70J-003-1F | 70J-003-1F | 86 | 50 | 65 | 35 | |
| 19-Aug-13 | 70J-004-1F | 70J-004-1F | 126 | 50 | 82 | 35 | |
| 19-Aug-13 | 70J-005-1B | 70J-005-1B | 355 | 50 | 394 | 35.5 | |
| 19-Aug-13 | 70J-005-1F | 70J-005-1F | 383 | 50 | 485 | 38.3 | |
| 14-Aug-13 | 70J-006-1F | 70J-006-1F | 180 | 50 | 124 | 35 | |
| 14-Aug-13 | 70J-007-1F | 70J-007-1F | 126 | 50 | 74 | 35 | |
| 19-Aug-13 | 70J-008-1F | 70J-008-1F | 58 | 50 | U | 35 | |
| 13-Aug-13 | 70J-009-1B | 70J-009-1B | 64 | 50 | 43 | 35 | |
| 13-Aug-13 | 70J-009-1F | 70J-009-1F | 70 | 50 | U | 35 | |
| 13-Aug-13 | 70J-010-1B | 70J-010-1B | 118 | 50 | 49 | 35 | |
| 13-Aug-13 | 70J-010-1F | 70J-010-1F | 109 | 50 | 51 | 35 | |
| 13-Aug-13 | 70J-011-1B | 70J-011-1B | 87 | 50 | U | 35 | |
| 13-Aug-13 | 70J-011-1F | 70J-011-1F | 68 | 50 | U | 35 | |
| 19-Aug-13 | 70J-012-1F | 70J-012-1F | 73 | 50 | 41 | 35 | |
| 15-Aug-13 | 70J-013-1F | 70J-013-1F | 111 | 50 | U | 35 | |
| 15-Aug-13 | 70J-014-1F | 70J-014-1F | 89 | 50 | U | 35 | |
| 19-Aug-13 | 70J-015-1B | 70J-015-1B | 414 | 50 | 400 | 41.4 | |
| 19-Aug-13 | 70J-015-1F | 70J-015-1F | 383 | 50 | 384 | 38.3 | |
| 19-Aug-13 | 70J-016-1F | 70J-016-1F | 67 | 50 | 49 | 35 | |
| 19-Aug-13 | 70J-017-1F | 70J-017-1F | 92 | 50 | U | 35 | |
| 15-Aug-13 | 70J-018-1F | 70J-018-1F | 161 | 50 | 45 | 35 | |
| 14-Aug-13 | 70J-019-1F | 70J-019-1F | U | 50 | U | 35 | |
| 19-Aug-13 | 70J-020-1B | 70J-020-1B | 489 | 50 | 454 | 48.9 | |
| 19-Aug-13 | 70J-020-1F | 70J-020-1F | 479 | 50 | 430 | 47.9 | |
| 19-Aug-13 | 70J-021-1F | 70J-021-1F | 78 | 50 | 48 | 35 | |
| 15-Aug-13 | 70J-022-1F | 70J-022-1F | 51 | 50 | U | 35 | |
| 14-Aug-13 | 70J-023-1F | 70J-023-1F | U | 50 | U | 35 | |
| 19-Aug-13 | 70J-024-1F | 70J-024-1F | 118 | 50 | 52 | 35 | |
| 20-Aug-13 | 70J-025-1F | 70J-025-1F | 170 | 50 | 96 | 35 | |
| 20-Aug-13 | 70J-026-1F | 70J-026-1F | 70 | 50 | U | 35 | |
| 20-Aug-13 | 70J-027-1F | 70J-027-1F | 72 | 50 | U | 35 | |
| 20-Aug-13 | 70J-028-1F | 70J-028-1F | 69 | 50 | U | 35 | |
| 15-Aug-13 | 70J-029-1B | 70J-029-1B | 334 | 50 | U | 35 | |
| 15-Aug-13 | 70J-029-1F | 70J-029-1F | 287 | 50 | 47 | 35 | |
| 20-Aug-13 | 70J-030-1F | 70J-030-1F | 99 | 50 | U | 35 | |
| 15-Aug-13 | 70J-031-1F | 70J-031-1F | 142 | 50 | 36 | 35 | |
| 15-Aug-13 | 80J-001-1F | 80J-001-1F | U | 50 | U | 35 | |

# SERAS XRF DAILY PRELIMINARY ANALYSIS REPORT
# (PRELIMINARY SCREENING DATA, NO QA/QC)

**Site:** Iron King Mine Site
**SERAS WA#:** SER00146
**XRF used:** NITON XLt792YW
**XRF S/N:** 8262
**Matrix type:** Soil
**XRF Operator:** Jay Patel
**Conc. Units:** mg/Kg

| Date Analyzed | SAMPLE ID | Location | Lead | | Arsenic | | |
|---|---|---|---|---|---|---|---|
| | | | Conc. | RL | Conc. | RL | |
| 20-Aug-13 | 80J-002-1F | 80J-002-1F | 101 | 50 | U | 35 | |
| 20-Aug-13 | 80J-003-1F | 80J-003-1F | 109 | 50 | U | 35 | |
| 20-Aug-13 | 80J-004-1F | 80J-004-1F | 93 | 50 | U | 35 | |
| 14-Aug-13 | 80J-005-1F | 80J-005-1F | 78 | 50 | U | 35 | |
| 20-Aug-13 | 80J-006-1F | 80J-006-1F | 75 | 50 | U | 35 | |
| 15-Aug-13 | 80J-007-1F | 80J-007-1F | 83 | 50 | U | 35 | |
| 15-Aug-13 | 80J-008-1F | 80J-008-1F | 110 | 50 | U | 35 | |
| 15-Aug-13 | 80J-009-1F | 80J-009-1F | 86 | 50 | U | 35 | |
| 15-Aug-13 | 80J-010-1F | 80J-010-1F | 58 | 50 | U | 35 | |
| 15-Aug-13 | 80J-011-1F | 80J-011-1F | 65 | 50 | U | 35 | |
| 15-Aug-13 | 80J-012-1F | 80J-012-1F | U | 50 | U | 35 | |
| 14-Aug-13 | 80J-013-1F | 80J-013-1F | 129 | 50 | 42 | 35 | |
| 15-Aug-13 | 80J-014-1F | 80J-014-1F | 65 | 50 | U | 35 | |
| 14-Aug-13 | 80J-015-1F | 80J-015-1F | U | 50 | U | 35 | |
| 20-Aug-13 | 80J-016-1F | 80J-016-1F | 115 | 50 | U | 35 | |
| 15-Aug-13 | 80J-017-1F | 80J-017-1F | 52 | 50 | U | 35 | |
| 14-Aug-13 | 80J-018-1F | 80J-018-1F | 53 | 50 | U | 35 | |
| 15-Aug-13 | 80J-019-1F | 80J-019-1F | 127 | 50 | 36 | 35 | |
| 15-Aug-13 | 80J-020-1F | 80J-020-1F | 144 | 50 | 45 | 35 | |
| 15-Aug-13 | 80J-021-1F | 80J-021-1F | 92 | 50 | 40 | 35 | |
| 15-Aug-13 | 80J-022-1F | 80J-022-1F | U | 50 | U | 35 | |
| 20-Aug-13 | 80J-023-1F | 80J-023-1F | 146 | 50 | 46 | 35 | |
| 14-Aug-13 | 80J-024-1F | 80J-024-1F | U | 50 | U | 35 | |
| 14-Aug-13 | 80J-025-1F | 80J-025-1F | 84 | 50 | U | 35 | |
| 20-Aug-13 | 80J-026-1F | 80J-026-1F | 62 | 50 | U | 35 | |
| 15-Aug-13 | 80J-027-1F | 80J-027-1F | 62 | 50 | U | 35 | |
| 15-Aug-13 | 80J-028-1F | 80J-028-1F | 50 | 50 | U | 35 | |
| 15-Aug-13 | 80J-029-1F | 80J-029-1F | 104 | 50 | U | 35 | |
| 14-Aug-13 | 80J-030-1F | 80J-030-1F | 66 | 50 | U | 35 | |
| 15-Aug-13 | 80J-031-1F | 80J-031-1F | 56 | 50 | U | 35 | |
| 14-Aug-13 | 80J-032-1F | 80J-032-1F | 75 | 50 | U | 35 | |
| 20-Aug-13 | 80J-033-1F | 80J-033-1F | 74 | 50 | U | 35 | |
| 20-Aug-13 | 85J-001-1F | 85J-001-1F | U | 50 | U | 35 | |
| 20-Aug-13 | 85J-002-1F | 85J-002-1F | 87 | 50 | U | 35 | |
| 20-Aug-13 | 85J-003-1F | 85J-003-1F | 90 | 50 | U | 35 | |
| 20-Aug-13 | 85J-004-1F | 85J-004-1F | 114 | 50 | U | 35 | |
| 20-Aug-13 | 85J-005-1F | 85J-005-1F | 114 | 50 | U | 35 | |

# SERAS XRF DAILY PRELIMINARY ANALYSIS REPORT
# (PRELIMINARY SCREENING DATA, NO QA/QC)

**Site:** Iron King Mine Site **SERAS WA#:** SER00146

**XRF used:** NITON XLt792YW

**XRF S/N:** 8262 **Matrix type:** Soil

**XRF Operator:** Jay Patel **Conc. Units:** mg/Kg

| Date Analyzed | SAMPLE ID | Location | Lead | | Arsenic | | |
|---|---|---|---|---|---|---|---|
| | | | Conc. | RL | Conc. | RL | |
| 20-Aug-13 | 85J-006-1F | 85J-006-1F | 103 | 50 | 37 | 35 | |
| 20-Aug-13 | 85J-007-1F | 85J-007-1F | 94 | 50 | U | 35 | |
| 20-Aug-13 | 85J-008-1F | 85J-008-1F | 80 | 50 | U | 35 | |
| 15-Aug-13 | 85J-009-1F | 85J-009-1F | 101 | 50 | U | 35 | |
| 20-Aug-13 | 85J-010-1F | 85J-010-1F | 92 | 50 | U | 35 | |
| 20-Aug-13 | 85J-011-1F | 85J-011-1F | 97 | 50 | U | 35 | |
| 20-Aug-13 | 85J-012-1F | 85J-012-1F | 108 | 50 | U | 35 | |
| 15-Aug-13 | 85J-013-1F | 85J-013-1F | 97 | 50 | U | 35 | |
| 20-Aug-13 | 85J-014-1F | 85J-014-1F | 115 | 50 | U | 35 | |
| 20-Aug-13 | 85J-015-1F | 85J-015-1F | 53 | 50 | U | 35 | |
| 14-Aug-13 | 85J-016-1F | 85J-016-1F | 55 | 50 | U | 35 | |
| 20-Aug-13 | 85J-017-1F | 85J-017-1F | 74 | 50 | U | 35 | |
| 20-Aug-13 | 85J-018-1F | 85J-018-1F | 117 | 50 | U | 35 | |
| 20-Aug-13 | 85J-019-1F | 85J-019-1F | 108 | 50 | 40 | 35 | |
| 15-Aug-13 | 85J-020-1F | 85J-020-1F | 93 | 50 | U | 35 | |
| 20-Aug-13 | 85J-021-1F | 85J-021-1F | 117 | 50 | U | 35 | |
| 20-Aug-13 | 85J-022-1F | 85J-022-1F | 114 | 50 | U | 35 | |
| 14-Aug-13 | 85J-023-1F | 85J-023-1F | 118 | 50 | U | 35 | |
| 20-Aug-13 | 85J-024-1F | 85J-024-1F | 97 | 50 | U | 35 | |
| 20-Aug-13 | 85J-025-1F | 85J-025-1F | 86 | 50 | U | 35 | |
| 20-Aug-13 | 85J-026-1F | 85J-026-1F | 115 | 50 | U | 35 | |
| 20-Aug-13 | 85J-027-1F | 85J-027-1F | 125 | 50 | U | 35 | |
| 20-Aug-13 | 85J-028-1F | 85J-028-1F | 94 | 50 | U | 35 | |
| 20-Aug-13 | 85J-029-1F | 85J-029-1F | 112 | 50 | U | 35 | |
| 20-Aug-13 | 85J-030-1F | 85J-030-1F | 92 | 50 | U | 35 | |
| 20-Aug-13 | 85J-031-1F | 85J-031-1F | 106 | 50 | U | 35 | |
| 20-Aug-13 | 85J-032-1F | 85J-032-1F | 112 | 50 | U | 35 | |
| 15-Aug-13 | 85J-033-1F | 85J-033-1F | 118 | 50 | U | 35 | |
| 14-Aug-13 | 85J-034-1F | 85J-034-1F | 154 | 50 | 42 | 35 | |
| 15-Aug-13 | 85J-035-1F | 85J-035-1F | 104 | 50 | 37 | 35 | |
| 14-Aug-13 | 85J-036-1F | 85J-036-1F | 78 | 50 | U | 35 | |
| 20-Aug-13 | 85J-037-1F | 85J-037-1F | 115 | 50 | U | 35 | |
| | | | | | | | |

RL - Reporting Level
U - Not Detected (less than the RL)
Note: Letter "F" & "B" at the end of location or sample number indicates front and back measurement of sample bag.

REAC, Edison, NJ
(732) 321-4200
EPA Contract 68-C99-223

**CHAIN OF CUSTODY RECORD**

Project Name: Iron King Mine Site
Project Number: 0-146
LM Contact: S. Grossman Phone: 732-321-4200

No: 06617
Sheet 01 of 01 (Do not copy)
(for addnl. samples use new form)

WO# R308007

**Sample Identification** / **Analyses Requested**

| REAC# | Sample No | Sampling Location | Matrix | Date Collected | # of Bottles | Container/Preservative | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | 55J-002-1 | N/A | Soil | 08/14/13 | 1 | Poly Bagges. | *Pb, As | | | | |
| 02 | -003-1 | | | | 1 | | | | | | |
| 03 | -004-1 | | | | 1 | | | | | | |
| 04 | -005-1 | | | | 1 | | | | | | |
| 05 | -006-1 | | | | 1 | | | | | | |
| 06 | -008-1 | | | | 1 | | | | | | |
| 07 | -009-1 | | | | 1 | | | | | | |
| 08 | -011-1 | | | | 1 | | | | | | |
| 09 | -015-1 | | | | 1 | | | | | | |
| 10 | -017-1 | | | | 1 | | | | | | |
| 11 | 60J-001-1 | | | | 1 | | | | | | |
| 12 | -002-1 | | | | 1 | | | | | | |
| 13 | -003-1 | | | | 1 | | | | | | |
| 14 | -004-1 | | | | 1 | | | | | | |
| 15 | -005-1 | | | | 1 | | | | | | |
| 16 | -006-1 | | | | 1 | | | | | | |
| 17 | -007-1 | | | | 1 | | | | | | |
| 18 | -008-1 | | | | 1 | | | | | | |
| 19 | -009-1 | | | | 1 | | | | | | |

[illegible] 8/19/13

Matrix:

A- Air
AT- Animal Tissue
DL- Drum Liquids
DS- Drum Solids
GW- Groundwater
O- Oil
PR- Product
PT- Plant Tissue
PW- Potable Water
S- Soil
SD- Sediment
SL- Sludge
SW- Surface Water
TX- TCLP Extract
W- Water
X- Other

Special Instructions:

* Analysis by XRF.

**SAMPLES TRANSFERRED FROM CHAIN OF CUSTODY #:**

| Items/Reason | Relinquished by | Date | Received by | Date | Time | Items/Reason | Relinquished by | Date | Received by | Date | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| All/Storage | [illegible] | 8/20/13 | [illegible] | 8/19/13 | 11:00 | All/Analysis | [illegible] | 8/19/13 | [illegible] | 8/19/13 | 11:30 |
| | | | [illegible] | 8/20/13 | 15:00 | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

☆ U.S. GPO: 2000-621-161

REAC, Edison, NJ
(732) 321-4200
EPA Contract 68-C99-223

## CHAIN OF CUSTODY RECORD

Project Name: Iron King Mine Site
Project Number: 0-146
LM Contact: S. Grossman Phone: 732-321-4200

No: 06618
Sheet 01 of 01 (Do not copy)
(for addnl. samples use new form)

WO# R308007

**Sample Identification** / **Analyses Requested**

| REAC# | Sample No | Sampling Location | Matrix | Date Collected | # of Bottles | Container/Preservative | * | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 60J-010-1 | N/A | S | 08/14/13 | 1 | Plastic Bags | Pb, As | | | | |
| 21 | -013-1 | | | | 1 | | | | | | |
| 22 | -019-1 | | | | 1 | | | | | | |
| 23 | -020-1 | | | | 1 | | | | | | |
| 24 | 70J-001-1 | | | | 1 | | | | | | |
| 25 | -002-1 | | | | 1 | | | | | | |
| 26 | -003-1 | | | | 1 | | | | | | |
| 27 | -004-1 | | | | 1 | | | | | | |
| 28 | -005-1 | | | | 1 | | | | | | |
| 29 | -008-1 | | | | 1 | | | | | | |
| 30 | -012-1 | | | | 1 | | | | | | |
| 31 | -015-1 | | | | 1 | | | | | | |
| 32 | -016-1 | | | | 1 | | | | | | |
| 33 | -017-1 | | | | 1 | | | | | | |
| 34 | -020-1 | | | | 1 | | | | | | |
| 35 | -021-1 | | | | 1 | | | | | | |
| 36 | -024-1 | | | | 1 | | | | | | |
| 37 | -025-1 | | | | 1 | | | | | | |
| 38 | -026-1 | | | | 1 | | | | | | |

8/19/13

Matrix:

A- Air
AT-Animal Tissue
DL- Drum Liquids
DS- Drum Solids
GW- Groundwater
O- Oil
PR-Product
PT-Plant Tissue
PW- Potable Water
S- Soil
SD- Sediment
SL- Sludge
SW- Surface Water
TX-TCLP Extract
W- Water
X- Other

Special Instructions:

* Analysis by XRF.

**SAMPLES TRANSFERRED FROM**

**CHAIN OF CUSTODY #:**

| Items/Reason | Relinquished by | Date | Received by | Date | Time | Items/Reason | Relinquished by | Date | Received by | Date | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | [signature] | 8/19/13 | 11:00 | All/Analysis | [signature] | 8/19/13 | [signature] | 8/19/13 | 11:30 |
| All/Storage | [signature] | 8/20/13 | [signature] | 8/20/13 | 15:00 | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

☆ U.S. GPO: 2000-681-151

REAC, Edison, NJ
(732) 321-4200
EPA Contract 68-C99-223

# CHAIN OF CUSTODY RECORD

Project Name: Iron King Mine Site
Project Number: 0-146
LM Contact: S. Grossman Phone: 732-321-4200

No: 06619
Sheet 01 of 01 (Do not copy)
(for addnl. samples use new form)

WO# R308007 **Sample Identification**

**Analyses Requested**

| REAC# | 76J Sample No | Sampling Location | Matrix | Date Collected | # of Bottles | Container/Preservative | * | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 39 | SS J70-027 -1 | N/A | S | 08/14/13 | 1 | Plastic Bags | Pb, As | | | | |
| 40 | -028 -1 | | | | | | | | | | |
| 41 | -030 -1 | | | | | | | | | | |
| 42 | 80J-002 -1 | | | | | | | | | | |
| 43 | -003 -1 | | | | | | | | | | |
| 44 | -004 -1 | | | | | | | | | | |
| 45 | -006 -1 | | | | | | | | | | |
| 46 | -016 -1 | | | | | | | | | | |
| 47 | -023 -1 | | | | | | | | | | |
| 48 | -026 -1 | | | | | | | | | | |
| 49 | -033 -1 | | | | | | | | | | |
| 50 | 85J-001 -1 | | | | | | | | | | |
| 51 | -002 -1 | | | | | | | | 8/19/13 | | |
| 52 | -003 -1 | | | | | | | | | | |
| 53 | -004 -1 | | | | | | | | | | |
| 54 | -005 -1 | | | | | | | | | | |
| 55 | -006 -1 | | | | | | | | | | |
| 56 | -007 -1 | | | | | | | | | | |
| 57 | -008 -1 | | | | | | | | | | |

Matrix:

A- Air
AT-Animal Tissue
DL- Drum Liquids
DS- Drum Solids
GW- Groundwater
O- Oil
PR-Product
PT-Plant Tissue
PW- Potable Water
S- Soil
SD- Sediment
SL- Sludge
SW- Surface Water
TX-TCLP Extract
W- Water
X- Other

Special Instructions:

* Analysis by XRF.

**SAMPLES TRANSFERRED FROM**

**CHAIN OF CUSTODY #:**

| Items/Reason | Relinquished by | Date | Received by | Date | Time | Items/Reason | Relinquished by | Date | Received by | Date | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| All/Storage | [signature] | 8/20/13 | [signature] | 8/19/13 | 11:00 | All Analysis | [signature] | 8/19/13 | [signature] | 8/19/13 | 11:30 |
| | | | [signature] | 8/20/13 | 15:00 | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

☆ U.S. GPO: 2000-621-181

REAC, Edison, NJ
(732) 321-4200
EPA Contract 68-C99-223

# CHAIN OF CUSTODY RECORD

Project Name: Iron King Mine Site
Project Number: C-146
LM Contact: S. Grossman Phone: 732-321-4200

No: 06620
Sheet 01 of 01 (Do not copy)
(for addnl. samples use new form)

WO# R308007

Sample Identification | Analyses Requested

| REAC# | Sample No | Sampling Location | Matrix | Date Collected | # of Bottles | Container/Preservative | * | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 58 | 85J-010-1 | N/A | S | 08/14/13 | 1 | Plastic Bags. | Pb, As | | | | |
| 59 | -011 -1 | | | | 1 | | | | | | |
| 60 | -012 -1 | | | | 1 | | | | | | |
| 61 | -014 -1 | | | | 1 | | | | | | |
| 62 | -015 -1 | | | | 1 | | | | | | |
| 63 | -017 -1 | | | | 1 | | | | | | |
| 64 | -018 -1 | | | | 1 | | | | | | |
| 65 | -019 -1 | | | | 1 | | | | | | |
| 66 | -021 -1 | | | | 1 | | | | | | |
| 67 | -022 -1 | | | | 1 | | | | | | |
| 68 | -024 -1 | | | | 1 | | | | | | |
| 69 | -025 -1 | | | | 1 | | | | | | |
| 70 | -026 -1 | | | | 1 | | | | | | |
| 71 | -027 -1 | | | | 1 | | | | | | |
| 72 | -028 -1 | | | | 1 | | | | | | |
| 73 | -029 -1 | | | | 1 | | | | | | |
| 74 | -030 -1 | | | | 1 | | | | | | |
| 75 | -031 -1 | | | | 1 | | | | | | |
| 76 | -032 -1 | | | | 1 | | | | | | |

8/19/13

Matrix:

A- Air
AT-Animal Tissue
DL- Drum Liquids
DS- Drum Solids
GW- Groundwater
O- Oil
PR-Product
PT-Plant Tissue
PW- Potable Water
S- Soil
SD- Sediment
SL- Sludge
SW- Surface Water
TX-TCLP Extract
W- Water
X- Other

Special Instructions:

* Analysis by XRF

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #:

| Items/Reason | Relinquished by | Date | Received by | Date | Time | Items/Reason | Relinquished by | Date | Received by | Date | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| All/Storage | [illegible] | 8/20/13 | [illegible] | 8/19/13 | 11:00 | All Analysis | [illegible] | 8/19/13 | [illegible] | 8/19/13 | 11:30 |
| | | | [illegible] | 8/20/13 | 15:00 | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

☆ U.S. GPO: 2000-821-151

REAC, Edison, NJ
(732) 321-4200
EPA Contract 68-C99-223

## CHAIN OF CUSTODY RECORD

Project Name: Iron King Mine Site
Project Number: 0-146
LM Contact: S. Grossman Phone: 732-321-4200

No: 06621
Sheet 01 of 01 (Do not copy)
(for addnl. samples use new form)

WO# R308007

| Sample Identification | | | | | | | Analyses Requested | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| REAC# | Sample No | Sampling Location | Matrix | Date Collected | # of Bottles | Container/Preservative | * | | | | |
| 77 | 85J-037-1 | N/A | S | 08/14/13 | 1 | Plastic Bags | Pb, As | | | | |

Matrix:

A- Air
AT-Animal Tissue
DL- Drum Liquids
DS- Drum Solids
GW- Groundwater
O- Oil
PR-Product
PT-Plant Tissue
PW- Potable Water
S- Soil
SD- Sediment
SL- Sludge
SW- Surface Water
TX-TCLP Extract
W- Water
X- Other

Special Instructions:

* Analysis by XRF.

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #:

| Items/Reason | Relinquished by | Date | Received by | Date | Time | Items/Reason | Relinquished by | Date | Received by | Date | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| All/Storage | [signature] | 8/20/13 | [signature] | 8/19/13 | 11:00 | All/Analysis | [signature] | 8/19/13 | [signature] | 8/19/13 | 11:30 |
| | | | [signature] | 8/20/13 | 15:00 | | | | | | |

☆ U.S. GPO: 2000-621-151

# APPENDIX C
# TAL Metals Confirmation Analytical Report
# Iron King Mine Site
# Technical Memorandum
# October 2013

# Sample Summary Report

| Case No: 43738 | Contract: EPW09038 | SDG No: MY9180 | Lab Code: CHEM |
|---|---|---|---|

| Sample Number: LCS | Method: ICP_AES | Matrix: Soil | MA Number: DEFAULT |
|---|---|---|---|
| Sample Location: | pH: | Sample Date: | Sample Time: |
| % Moisture : | | % Solids : 100 | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 38.9 | mg/kg | 1 | | | Yes | |
| Antimony | 11.3 | mg/kg | 1 | | | Yes | |
| Arsenic | 2.0 | mg/kg | 1 | | | Yes | |
| Barium | 40.3 | mg/kg | 1 | | | Yes | |
| Beryllium | 1.0 | mg/kg | 1 | | | Yes | |
| Cadmium | 0.96 | mg/kg | 1 | | | Yes | |
| Chromium | 2.0 | mg/kg | 1 | | | Yes | |
| Cobalt | 9.6 | mg/kg | 1 | | | Yes | |
| Copper | 5.2 | mg/kg | 1 | | | Yes | |
| Iron | 19.3 | mg/kg | 1 | | | Yes | |
| Lead | 2.1 | mg/kg | 1 | | | Yes | |
| Manganese | 2.9 | mg/kg | 1 | | | Yes | |
| Nickel | 7.8 | mg/kg | 1 | | | Yes | |
| Selenium | 6.5 | mg/kg | 1 | | | Yes | |
| Silver | 1.8 | mg/kg | 1 | | | Yes | |
| Thallium | 4.7 | mg/kg | 1 | | | Yes | |
| Vanadium | 10.2 | mg/kg | 1 | | | Yes | |
| Zinc | 10.8 | mg/kg | 1 | | | Yes | |
| Calcium | 1030 | mg/kg | 1 | | | Yes | |
| Magnesium | 965 | mg/kg | 1 | | | Yes | |
| Sodium | 1000 | mg/kg | 1 | | | Yes | |
| Potassium | 967 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9180 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0001 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 11:32:00 |
| % Moisture : | | | | % Solids : | 97 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 17600 | mg/kg | 1 | | | Yes | |
| Antimony | 16.0 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 174 | mg/kg | 1 | | | Yes | |
| Barium | 237 | mg/kg | 1 | | | Yes | |
| Beryllium | 1.0 | mg/kg | 1 | | | Yes | |
| Cadmium | 3.9 | mg/kg | 1 | | | Yes | |
| Calcium | 12500 | mg/kg | 1 | | | Yes | |
| Chromium | 28.9 | mg/kg | 1 | | | Yes | |
| Cobalt | 16.3 | mg/kg | 1 | | | Yes | |
| Copper | 116 | mg/kg | 1 | | | Yes | |
| Iron | 42900 | mg/kg | 1 | E | J | Yes | |
| Lead | 955 | mg/kg | 1 | | | Yes | |
| Magnesium | 7660 | mg/kg | 1 | | | Yes | |
| Manganese | 1120 | mg/kg | 1 | | | Yes | |
| Nickel | 30.0 | mg/kg | 1 | | | Yes | |
| Potassium | 3430 | mg/kg | 1 | | | Yes | |
| Selenium | 0.77 | mg/kg | 1 | J | J | Yes | |
| Silver | 9.7 | mg/kg | 1 | | | Yes | |
| Sodium | 441 | mg/kg | 1 | | | Yes | |
| Thallium | 2.0 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 67.1 | mg/kg | 1 | E | J | Yes | |
| Zinc | 778 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9180 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0001 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 11:32:00 |
| % Moisture : | | | | % Solids : | 97 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 1.9 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9181 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0002 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 11:38:00 |
| % Moisture : | | | | % Solids : | 98.7 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 1.8 | mg/kg | 2 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| Sample Number: | MY9181 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
|---|---|---|---|---|---|---|---|
| Sample Location: | 146-0002 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 11:38:00 |
| % Moisture : | | | | % Solids : | 98.7 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 11200 | mg/kg | 1 | | | Yes | |
| Antimony | 11.3 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 252 | mg/kg | 1 | | | Yes | |
| Barium | 160 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.75 | mg/kg | 1 | | | Yes | |
| Cadmium | 5.0 | mg/kg | 1 | | | Yes | |
| Calcium | 8650 | mg/kg | 1 | | | Yes | |
| Chromium | 21.7 | mg/kg | 1 | | | Yes | |
| Cobalt | 10.1 | mg/kg | 1 | | | Yes | |
| Copper | 191 | mg/kg | 1 | | | Yes | |
| Iron | 33200 | mg/kg | 1 | E | J | Yes | |
| Lead | 761 | mg/kg | 1 | | | Yes | |
| Magnesium | 4460 | mg/kg | 1 | | | Yes | |
| Manganese | 501 | mg/kg | 1 | | | Yes | |
| Nickel | 19.8 | mg/kg | 1 | | | Yes | |
| Potassium | 3650 | mg/kg | 1 | | | Yes | |
| Selenium | 0.90 | mg/kg | 1 | J | J | Yes | |
| Silver | 7.9 | mg/kg | 1 | | | Yes | |
| Sodium | 387 | mg/kg | 1 | J | U | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 41.2 | mg/kg | 1 | E | J | Yes | |
| Zinc | 937 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9182 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0003 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 13:35:00 |
| % Moisture : | | | | % Solids : | 98.8 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 12000 | mg/kg | 1 | | | Yes | |
| Antimony | 11.5 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 276 | mg/kg | 1 | | | Yes | |
| Barium | 166 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.82 | mg/kg | 1 | | | Yes | |
| Cadmium | 4.4 | mg/kg | 1 | | | Yes | |
| Calcium | 9020 | mg/kg | 1 | | | Yes | |
| Chromium | 25.0 | mg/kg | 1 | | | Yes | |
| Cobalt | 11.8 | mg/kg | 1 | | | Yes | |
| Copper | 185 | mg/kg | 1 | | | Yes | |
| Iron | 37200 | mg/kg | 1 | E | J | Yes | |
| Lead | 737 | mg/kg | 1 | | | Yes | |
| Magnesium | 4880 | mg/kg | 1 | | | Yes | |
| Manganese | 511 | mg/kg | 1 | | | Yes | |
| Nickel | 22.3 | mg/kg | 1 | | | Yes | |
| Potassium | 3490 | mg/kg | 1 | | | Yes | |
| Selenium | 0.39 | mg/kg | 1 | J | J | Yes | |
| Silver | 8.0 | mg/kg | 1 | | | Yes | |
| Sodium | 471 | mg/kg | 1 | | | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 47.1 | mg/kg | 1 | E | J | Yes | |
| Zinc | 791 | mg/kg | 1 | E | J | Yes | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
| Sample Number: | MY9182 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0003 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 13:35:00 |
| % Moisture : | | | | % Solids : | 98.8 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 1.9 | mg/kg | 2 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9183 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0004 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 13:51:00 |
| % Moisture : | | | | % Solids : | 97.9 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.78 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9183 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0004 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 13:51:00 |
| % Moisture : | | | | % Solids : | 97.9 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 15700 | mg/kg | 1 | | | Yes | |
| Antimony | 2.1 | mg/kg | 1 | JN | J- | Yes | |
| Arsenic | 24.6 | mg/kg | 1 | | | Yes | |
| Barium | 183 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.87 | mg/kg | 1 | | | Yes | |
| Cadmium | 2.6 | mg/kg | 1 | | | Yes | |
| Calcium | 8390 | mg/kg | 1 | | | Yes | |
| Chromium | 26.1 | mg/kg | 1 | | | Yes | |
| Cobalt | 14.8 | mg/kg | 1 | | | Yes | |
| Copper | 183 | mg/kg | 1 | | | Yes | |
| Iron | 29100 | mg/kg | 1 | E | J | Yes | |
| Lead | 139 | mg/kg | 1 | | | Yes | |
| Magnesium | 5920 | mg/kg | 1 | | | Yes | |
| Manganese | 872 | mg/kg | 1 | | | Yes | |
| Nickel | 24.0 | mg/kg | 1 | | | Yes | |
| Potassium | 5380 | mg/kg | 1 | | | Yes | |
| Selenium | 2.7 | mg/kg | 1 | U | U | Yes | |
| Silver | 3.4 | mg/kg | 1 | | | Yes | |
| Sodium | 393 | mg/kg | 1 | | | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 46.0 | mg/kg | 1 | E | J | Yes | |
| Zinc | 396 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9184 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0005 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 10:33:00 |
| % Moisture : | | | | % Solids : | 99.1 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.058 | mg/kg | 1 | J | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9184 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0005 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 10:33:00 |
| % Moisture : | | | | % Solids : | 99.1 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 10200 | mg/kg | 1 | | | Yes | |
| Antimony | 2.2 | mg/kg | 1 | JN | J- | Yes | |
| Arsenic | 23.5 | mg/kg | 1 | | | Yes | |
| Barium | 109 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.65 | mg/kg | 1 | | | Yes | |
| Cadmium | 1.0 | mg/kg | 1 | | | Yes | |
| Calcium | 11400 | mg/kg | 1 | | | Yes | |
| Chromium | 24.0 | mg/kg | 1 | | | Yes | |
| Cobalt | 16.3 | mg/kg | 1 | | | Yes | |
| Copper | 93.0 | mg/kg | 1 | | | Yes | |
| Iron | 30200 | mg/kg | 1 | E | J | Yes | |
| Lead | 73.2 | mg/kg | 1 | | | Yes | |
| Magnesium | 5110 | mg/kg | 1 | | | Yes | |
| Manganese | 607 | mg/kg | 1 | | | Yes | |
| Nickel | 22.2 | mg/kg | 1 | | | Yes | |
| Potassium | 2530 | mg/kg | 1 | | | Yes | |
| Selenium | 2.6 | mg/kg | 1 | U | U | Yes | |
| Silver | 3.1 | mg/kg | 1 | | | Yes | |
| Sodium | 383 | mg/kg | 1 | | | Yes | |
| Thallium | 1.9 | mg/kg | 1 | U | U | Yes | |
| Vanadium | 60.2 | mg/kg | 1 | E | J | Yes | |
| Zinc | 178 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9185 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0006 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 11:15:00 |
| % Moisture : | | | | % Solids : | 98 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 13200 | mg/kg | 1 | | | Yes | |
| Antimony | 2.1 | mg/kg | 1 | JN | J- | Yes | |
| Arsenic | 25.4 | mg/kg | 1 | | | Yes | |
| Barium | 158 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.83 | mg/kg | 1 | | | Yes | |
| Cadmium | 1.2 | mg/kg | 1 | | | Yes | |
| Calcium | 6110 | mg/kg | 1 | | | Yes | |
| Chromium | 25.6 | mg/kg | 1 | | | Yes | |
| Cobalt | 12.8 | mg/kg | 1 | | | Yes | |
| Copper | 148 | mg/kg | 1 | | | Yes | |
| Iron | 28300 | mg/kg | 1 | E | J | Yes | |
| Lead | 122 | mg/kg | 1 | | | Yes | |
| Magnesium | 5490 | mg/kg | 1 | | | Yes | |
| Manganese | 669 | mg/kg | 1 | | | Yes | |
| Nickel | 28.7 | mg/kg | 1 | | | Yes | |
| Potassium | 4030 | mg/kg | 1 | | | Yes | |
| Selenium | 2.5 | mg/kg | 1 | U | U | Yes | |
| Silver | 3.2 | mg/kg | 1 | | | Yes | |
| Sodium | 411 | mg/kg | 1 | | | Yes | |
| Thallium | 1.8 | mg/kg | 1 | U | U | Yes | |
| Vanadium | 46.1 | mg/kg | 1 | E | J | Yes | |
| Zinc | 252 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9185 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0006 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 11:15:00 |
| % Moisture : | | | | % Solids : | 98 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.19 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9186 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0007 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 09:50:00 |
| % Moisture : | | | | % Solids : | 98.8 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 13200 | mg/kg | 1 | | | Yes | |
| Antimony | 1.7 | mg/kg | 1 | JN | J- | Yes | |
| Arsenic | 23.1 | mg/kg | 1 | | | Yes | |
| Barium | 186 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.96 | mg/kg | 1 | | | Yes | |
| Cadmium | 1.4 | mg/kg | 1 | | | Yes | |
| Calcium | 7870 | mg/kg | 1 | | | Yes | |
| Chromium | 24.4 | mg/kg | 1 | | | Yes | |
| Cobalt | 15.0 | mg/kg | 1 | | | Yes | |
| Copper | 126 | mg/kg | 1 | | | Yes | |
| Iron | 30900 | mg/kg | 1 | E | J | Yes | |
| Lead | 59.5 | mg/kg | 1 | | | Yes | |
| Magnesium | 5380 | mg/kg | 1 | | | Yes | |
| Manganese | 837 | mg/kg | 1 | | | Yes | |
| Nickel | 26.6 | mg/kg | 1 | | | Yes | |
| Potassium | 3780 | mg/kg | 1 | | | Yes | |
| Selenium | 2.7 | mg/kg | 1 | U | U | Yes | |
| Silver | 3.3 | mg/kg | 1 | | | Yes | |
| Sodium | 451 | mg/kg | 1 | | | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 53.7 | mg/kg | 1 | E | J | Yes | |
| Zinc | 157 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9186 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0007 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 09:50:00 |
| % Moisture : | | | | % Solids : | 98.8 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.084 | mg/kg | 1 | J | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9187 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0008 | pH: | 2 | Sample Date: | 08/14/2013 | Sample Time: | 11:42:00 |
| % Moisture : | | | | % Solids : | 92 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 1.1 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9187 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0008 | pH: | 2 | Sample Date: | 08/14/2013 | Sample Time: | 11:42:00 |
| % Moisture : | | | | % Solids : | 92 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 14900 | mg/kg | 1 | | | Yes | |
| Antimony | 7.7 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 204 | mg/kg | 1 | | | Yes | |
| Barium | 172 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.97 | mg/kg | 1 | | | Yes | |
| Cadmium | 4.2 | mg/kg | 1 | | | Yes | |
| Calcium | 10900 | mg/kg | 1 | | | Yes | |
| Chromium | 21.2 | mg/kg | 1 | | | Yes | |
| Cobalt | 12.8 | mg/kg | 1 | | | Yes | |
| Copper | 174 | mg/kg | 1 | | | Yes | |
| Iron | 36700 | mg/kg | 1 | E | J | Yes | |
| Lead | 599 | mg/kg | 1 | | | Yes | |
| Magnesium | 4980 | mg/kg | 1 | | | Yes | |
| Manganese | 597 | mg/kg | 1 | | | Yes | |
| Nickel | 17.7 | mg/kg | 1 | | | Yes | |
| Potassium | 4150 | mg/kg | 1 | | | Yes | |
| Selenium | 2.9 | mg/kg | 1 | U | U | Yes | |
| Silver | 6.5 | mg/kg | 1 | | | Yes | |
| Sodium | 599 | mg/kg | 1 | | | Yes | |
| Thallium | 2.1 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 45.3 | mg/kg | 1 | E | J | Yes | |
| Zinc | 745 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9187D | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | | pH: | 2 | Sample Date: | 08/14/2013 | Sample Time: | 11:42:00 |
| % Moisture : | | | | % Solids : | 92 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 1.1 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9187D | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | | pH: | 2 | Sample Date: | 08/14/2013 | Sample Time: | 11:42:00 |
| % Moisture : | | | | % Solids : | 92 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 14700 | mg/kg | 1 | | | Yes | |
| Antimony | 7.7 | mg/kg | 1 | | | Yes | |
| Arsenic | 200 | mg/kg | 1 | | | Yes | |
| Barium | 168 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.93 | mg/kg | 1 | | | Yes | |
| Cadmium | 4.2 | mg/kg | 1 | | | Yes | |
| Calcium | 10800 | mg/kg | 1 | | | Yes | |
| Chromium | 20.9 | mg/kg | 1 | | | Yes | |
| Cobalt | 12.6 | mg/kg | 1 | | | Yes | |
| Copper | 172 | mg/kg | 1 | | | Yes | |
| Iron | 36200 | mg/kg | 1 | | | Yes | |
| Lead | 592 | mg/kg | 1 | | | Yes | |
| Magnesium | 4920 | mg/kg | 1 | | | Yes | |
| Manganese | 587 | mg/kg | 1 | | | Yes | |
| Nickel | 17.4 | mg/kg | 1 | | | Yes | |
| Potassium | 4110 | mg/kg | 1 | | | Yes | |
| Selenium | 0.40 | mg/kg | 1 | J | J | Yes | |
| Silver | 6.4 | mg/kg | 1 | | | Yes | |
| Sodium | 600 | mg/kg | 1 | | | Yes | |
| Thallium | 2.0 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 44.5 | mg/kg | 1 | | | Yes | |
| Zinc | 798 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9187S | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | | pH: | 2 | Sample Date: | 08/14/2013 | Sample Time: | 11:42:00 |
| % Moisture : | | | | % Solids : | 92 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Antimony | 18.3 | mg/kg | 1 | N | | Yes | |
| Arsenic | 187 | mg/kg | 1 | | | Yes | |
| Barium | 623 | mg/kg | 1 | | | Yes | |
| Beryllium | 10.9 | mg/kg | 1 | | | Yes | |
| Cadmium | 14.6 | mg/kg | 1 | | | Yes | |
| Chromium | 61.0 | mg/kg | 1 | | | Yes | |
| Cobalt | 125 | mg/kg | 1 | | | Yes | |
| Copper | 232 | mg/kg | 1 | | | Yes | |
| Lead | 417 | mg/kg | 1 | | | Yes | |
| Manganese | 861 | mg/kg | 1 | | | Yes | |
| Nickel | 127 | mg/kg | 1 | | | Yes | |
| Selenium | 9.4 | mg/kg | 1 | | | Yes | |
| Silver | 15.9 | mg/kg | 1 | | | Yes | |
| Thallium | 10.6 | mg/kg | 1 | | | Yes | |
| Vanadium | 147 | mg/kg | 1 | | | Yes | |
| Zinc | 961 | mg/kg | 1 | | | Yes | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9187S | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | | pH: | 2 | Sample Date: | 08/14/2013 | Sample Time: | 11:42:00 |
| % Moisture : | | | | % Solids : | 92 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 1.7 | mg/kg | 1 | | | Yes | |



14:36 Wed, Sep 11, 2013

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9188 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0009 | pH: | 2 | Sample Date: | 08/14/2013 | Sample Time: | 11:52:00 |
| % Moisture : | | | | % Solids : | 91.6 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 10100 | mg/kg | 1 | | | Yes | |
| Antimony | 46.3 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 1630 | mg/kg | 10 | D | | Yes | |
| Barium | 180 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.85 | mg/kg | 1 | | | Yes | |
| Cadmium | 3.5 | mg/kg | 1 | | | Yes | |
| Calcium | 4610 | mg/kg | 1 | | | Yes | |
| Chromium | 16.8 | mg/kg | 1 | | | Yes | |
| Cobalt | 7.2 | mg/kg | 1 | | | Yes | |
| Copper | 167 | mg/kg | 1 | | | Yes | |
| Iron | 51600 | mg/kg | 1 | E | J | Yes | |
| Lead | 1470 | mg/kg | 1 | | | Yes | |
| Magnesium | 3640 | mg/kg | 1 | | | Yes | |
| Manganese | 314 | mg/kg | 1 | | | Yes | |
| Nickel | 11.7 | mg/kg | 1 | | | Yes | |
| Potassium | 3420 | mg/kg | 1 | | | Yes | |
| Selenium | 6.5 | mg/kg | 1 | | | Yes | |
| Silver | 15.9 | mg/kg | 1 | | | Yes | |
| Sodium | 602 | mg/kg | 1 | | | Yes | |
| Thallium | 2.1 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 47.3 | mg/kg | 1 | E | J | Yes | |
| Zinc | 735 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9188 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0009 | pH: | 2 | Sample Date: | 08/14/2013 | Sample Time: | 11:52:00 |
| % Moisture : | | | | % Solids : | 91.6 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 3.2 | mg/kg | 2 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9189 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0010 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 11:39:00 |
| % Moisture : | | | | % Solids : | 98.5 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 11200 | mg/kg | 1 | | | Yes | |
| Antimony | 15.8 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 283 | mg/kg | 1 | | | Yes | |
| Barium | 167 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.87 | mg/kg | 1 | | | Yes | |
| Cadmium | 5.0 | mg/kg | 1 | | | Yes | |
| Calcium | 9140 | mg/kg | 1 | | | Yes | |
| Chromium | 21.4 | mg/kg | 1 | | | Yes | |
| Cobalt | 10.7 | mg/kg | 1 | | | Yes | |
| Copper | 177 | mg/kg | 1 | | | Yes | |
| Iron | 34100 | mg/kg | 1 | E | J | Yes | |
| Lead | 1080 | mg/kg | 1 | | | Yes | |
| Magnesium | 4300 | mg/kg | 1 | | | Yes | |
| Manganese | 534 | mg/kg | 1 | | | Yes | |
| Nickel | 20.3 | mg/kg | 1 | | | Yes | |
| Potassium | 3340 | mg/kg | 1 | | | Yes | |
| Selenium | 1.1 | mg/kg | 1 | J | J | Yes | |
| Silver | 10.2 | mg/kg | 1 | | | Yes | |
| Sodium | 443 | mg/kg | 1 | | | Yes | |
| Thallium | 1.8 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 42.3 | mg/kg | 1 | E | J | Yes | |
| Zinc | 957 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9189 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0010 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 11:39:00 |
| % Moisture : | | | | % Solids : | 98.5 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 3.1 | mg/kg | 2 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9190 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0011 | pH: | 2 | Sample Date: | 08/14/2013 | Sample Time: | 11:46:00 |
| % Moisture : | | | | % Solids : | 91.1 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 11800 | mg/kg | 1 | | | Yes | |
| Antimony | 4.6 | mg/kg | 1 | JN | J- | Yes | |
| Arsenic | 474 | mg/kg | 1 | | | Yes | |
| Barium | 168 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.77 | mg/kg | 1 | | | Yes | |
| Cadmium | 2.8 | mg/kg | 1 | | | Yes | |
| Calcium | 4430 | mg/kg | 1 | | | Yes | |
| Chromium | 20.8 | mg/kg | 1 | | | Yes | |
| Cobalt | 9.2 | mg/kg | 1 | | | Yes | |
| Copper | 264 | mg/kg | 1 | | | Yes | |
| Iron | 36400 | mg/kg | 1 | E | J | Yes | |
| Lead | 152 | mg/kg | 1 | | | Yes | |
| Magnesium | 4260 | mg/kg | 1 | | | Yes | |
| Manganese | 329 | mg/kg | 1 | | | Yes | |
| Nickel | 16.0 | mg/kg | 1 | | | Yes | |
| Potassium | 3240 | mg/kg | 1 | | | Yes | |
| Selenium | 0.47 | mg/kg | 1 | J | J | Yes | |
| Silver | 5.1 | mg/kg | 1 | | | Yes | |
| Sodium | 439 | mg/kg | 1 | J | U | Yes | |
| Thallium | 2.2 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 43.1 | mg/kg | 1 | E | J | Yes | |
| Zinc | 478 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9190 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0011 | pH: | 2 | Sample Date: | 08/14/2013 | Sample Time: | 11:46:00 |
| % Moisture : | | | | % Solids : | 91.1 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.35 | mg/kg | 1 | | | Yes | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
| Sample Number: | MY9191 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0012 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:18:00 |
| % Moisture : | | | | % Solids : | 97.5 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.49 | mg/kg | 1 | | | Yes | |

| Case No: 43738 | Contract: EPW09038 | SDG No: MY9180 | Lab Code: CHEM |
|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9191 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0012 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:18:00 |
| % Moisture : | | | | % Solids : | 97.5 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 13000 | mg/kg | 1 | | | Yes | |
| Antimony | 3.7 | mg/kg | 1 | JN | J- | Yes | |
| Arsenic | 101 | mg/kg | 1 | | | Yes | |
| Barium | 243 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.83 | mg/kg | 1 | | | Yes | |
| Cadmium | 3.9 | mg/kg | 1 | | | Yes | |
| Calcium | 9510 | mg/kg | 1 | | | Yes | |
| Chromium | 22.0 | mg/kg | 1 | | | Yes | |
| Cobalt | 11.8 | mg/kg | 1 | | | Yes | |
| Copper | 165 | mg/kg | 1 | | | Yes | |
| Iron | 28200 | mg/kg | 1 | E | J | Yes | |
| Lead | 434 | mg/kg | 1 | | | Yes | |
| Magnesium | 5140 | mg/kg | 1 | | | Yes | |
| Manganese | 673 | mg/kg | 1 | | | Yes | |
| Nickel | 20.8 | mg/kg | 1 | | | Yes | |
| Potassium | 4330 | mg/kg | 1 | | | Yes | |
| Selenium | 2.7 | mg/kg | 1 | U | U | Yes | |
| Silver | 5.1 | mg/kg | 1 | | | Yes | |
| Sodium | 391 | mg/kg | 1 | J | U | Yes | |
| Thallium | 2.0 | mg/kg | 1 | U | U | Yes | |
| Vanadium | 39.9 | mg/kg | 1 | E | J | Yes | |
| Zinc | 700 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9192 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0013 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:20:00 |
| % Moisture : | | | | % Solids : | 98.6 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.29 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9192 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0013 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:20:00 |
| % Moisture : | | | | % Solids : | 98.6 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 12000 | mg/kg | 1 | | | Yes | |
| Antimony | 2.1 | mg/kg | 1 | JN | J- | Yes | |
| Arsenic | 40.1 | mg/kg | 1 | | | Yes | |
| Barium | 149 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.80 | mg/kg | 1 | | | Yes | |
| Cadmium | 2.0 | mg/kg | 1 | | | Yes | |
| Calcium | 9270 | mg/kg | 1 | | | Yes | |
| Chromium | 57.0 | mg/kg | 1 | | | Yes | |
| Cobalt | 12.5 | mg/kg | 1 | | | Yes | |
| Copper | 118 | mg/kg | 1 | | | Yes | |
| Iron | 25900 | mg/kg | 1 | E | J | Yes | |
| Lead | 142 | mg/kg | 1 | | | Yes | |
| Magnesium | 5040 | mg/kg | 1 | | | Yes | |
| Manganese | 652 | mg/kg | 1 | | | Yes | |
| Nickel | 36.3 | mg/kg | 1 | | | Yes | |
| Potassium | 3530 | mg/kg | 1 | | | Yes | |
| Selenium | 2.8 | mg/kg | 1 | U | U | Yes | |
| Silver | 3.2 | mg/kg | 1 | | | Yes | |
| Sodium | 396 | mg/kg | 1 | J | U | Yes | |
| Thallium | 2.0 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 42.8 | mg/kg | 1 | E | J | Yes | |
| Zinc | 317 | mg/kg | 1 | E | J | Yes | |

| Case No: 43738 | Contract: EPW09038 | SDG No: MY9180 | Lab Code: CHEM |
|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9193 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0014 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:32:00 |
| % Moisture : | | | | % Solids : | 99.8 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.73 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9193 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0014 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:32:00 |
| % Moisture : | | | | % Solids : | 99.8 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 11200 | mg/kg | 1 | | | Yes | |
| Antimony | 6.9 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 113 | mg/kg | 1 | | | Yes | |
| Barium | 147 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.75 | mg/kg | 1 | | | Yes | |
| Cadmium | 6.0 | mg/kg | 1 | | | Yes | |
| Calcium | 9580 | mg/kg | 1 | | | Yes | |
| Chromium | 24.6 | mg/kg | 1 | | | Yes | |
| Cobalt | 14.4 | mg/kg | 1 | | | Yes | |
| Copper | 113 | mg/kg | 1 | | | Yes | |
| Iron | 34100 | mg/kg | 1 | E | J | Yes | |
| Lead | 742 | mg/kg | 1 | | | Yes | |
| Magnesium | 5780 | mg/kg | 1 | | | Yes | |
| Manganese | 836 | mg/kg | 1 | | | Yes | |
| Nickel | 27.2 | mg/kg | 1 | | | Yes | |
| Potassium | 2530 | mg/kg | 1 | | | Yes | |
| Selenium | 1.7 | mg/kg | 1 | J | J | Yes | |
| Silver | 6.4 | mg/kg | 1 | | | Yes | |
| Sodium | 385 | mg/kg | 1 | J | U | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 53.0 | mg/kg | 1 | E | J | Yes | |
| Zinc | 1260 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9194 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0015 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:36:00 |
| % Moisture : | | | | % Solids : | 99.5 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 1.7 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9194 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0015 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:36:00 |
| % Moisture : | | | | % Solids : | 99.5 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 11300 | mg/kg | 1 | | | Yes | |
| Antimony | 10.3 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 196 | mg/kg | 1 | | | Yes | |
| Barium | 165 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.86 | mg/kg | 1 | | | Yes | |
| Cadmium | 7.2 | mg/kg | 1 | | | Yes | |
| Calcium | 7190 | mg/kg | 1 | | | Yes | |
| Chromium | 22.9 | mg/kg | 1 | | | Yes | |
| Cobalt | 16.0 | mg/kg | 1 | | | Yes | |
| Copper | 143 | mg/kg | 1 | | | Yes | |
| Iron | 40300 | mg/kg | 1 | E | J | Yes | |
| Lead | 754 | mg/kg | 1 | | | Yes | |
| Magnesium | 5480 | mg/kg | 1 | | | Yes | |
| Manganese | 994 | mg/kg | 1 | | | Yes | |
| Nickel | 26.7 | mg/kg | 1 | | | Yes | |
| Potassium | 3080 | mg/kg | 1 | | | Yes | |
| Selenium | 2.5 | mg/kg | 1 | U | U | Yes | |
| Silver | 7.8 | mg/kg | 1 | | | Yes | |
| Sodium | 518 | mg/kg | 1 | | | Yes | |
| Thallium | 1.8 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 53.3 | mg/kg | 1 | E | J | Yes | |
| Zinc | 1480 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9195 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0016 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:45:00 |
| % Moisture : | | | | % Solids : | 98.3 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 2.5 | mg/kg | 2 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9195 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0016 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:45:00 |
| % Moisture : | | | | % Solids : | 98.3 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 12700 | mg/kg | 1 | | | Yes | |
| Antimony | 13.6 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 233 | mg/kg | 1 | | | Yes | |
| Barium | 148 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.83 | mg/kg | 1 | | | Yes | |
| Cadmium | 10.1 | mg/kg | 1 | | | Yes | |
| Calcium | 11600 | mg/kg | 1 | | | Yes | |
| Chromium | 19.6 | mg/kg | 1 | | | Yes | |
| Cobalt | 13.5 | mg/kg | 1 | | | Yes | |
| Copper | 162 | mg/kg | 1 | | | Yes | |
| Iron | 38900 | mg/kg | 1 | E | J | Yes | |
| Lead | 1110 | mg/kg | 1 | | | Yes | |
| Magnesium | 5870 | mg/kg | 1 | | | Yes | |
| Manganese | 658 | mg/kg | 1 | | | Yes | |
| Nickel | 21.3 | mg/kg | 1 | | | Yes | |
| Potassium | 3760 | mg/kg | 1 | | | Yes | |
| Selenium | 0.60 | mg/kg | 1 | J | J | Yes | |
| Silver | 11.2 | mg/kg | 1 | | | Yes | |
| Sodium | 405 | mg/kg | 1 | | | Yes | |
| Thallium | 2.0 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 44.8 | mg/kg | 1 | E | J | Yes | |
| Zinc | 2180 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9196 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0017 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:50:00 |
| % Moisture : | | | | % Solids : | 98.9 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 4.8 | mg/kg | 5 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9196 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0017 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:50:00 |
| % Moisture : | | | | % Solids : | 98.9 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 9460 | mg/kg | 1 | | | Yes | |
| Antimony | 33.1 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 390 | mg/kg | 1 | | | Yes | |
| Barium | 124 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.68 | mg/kg | 1 | | | Yes | |
| Cadmium | 10.1 | mg/kg | 1 | | | Yes | |
| Calcium | 7320 | mg/kg | 1 | | | Yes | |
| Chromium | 20.5 | mg/kg | 1 | | | Yes | |
| Cobalt | 9.7 | mg/kg | 1 | | | Yes | |
| Copper | 222 | mg/kg | 1 | | | Yes | |
| Iron | 35100 | mg/kg | 1 | E | J | Yes | |
| Lead | 2050 | mg/kg | 1 | | | Yes | |
| Magnesium | 3790 | mg/kg | 1 | | | Yes | |
| Manganese | 428 | mg/kg | 1 | | | Yes | |
| Nickel | 17.7 | mg/kg | 1 | | | Yes | |
| Potassium | 3520 | mg/kg | 1 | | | Yes | |
| Selenium | 2.7 | mg/kg | 1 | | | Yes | |
| Silver | 18.3 | mg/kg | 1 | | | Yes | |
| Sodium | 359 | mg/kg | 1 | | | Yes | |
| Thallium | 1.8 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 38.7 | mg/kg | 1 | E | J | Yes | |
| Zinc | 1960 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9197 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0018 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:53:00 |
| % Moisture : | | | | % Solids : | 98.2 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 2.2 | mg/kg | 2 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9197 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0018 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:53:00 |
| % Moisture : | | | | % Solids : | 98.2 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 14200 | mg/kg | 1 | | | Yes | |
| Antimony | 17.2 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 452 | mg/kg | 1 | | | Yes | |
| Barium | 124 | mg/kg | 1 | | | Yes | |
| Beryllium | 1.0 | mg/kg | 1 | | | Yes | |
| Cadmium | 21.2 | mg/kg | 1 | | | Yes | |
| Calcium | 9060 | mg/kg | 1 | | | Yes | |
| Chromium | 22.8 | mg/kg | 1 | | | Yes | |
| Cobalt | 11.0 | mg/kg | 1 | | | Yes | |
| Copper | 270 | mg/kg | 1 | | | Yes | |
| Iron | 42000 | mg/kg | 1 | E | J | Yes | |
| Lead | 1120 | mg/kg | 1 | | | Yes | |
| Magnesium | 5060 | mg/kg | 1 | | | Yes | |
| Manganese | 367 | mg/kg | 1 | | | Yes | |
| Nickel | 24.9 | mg/kg | 1 | | | Yes | |
| Potassium | 3840 | mg/kg | 1 | | | Yes | |
| Selenium | 0.96 | mg/kg | 1 | J | J | Yes | |
| Silver | 9.4 | mg/kg | 1 | | | Yes | |
| Sodium | 677 | mg/kg | 1 | | | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 50.6 | mg/kg | 1 | E | J | Yes | |
| Zinc | 6000 | mg/kg | 10 | ED | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9198 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0019 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:54:00 |
| % Moisture : | | | | % Solids : | 99.2 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 3.8 | mg/kg | 5 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9198 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0019 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:54:00 |
| % Moisture : | | | | % Solids : | 99.2 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 11900 | mg/kg | 1 | | | Yes | |
| Antimony | 13.6 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 271 | mg/kg | 1 | | | Yes | |
| Barium | 103 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.72 | mg/kg | 1 | | | Yes | |
| Cadmium | 11.9 | mg/kg | 1 | | | Yes | |
| Calcium | 5960 | mg/kg | 1 | | | Yes | |
| Chromium | 25.7 | mg/kg | 1 | | | Yes | |
| Cobalt | 12.3 | mg/kg | 1 | | | Yes | |
| Copper | 142 | mg/kg | 1 | | | Yes | |
| Iron | 35500 | mg/kg | 1 | E | J | Yes | |
| Lead | 1150 | mg/kg | 1 | | | Yes | |
| Magnesium | 5100 | mg/kg | 1 | | | Yes | |
| Manganese | 569 | mg/kg | 1 | | | Yes | |
| Nickel | 21.9 | mg/kg | 1 | | | Yes | |
| Potassium | 2170 | mg/kg | 1 | | | Yes | |
| Selenium | 0.88 | mg/kg | 1 | J | J | Yes | |
| Silver | 10.3 | mg/kg | 1 | | | Yes | |
| Sodium | 397 | mg/kg | 1 | J | U | Yes | |
| Thallium | 2.0 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 61.5 | mg/kg | 1 | E | J | Yes | |
| Zinc | 2160 | mg/kg | 1 | E | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A0 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0021 | pH: | 2 | Sample Date: | 08/14/2013 | Sample Time: | 12:35:00 |
| % Moisture : | | | | % Solids : | 88.6 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.073 | mg/kg | 1 | J | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A0 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0021 | pH: | 2 | Sample Date: | 08/14/2013 | Sample Time: | 12:35:00 |
| % Moisture : | | | | % Solids : | 88.6 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 24500 | mg/kg | 1 | | | Yes | |
| Antimony | 1.2 | mg/kg | 1 | JN | J- | Yes | |
| Arsenic | 33.4 | mg/kg | 1 | | | Yes | |
| Barium | 121 | mg/kg | 1 | | | Yes | |
| Beryllium | 1.2 | mg/kg | 1 | | | Yes | |
| Cadmium | 0.62 | mg/kg | 1 | | | Yes | |
| Calcium | 15600 | mg/kg | 1 | | | Yes | |
| Chromium | 27.7 | mg/kg | 1 | | | Yes | |
| Cobalt | 10.9 | mg/kg | 1 | | | Yes | |
| Copper | 28.6 | mg/kg | 1 | | | Yes | |
| Iron | 31500 | mg/kg | 1 | E | J | Yes | |
| Lead | 27.8 | mg/kg | 1 | | | Yes | |
| Magnesium | 5930 | mg/kg | 1 | | | Yes | |
| Manganese | 538 | mg/kg | 1 | | | Yes | |
| Nickel | 21.9 | mg/kg | 1 | | | Yes | |
| Potassium | 2120 | mg/kg | 1 | | | Yes | |
| Selenium | 3.0 | mg/kg | 1 | U | U | Yes | |
| Silver | 2.9 | mg/kg | 1 | | | Yes | |
| Sodium | 431 | mg/kg | 1 | J | U | Yes | |
| Thallium | 2.2 | mg/kg | 1 | U | U | Yes | |
| Vanadium | 64.9 | mg/kg | 1 | E | J | Yes | |
| Zinc | 124 | mg/kg | 1 | E | J | Yes | |

| Case No: 43738 | Contract: EPW09038 | SDG No: MY9180 | Lab Code: CHEM |
|---|---|---|---|
| Sample Number: PBS01 | Method: ICP_AES | Matrix: Soil | MA Number: DEFAULT |
| Sample Location: | pH: | Sample Date: | Sample Time: |
| % Moisture : | | % Solids : | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 20.0 | mg/kg | 1 | U | U | Yes | |
| Antimony | 6.0 | mg/kg | 1 | U | U | Yes | |
| Arsenic | 1.0 | mg/kg | 1 | U | U | Yes | |
| Barium | 20.0 | mg/kg | 1 | U | U | Yes | |
| Beryllium | 0.10 | mg/kg | 1 | J | J | Yes | |
| Cadmium | 0.50 | mg/kg | 1 | U | U | Yes | |
| Calcium | 500 | mg/kg | 1 | U | U | Yes | |
| Chromium | 1.0 | mg/kg | 1 | U | U | Yes | |
| Cobalt | 5.0 | mg/kg | 1 | U | U | Yes | |
| Copper | 2.5 | mg/kg | 1 | U | U | Yes | |
| Iron | -1.8 | mg/kg | 1 | J | J | Yes | |
| Lead | 1.0 | mg/kg | 1 | U | U | Yes | |
| Magnesium | 500 | mg/kg | 1 | J | U | Yes | |
| Manganese | 1.5 | mg/kg | 1 | U | U | Yes | |
| Nickel | 4.0 | mg/kg | 1 | U | U | Yes | |
| Potassium | -18 | mg/kg | 1 | J | J | Yes | |
| Selenium | 3.5 | mg/kg | 1 | U | U | Yes | |
| Silver | 1.0 | mg/kg | 1 | U | U | Yes | |
| Sodium | 500 | mg/kg | 1 | U | U | Yes | |
| Thallium | 2.5 | mg/kg | 1 | U | U | Yes | |
| Vanadium | 5.0 | mg/kg | 1 | U | U | Yes | |
| Zinc | 6.0 | mg/kg | 1 | J | U | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9180 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | PBS02 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | | pH: | | Sample Date: | | Sample Time: | |
| % Moisture : | | | | % Solids : | | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.10 | mg/kg | 1 | U | U | Yes | |

# Sample Summary Report

| Case No: 43738 | Contract: EPW09038 | SDG No: MY9199 | Lab Code: CHEM |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Sample Number: LCS | Method: ICP_AES | Matrix: Soil | MA Number: DEFAULT |
| Sample Location: | pH: | Sample Date: | Sample Time: |
| % Moisture : | | % Solids : 100 | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 40.4 | mg/kg | 1 | | | Yes | |
| Antimony | 12.0 | mg/kg | 1 | | | Yes | |
| Arsenic | 1.9 | mg/kg | 1 | | | Yes | |
| Barium | 42.2 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.98 | mg/kg | 1 | | | Yes | |
| Cadmium | 0.98 | mg/kg | 1 | | | Yes | |
| Chromium | 2.2 | mg/kg | 1 | | | Yes | |
| Cobalt | 9.7 | mg/kg | 1 | | | Yes | |
| Copper | 5.3 | mg/kg | 1 | | | Yes | |
| Iron | 20.7 | mg/kg | 1 | | | Yes | |
| Lead | 2.0 | mg/kg | 1 | | | Yes | |
| Manganese | 3.2 | mg/kg | 1 | | | Yes | |
| Nickel | 8.0 | mg/kg | 1 | | | Yes | |
| Selenium | 6.3 | mg/kg | 1 | | | Yes | |
| Silver | 1.9 | mg/kg | 1 | | | Yes | |
| Thallium | 4.7 | mg/kg | 1 | | | Yes | |
| Vanadium | 10.6 | mg/kg | 1 | | | Yes | |
| Zinc | 12.0 | mg/kg | 1 | | | Yes | |
| Potassium | 985 | mg/kg | 1 | | | Yes | |
| Calcium | 1070 | mg/kg | 1 | | | Yes | |
| Magnesium | 1010 | mg/kg | 1 | | | Yes | |
| Sodium | 1040 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9199 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0020 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:56:00 |
| % Moisture : | | | | % Solids : | 98.9 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 9.5 | mg/kg | 10 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9199 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0020 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:56:00 |
| % Moisture : | | | | % Solids : | 98.9 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 7460 | mg/kg | 1 | | | Yes | |
| Antimony | 48.6 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 905 | mg/kg | 10 | D | | Yes | |
| Barium | 123 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.82 | mg/kg | 1 | | | Yes | |
| Cadmium | 18.7 | mg/kg | 1 | N | J | Yes | |
| Calcium | 5800 | mg/kg | 1 | | | Yes | |
| Chromium | 14.7 | mg/kg | 1 | | | Yes | |
| Cobalt | 8.4 | mg/kg | 1 | E | J | Yes | |
| Copper | 296 | mg/kg | 1 | | | Yes | |
| Iron | 48800 | mg/kg | 1 | | | Yes | |
| Lead | 3330 | mg/kg | 1 | | | Yes | |
| Magnesium | 3140 | mg/kg | 1 | | | Yes | |
| Manganese | 447 | mg/kg | 1 | | | Yes | |
| Nickel | 12.5 | mg/kg | 1 | | | Yes | |
| Potassium | 3250 | mg/kg | 1 | | | Yes | |
| Selenium | 6.6 | mg/kg | 1 | | | Yes | |
| Silver | 24.7 | mg/kg | 1 | | | Yes | |
| Sodium | 502 | mg/kg | 1 | | | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 34.5 | mg/kg | 1 | | | Yes | |
| Zinc | 4370 | mg/kg | 10 | D | | Yes | |

| Case No: 43738 | Contract: EPW09038 | SDG No: MY9199 | Lab Code: CHEM |
|---|---|---|---|
| Sample Number: MY9199D | Method: Hg | Matrix: Soil | MA Number: DEFAULT |
| Sample Location: | pH: 2 | Sample Date: 08/13/2013 | Sample Time: 14:56:00 |
| % Moisture : | | % Solids : 98.9 | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 8.6 | mg/kg | 10 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9199D | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:56:00 |
| % Moisture : | | | | % Solids : | 98.9 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 7520 | mg/kg | 1 | | | Yes | |
| Antimony | 49.0 | mg/kg | 1 | | | Yes | |
| Arsenic | 894 | mg/kg | 10 | | | Yes | |
| Barium | 121 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.88 | mg/kg | 1 | | | Yes | |
| Cadmium | 18.6 | mg/kg | 1 | | | Yes | |
| Calcium | 5810 | mg/kg | 1 | | | Yes | |
| Chromium | 14.7 | mg/kg | 1 | | | Yes | |
| Cobalt | 8.4 | mg/kg | 1 | | | Yes | |
| Copper | 297 | mg/kg | 1 | | | Yes | |
| Iron | 48800 | mg/kg | 1 | | | Yes | |
| Lead | 3300 | mg/kg | 1 | | | Yes | |
| Magnesium | 3110 | mg/kg | 1 | | | Yes | |
| Manganese | 445 | mg/kg | 1 | | | Yes | |
| Nickel | 12.5 | mg/kg | 1 | | | Yes | |
| Potassium | 3270 | mg/kg | 1 | | | Yes | |
| Selenium | 6.7 | mg/kg | 1 | | | Yes | |
| Silver | 24.5 | mg/kg | 1 | | | Yes | |
| Sodium | 498 | mg/kg | 1 | | | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 34.4 | mg/kg | 1 | | | Yes | |
| Zinc | 4300 | mg/kg | 10 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9199S | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:56:00 |
| % Moisture : | | | | % Solids : | 98.9 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 8.9 | mg/kg | 10 | | | Yes | |

| Case No: 43738 | Contract: EPW09038 | SDG No: MY9199 | Lab Code: CHEM |
|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY9199S | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:56:00 |
| % Moisture : | | | | % Solids : | 98.9 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Antimony | 57.9 | mg/kg | 1 | N | | Yes | |
| Arsenic | 944 | mg/kg | 10 | | | Yes | |
| Barium | 525 | mg/kg | 1 | | | Yes | |
| Beryllium | 10.4 | mg/kg | 1 | | | Yes | |
| Cadmium | 34.6 | mg/kg | 1 | N | | Yes | |
| Chromium | 55.6 | mg/kg | 1 | | | Yes | |
| Cobalt | 108 | mg/kg | 1 | | | Yes | |
| Copper | 348 | mg/kg | 1 | | | Yes | |
| Lead | 3860 | mg/kg | 1 | | | Yes | |
| Manganese | 539 | mg/kg | 1 | | | Yes | |
| Nickel | 113 | mg/kg | 1 | | | Yes | |
| Selenium | 16.1 | mg/kg | 1 | | | Yes | |
| Silver | 33.3 | mg/kg | 1 | | | Yes | |
| Thallium | 10.7 | mg/kg | 1 | | | Yes | |
| Vanadium | 134 | mg/kg | 1 | | | Yes | |
| Zinc | 5500 | mg/kg | 10 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

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|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A1 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0022 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 15:02:00 |
| % Moisture : | | | | % Solids : | 99.5 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 8340 | mg/kg | 1 | | | Yes | |
| Antimony | 18.8 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 468 | mg/kg | 1 | | | Yes | |
| Barium | 102 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.73 | mg/kg | 1 | | | Yes | |
| Cadmium | 14.5 | mg/kg | 1 | N | J | Yes | |
| Calcium | 5250 | mg/kg | 1 | | | Yes | |
| Chromium | 18.6 | mg/kg | 1 | | | Yes | |
| Cobalt | 9.8 | mg/kg | 1 | E | J | Yes | |
| Copper | 182 | mg/kg | 1 | | | Yes | |
| Iron | 37000 | mg/kg | 1 | | | Yes | |
| Lead | 1440 | mg/kg | 1 | | | Yes | |
| Magnesium | 4050 | mg/kg | 1 | | | Yes | |
| Manganese | 492 | mg/kg | 1 | | | Yes | |
| Nickel | 15.9 | mg/kg | 1 | | | Yes | |
| Potassium | 2430 | mg/kg | 1 | | | Yes | |
| Selenium | 2.8 | mg/kg | 1 | | | Yes | |
| Silver | 12.4 | mg/kg | 1 | | | Yes | |
| Sodium | 384 | mg/kg | 1 | J | U | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 36.9 | mg/kg | 1 | | | Yes | |
| Zinc | 4230 | mg/kg | 10 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A1 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0022 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 15:02:00 |
| % Moisture : | | | | % Solids : | 99.5 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 3.7 | mg/kg | 5 | D | | Yes | |

| Case No: 43738 | Contract: EPW09038 | SDG No: MY9199 | Lab Code: CHEM |
|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A2 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0023 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 15:01:00 |
| % Moisture : | | | | % Solids : | 99.4 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 1.4 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A2 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0023 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 15:01:00 |
| % Moisture : | | | | % Solids : | 99.4 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 9040 | mg/kg | 1 | | | Yes | |
| Antimony | 9.5 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 337 | mg/kg | 1 | | | Yes | |
| Barium | 158 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.77 | mg/kg | 1 | | | Yes | |
| Cadmium | 6.5 | mg/kg | 1 | N | J | Yes | |
| Calcium | 6340 | mg/kg | 1 | | | Yes | |
| Chromium | 19.4 | mg/kg | 1 | | | Yes | |
| Cobalt | 11.9 | mg/kg | 1 | E | J | Yes | |
| Copper | 140 | mg/kg | 1 | | | Yes | |
| Iron | 33800 | mg/kg | 1 | | | Yes | |
| Lead | 535 | mg/kg | 1 | | | Yes | |
| Magnesium | 4360 | mg/kg | 1 | | | Yes | |
| Manganese | 1520 | mg/kg | 1 | | | Yes | |
| Nickel | 18.7 | mg/kg | 1 | | | Yes | |
| Potassium | 2910 | mg/kg | 1 | | | Yes | |
| Selenium | 0.40 | mg/kg | 1 | J | J | Yes | |
| Silver | 6.6 | mg/kg | 1 | | | Yes | |
| Sodium | 381 | mg/kg | 1 | J | U | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 48.1 | mg/kg | 1 | | | Yes | |
| Zinc | 1480 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

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|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A3 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0024 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 15:05:00 |
| % Moisture : | | | | % Solids : | 99.3 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 9640 | mg/kg | 1 | | | Yes | |
| Antimony | 12.4 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 249 | mg/kg | 1 | | | Yes | |
| Barium | 142 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.78 | mg/kg | 1 | | | Yes | |
| Cadmium | 11.4 | mg/kg | 1 | N | J | Yes | |
| Calcium | 6570 | mg/kg | 1 | | | Yes | |
| Chromium | 21.3 | mg/kg | 1 | | | Yes | |
| Cobalt | 12.3 | mg/kg | 1 | E | J | Yes | |
| Copper | 168 | mg/kg | 1 | | | Yes | |
| Iron | 34600 | mg/kg | 1 | | | Yes | |
| Lead | 1020 | mg/kg | 1 | | | Yes | |
| Magnesium | 5020 | mg/kg | 1 | | | Yes | |
| Manganese | 666 | mg/kg | 1 | | | Yes | |
| Nickel | 20.6 | mg/kg | 1 | | | Yes | |
| Potassium | 3260 | mg/kg | 1 | | | Yes | |
| Selenium | 1.7 | mg/kg | 1 | J | J | Yes | |
| Silver | 8.7 | mg/kg | 1 | | | Yes | |
| Sodium | 430 | mg/kg | 1 | | | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 44.1 | mg/kg | 1 | | | Yes | |
| Zinc | 2860 | mg/kg | 10 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A3 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0024 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 15:05:00 |
| % Moisture : | | | | % Solids : | 99.3 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 2.4 | mg/kg | 2 | D | | Yes | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
| Sample Number: | MY91A4 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0025 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:42:00 |
| % Moisture : | | | | % Solids : | 99.2 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.68 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A4 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0025 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:42:00 |
| % Moisture : | | | | % Solids : | 99.2 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 9970 | mg/kg | 1 | | | Yes | |
| Antimony | 5.2 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 106 | mg/kg | 1 | | | Yes | |
| Barium | 137 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.78 | mg/kg | 1 | | | Yes | |
| Cadmium | 5.6 | mg/kg | 1 | N | J | Yes | |
| Calcium | 7130 | mg/kg | 1 | | | Yes | |
| Chromium | 20.6 | mg/kg | 1 | | | Yes | |
| Cobalt | 12.4 | mg/kg | 1 | E | J | Yes | |
| Copper | 146 | mg/kg | 1 | | | Yes | |
| Iron | 32700 | mg/kg | 1 | | | Yes | |
| Lead | 351 | mg/kg | 1 | | | Yes | |
| Magnesium | 5110 | mg/kg | 1 | | | Yes | |
| Manganese | 699 | mg/kg | 1 | | | Yes | |
| Nickel | 21.8 | mg/kg | 1 | | | Yes | |
| Potassium | 3370 | mg/kg | 1 | | | Yes | |
| Selenium | 2.6 | mg/kg | 1 | U | U | Yes | |
| Silver | 4.9 | mg/kg | 1 | | | Yes | |
| Sodium | 376 | mg/kg | 1 | J | U | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 43.5 | mg/kg | 1 | | | Yes | |
| Zinc | 883 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A5 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0026 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:47:00 |
| % Moisture : | | | | % Solids : | 99.2 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 3.0 | mg/kg | 2 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A5 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0026 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 14:47:00 |
| % Moisture : | | | | % Solids : | 99.2 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 8490 | mg/kg | 1 | | | Yes | |
| Antimony | 25.4 | mg/kg | 1 | N | J- | Yes | |
| Arsenic | 377 | mg/kg | 1 | | | Yes | |
| Barium | 118 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.83 | mg/kg | 1 | | | Yes | |
| Cadmium | 17.9 | mg/kg | 1 | N | J | Yes | |
| Calcium | 6060 | mg/kg | 1 | | | Yes | |
| Chromium | 22.9 | mg/kg | 1 | | | Yes | |
| Cobalt | 12.8 | mg/kg | 1 | E | J | Yes | |
| Copper | 229 | mg/kg | 1 | | | Yes | |
| Iron | 39700 | mg/kg | 1 | | | Yes | |
| Lead | 1240 | mg/kg | 1 | | | Yes | |
| Magnesium | 3890 | mg/kg | 1 | | | Yes | |
| Manganese | 599 | mg/kg | 1 | | | Yes | |
| Nickel | 21.8 | mg/kg | 1 | | | Yes | |
| Potassium | 2400 | mg/kg | 1 | | | Yes | |
| Selenium | 1.1 | mg/kg | 1 | J | J | Yes | |
| Silver | 11.7 | mg/kg | 1 | | | Yes | |
| Sodium | 390 | mg/kg | 1 | | | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 42.6 | mg/kg | 1 | | | Yes | |
| Zinc | 3110 | mg/kg | 10 | D | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| Sample Number: | MY91A6 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
|---|---|---|---|---|---|---|---|
| Sample Location: | 146-0027 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 17:34:00 |
| % Moisture : | | | | % Solids : | 99.1 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 11500 | mg/kg | 1 | | | Yes | |
| Antimony | 1.9 | mg/kg | 1 | JN | J- | Yes | |
| Arsenic | 44.5 | mg/kg | 1 | | | Yes | |
| Barium | 150 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.74 | mg/kg | 1 | | | Yes | |
| Cadmium | 1.0 | mg/kg | 1 | N | J | Yes | |
| Calcium | 10800 | mg/kg | 1 | | | Yes | |
| Chromium | 34.8 | mg/kg | 1 | | | Yes | |
| Cobalt | 13.9 | mg/kg | 1 | E | J | Yes | |
| Copper | 119 | mg/kg | 1 | | | Yes | |
| Iron | 25400 | mg/kg | 1 | | | Yes | |
| Lead | 39.2 | mg/kg | 1 | | | Yes | |
| Magnesium | 6190 | mg/kg | 1 | | | Yes | |
| Manganese | 881 | mg/kg | 1 | | | Yes | |
| Nickel | 32.2 | mg/kg | 1 | | | Yes | |
| Potassium | 3830 | mg/kg | 1 | | | Yes | |
| Selenium | 2.8 | mg/kg | 1 | U | U | Yes | |
| Silver | 2.7 | mg/kg | 1 | | | Yes | |
| Sodium | 404 | mg/kg | 1 | J | U | Yes | |
| Thallium | 2.0 | mg/kg | 1 | U | U | Yes | |
| Vanadium | 42.1 | mg/kg | 1 | | | Yes | |
| Zinc | 139 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A6 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0027 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 17:34:00 |
| % Moisture : | | | | % Solids : | 99.1 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.090 | mg/kg | 1 | J | J | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A7 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0028 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 16:12:00 |
| % Moisture : | | | | % Solids : | 97.1 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.21 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A7 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0028 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 16:12:00 |
| % Moisture : | | | | % Solids : | 97.1 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 14300 | mg/kg | 1 | | | Yes | |
| Antimony | 3.1 | mg/kg | 1 | JN | J- | Yes | |
| Arsenic | 46.8 | mg/kg | 1 | | | Yes | |
| Barium | 269 | mg/kg | 1 | | | Yes | |
| Beryllium | 1.0 | mg/kg | 1 | | | Yes | |
| Cadmium | 2.8 | mg/kg | 1 | N | J | Yes | |
| Calcium | 7760 | mg/kg | 1 | | | Yes | |
| Chromium | 33.5 | mg/kg | 1 | | | Yes | |
| Cobalt | 21.4 | mg/kg | 1 | E | J | Yes | |
| Copper | 301 | mg/kg | 1 | | | Yes | |
| Iron | 42400 | mg/kg | 1 | | | Yes | |
| Lead | 140 | mg/kg | 1 | | | Yes | |
| Magnesium | 7480 | mg/kg | 1 | | | Yes | |
| Manganese | 1640 | mg/kg | 1 | | | Yes | |
| Nickel | 38.8 | mg/kg | 1 | | | Yes | |
| Potassium | 3320 | mg/kg | 1 | | | Yes | |
| Selenium | 2.8 | mg/kg | 1 | U | U | Yes | |
| Silver | 4.8 | mg/kg | 1 | | | Yes | |
| Sodium | 1060 | mg/kg | 1 | | | Yes | |
| Thallium | 2.0 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 73.7 | mg/kg | 1 | | | Yes | |
| Zinc | 432 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A8 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0029 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 16:12:00 |
| % Moisture : | | | | % Solids : | 97.2 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.18 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A8 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0029 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 16:12:00 |
| % Moisture : | | | | % Solids : | 97.2 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 13500 | mg/kg | 1 | | | Yes | |
| Antimony | 2.6 | mg/kg | 1 | JN | J- | Yes | |
| Arsenic | 40.9 | mg/kg | 1 | | | Yes | |
| Barium | 236 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.95 | mg/kg | 1 | | | Yes | |
| Cadmium | 2.6 | mg/kg | 1 | N | J | Yes | |
| Calcium | 7850 | mg/kg | 1 | | | Yes | |
| Chromium | 33.2 | mg/kg | 1 | | | Yes | |
| Cobalt | 20.0 | mg/kg | 1 | E | J | Yes | |
| Copper | 265 | mg/kg | 1 | | | Yes | |
| Iron | 38600 | mg/kg | 1 | | | Yes | |
| Lead | 306 | mg/kg | 1 | | | Yes | |
| Magnesium | 7150 | mg/kg | 1 | | | Yes | |
| Manganese | 1250 | mg/kg | 1 | | | Yes | |
| Nickel | 35.9 | mg/kg | 1 | | | Yes | |
| Potassium | 3220 | mg/kg | 1 | | | Yes | |
| Selenium | 2.6 | mg/kg | 1 | U | U | Yes | |
| Silver | 4.4 | mg/kg | 1 | | | Yes | |
| Sodium | 1040 | mg/kg | 1 | | | Yes | |
| Thallium | 1.9 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 67.4 | mg/kg | 1 | | | Yes | |
| Zinc | 389 | mg/kg | 1 | | | Yes | |

| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A9 | Method: | ICP_AES | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0030 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 09:50:00 |
| % Moisture : | | | | % Solids : | 98.6 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 10900 | mg/kg | 1 | | | Yes | |
| Antimony | 1.3 | mg/kg | 1 | JN | J- | Yes | |
| Arsenic | 21.3 | mg/kg | 1 | | | Yes | |
| Barium | 187 | mg/kg | 1 | | | Yes | |
| Beryllium | 0.77 | mg/kg | 1 | | | Yes | |
| Cadmium | 1.2 | mg/kg | 1 | N | J | Yes | |
| Calcium | 7170 | mg/kg | 1 | | | Yes | |
| Chromium | 20.6 | mg/kg | 1 | | | Yes | |
| Cobalt | 13.5 | mg/kg | 1 | E | J | Yes | |
| Copper | 110 | mg/kg | 1 | | | Yes | |
| Iron | 26000 | mg/kg | 1 | | | Yes | |
| Lead | 51.5 | mg/kg | 1 | | | Yes | |
| Magnesium | 4830 | mg/kg | 1 | | | Yes | |
| Manganese | 907 | mg/kg | 1 | | | Yes | |
| Nickel | 21.3 | mg/kg | 1 | | | Yes | |
| Potassium | 3390 | mg/kg | 1 | | | Yes | |
| Selenium | 2.8 | mg/kg | 1 | U | U | Yes | |
| Silver | 2.8 | mg/kg | 1 | | | Yes | |
| Sodium | 406 | mg/kg | 1 | J | U | Yes | |
| Thallium | 2.0 | mg/kg | 1 | J | U | Yes | |
| Vanadium | 46.2 | mg/kg | 1 | | | Yes | |
| Zinc | 145 | mg/kg | 1 | | | Yes | |

| Case No: 43738 | Contract: EPW09038 | SDG No: MY9199 | Lab Code: CHEM |
|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | MY91A9 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | 146-0030 | pH: | 2 | Sample Date: | 08/13/2013 | Sample Time: | 09:50:00 |
| % Moisture : | | | | % Solids : | 98.6 | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.083 | mg/kg | 1 | J | J | Yes | |

| Case No: 43738 | Contract: EPW09038 | SDG No: MY9199 | Lab Code: CHEM |
|---|---|---|---|
| Sample Number: PBS01 | Method: ICP_AES | Matrix: Soil | MA Number: DEFAULT |
| Sample Location: | pH: | Sample Date: | Sample Time: |
| % Moisture : | | % Solids : | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Aluminum | 20.0 | mg/kg | 1 | U | U | Yes | |
| Antimony | 6.0 | mg/kg | 1 | U | U | Yes | |
| Arsenic | 1.0 | mg/kg | 1 | U | U | Yes | |
| Barium | 20.0 | mg/kg | 1 | U | U | Yes | |
| Beryllium | 0.50 | mg/kg | 1 | U | U | Yes | |
| Cadmium | -0.011 | mg/kg | 1 | J | J | Yes | |
| Calcium | 500 | mg/kg | 1 | U | U | Yes | |
| Chromium | 1.0 | mg/kg | 1 | U | U | Yes | |
| Cobalt | 5.0 | mg/kg | 1 | U | U | Yes | |
| Copper | 2.5 | mg/kg | 1 | U | U | Yes | |
| Iron | 10.0 | mg/kg | 1 | U | U | Yes | |
| Lead | 1.0 | mg/kg | 1 | U | U | Yes | |
| Magnesium | 500 | mg/kg | 1 | U | U | Yes | |
| Manganese | 1.5 | mg/kg | 1 | U | U | Yes | |
| Nickel | 4.0 | mg/kg | 1 | U | U | Yes | |
| Potassium | 500 | mg/kg | 1 | U | U | Yes | |
| Selenium | 3.5 | mg/kg | 1 | U | U | Yes | |
| Silver | 1.0 | mg/kg | 1 | U | U | Yes | |
| Sodium | 500 | mg/kg | 1 | U | U | Yes | |
| Thallium | 2.5 | mg/kg | 1 | U | U | Yes | |
| Vanadium | 5.0 | mg/kg | 1 | U | U | Yes | |
| Zinc | 6.0 | mg/kg | 1 | U | U | Yes | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Case No: | 43738 | Contract: | EPW09038 | SDG No: | MY9199 | Lab Code: | CHEM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Number: | PBS02 | Method: | Hg | Matrix: | Soil | MA Number: | DEFAULT |
| Sample Location: | | pH: | | Sample Date: | | Sample Time: | |
| % Moisture : | | | | % Solids : | | | |

| Analyte Name | Result | Units | Dilution Factor | Lab Flag | Validation | Reportable | Validation Level |
|---|---|---|---|---|---|---|---|
| Mercury | 0.10 | mg/kg | 1 | U | U | Yes | |



18:38 Mon, Sep 30, 2013

# APPENDIX D
# TCLP Metals Analytical Report
# Iron King Mine Site
# Technical Memorandum
# October 2013

**United States Environmental Protection Agency**
**Region 9 Laboratory**
**1337 S. 46th Street Building 201**
**Richmond, CA 94804**

**Date:** **9/9/2013**

**Subject:** **Analytical Testing Results - Project R13SA1**
**SDG: 13231B**

**From:** **Brenda Bettencourt, Director**
**EPA Region 9 Laboratory**
**MTS-2**

**To:** **Zi Zi Searles**
**California Site Cleanup Section 1**
**SFD-7-1**

Attached are the results from the analysis of samples from the **Iron King Mine Wells/Jones Street 2013 Sampling** project. These data have been reviewed in accordance with EPA Region 9 Laboratory policy.

A full documentation package for these data, including raw data and sample custody documentation, is on file at the EPA Region 9 Laboratory. If you would like to request additional review and/or validation of the data, please contact Eugenia McNaughton at the Region 9 Quality Assurance Office.

If you have any questions, please ask for Richard Bauer, the Lab Project Manager at (510)412-2300.

Electronic CC: Scott Grossman, SERAS
Terrance Johnson, ERT West
Jeff Dhont, EPA Region 9

**Analyses included in this report:**

TCLP Metals by ICP
TCLP Mercury
TCLP Extraction by 1311

United States Environmental Protection Agency
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| | | | | |
|---|---|---|---|---|
| **Project Manager:** | Zi Zi Searles | **California Site Cleanup Section 1** | **SDG:** | 13231B |
| **Project Number:** | R13SA1 | **75 Hawthorne Street** | **Reported:** | 09/09/13 16:31 |
| **Project:** | Iron King Mine Wells/Jones Street 2013 Sampling | **San Francisco CA, 94105** | | |

## ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Collected | Date Received |
|---|---|---|---|---|
| 146-0101 | 1308026-01 | Soil | 08/15/13 00:00 | 08/19/13 14:00 |
| 146-0102 | 1308026-02 | Soil | 08/15/13 00:00 | 08/19/13 14:00 |
| 146-0103 | 1308026-03 | Soil | 08/15/13 00:00 | 08/19/13 14:00 |

**SDG ID 13231B**

Samples were processed according to the Toxicity Characteristic Leaching Procedure (TCLP, EPA method SW 1311) prior to digestion and analysis. Results reported are concentrations in the resulting leachate.

Mercury: Samples were received at 19 degrees C, which is outside the recommended temperature range of 0 to 6 degrees C for mercury samples. The results for mercury analysis were flagged as estimated.

Mercury TCLP: The extraction blank (B13H129-BLK2) concentration for mercury is above 1/2 the quantitation limit for mercury. Sample concentrations of the three samples are approximately the same as the blank concentration. Sample results are flagged as estimated. The regulatory limit for mercury (0.2 mg/L) is substantially higher than the reported blank and sample concentrations.

**Work Order(s)**

**1308026**

United States Environmental Protection Agency
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| | | | |
|---|---|---|---|
| **Project Manager:** Zi Zi Searles | **California Site Cleanup Section 1** | **SDG:** | 13231B |
| **Project Number:** R13SA1 | **75 Hawthorne Street** | **Reported:** | 09/09/13 16:31 |
| **Project:** Iron King Mine Wells/Jones Street 2013 Sampling | **San Francisco CA, 94105** | | |

## Sample Results

| Analyte | Reanalysis / Extract | Result | Qualifiers / Comments | Quantitation Limit | Units | Batch | Prepared | Analyzed | Method |
|---|---|---|---|---|---|---|---|---|---|
| **Lab ID: 1308026-01** | | | | | | | | | **Soil - Sampled: 08/15/13 00:00** |
| **Sample ID: 146-0101** | | | | | **Analysis of Toxicity Characteristic Leaching Procedure (TCLP) Extracts** | | | | |
| Arsenic | | 0.66 | | 0.20 | mg/L | B13H133 | 08/29/13 | 08/30/13 | 6010C/SOP503 |
| Barium | | ND | U | 0.50 | " | " | " | " | 6010C/SOP503 |
| Cadmium | | 0.026 | C1, J | 0.050 | " | " | " | " | 6010C/SOP503 |
| Chromium | | ND | U | 0.10 | " | " | " | " | 6010C/SOP503 |
| Lead | | ND | U | 0.30 | " | " | " | " | 6010C/SOP503 |
| Selenium | | ND | U | 0.20 | " | " | " | " | 6010C/SOP503 |
| Silver | | ND | U | 0.10 | " | " | " | " | 6010C/SOP503 |
| Mercury | | 0.00028 | A2, B1, C1, J | 0.00030 | " | B13H129 | 08/29/13 | 08/29/13 | 245.1/SOP515 |
| TCLP Extraction | | Performed | | | N/A | B13H113 | 08/26/13 | 08/27/13 | 1311/SOP250 |
| **Lab ID: 1308026-02** | | | | | | | | | **Soil - Sampled: 08/15/13 00:00** |
| **Sample ID: 146-0102** | | | | | **Analysis of Toxicity Characteristic Leaching Procedure (TCLP) Extracts** | | | | |
| Arsenic | | 0.43 | | 0.20 | mg/L | B13H133 | 08/29/13 | 08/30/13 | 6010C/SOP503 |
| Barium | | ND | U | 0.50 | " | " | " | " | 6010C/SOP503 |
| Cadmium | | 0.088 | | 0.050 | " | " | " | " | 6010C/SOP503 |
| Chromium | | ND | U | 0.10 | " | " | " | " | 6010C/SOP503 |
| Lead | | ND | U | 0.30 | " | " | " | " | 6010C/SOP503 |
| Selenium | | ND | U | 0.20 | " | " | " | " | 6010C/SOP503 |
| Silver | | ND | U | 0.10 | " | " | " | " | 6010C/SOP503 |
| Mercury | | 0.00020 | A2, B1, C1, J | 0.00030 | " | B13H129 | 08/29/13 | 08/29/13 | 245.1/SOP515 |
| TCLP Extraction | | Performed | | | N/A | B13H113 | 08/26/13 | 08/27/13 | 1311/SOP250 |
| **Lab ID: 1308026-03** | | | | | | | | | **Soil - Sampled: 08/15/13 00:00** |
| **Sample ID: 146-0103** | | | | | **Analysis of Toxicity Characteristic Leaching Procedure (TCLP) Extracts** | | | | |
| Arsenic | | 0.40 | | 0.20 | mg/L | B13H133 | 08/29/13 | 08/30/13 | 6010C/SOP503 |
| Barium | | 0.33 | C1, J | 0.50 | " | " | " | " | 6010C/SOP503 |
| Cadmium | | 0.033 | C1, J | 0.050 | " | " | " | " | 6010C/SOP503 |
| Chromium | | ND | U | 0.10 | " | " | " | " | 6010C/SOP503 |
| Lead | | ND | U | 0.30 | " | " | " | " | 6010C/SOP503 |
| Selenium | | ND | U | 0.20 | " | " | " | " | 6010C/SOP503 |
| Silver | | ND | U | 0.10 | " | " | " | " | 6010C/SOP503 |
| Mercury | | 0.00022 | A2, B1, C1, J | 0.00030 | " | B13H129 | 08/29/13 | 08/29/13 | 245.1/SOP515 |
| TCLP Extraction | | Performed | | | N/A | B13H113 | 08/26/13 | 08/27/13 | 1311/SOP250 |

**United States Environmental Protection Agency**

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| | | | | | |
|---|---|---|---|---|---|
| **Project Manager:** | Zi Zi Searles | **California Site Cleanup Section 1** | | **SDG:** | 13231B |
| **Project Number:** | R13SA1 | **75 Hawthorne Street** | | **Reported:** | 09/09/13 16:31 |
| **Project:** | Iron King Mine Wells/Jones Street 2013 Sampling | **San Francisco CA, 94105** | | | |

## Quality Control

| Analyte | Result | Qualifiers / Comments | Quantitation Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B13H113 - 1311 TCLP - TCLP extraction** | | | | | | | | **Prepared: 08/26/13 Analyzed: 08/27/13** | | |
| | | | | **Analysis of Toxicity Characteristic Leaching Procedure (TCLP) Extracts - Quality Control** | | | | | | |
| **Blank (B13H113-BLK1)** | | | | | | | | | | |
| TCLP Extraction | Performed | | | N/A | | | | | | |
| **Duplicate (B13H113-DUP1)** | | **Source: 1308026-01** | | | | | | | | |
| TCLP Extraction | Performed | | | N/A | | Performed | | | | 200 |
| **Batch B13H129 - Leachate Digest - Metals, TCLP, Mercury** | | | | | | | | **Prepared & Analyzed: 08/29/13** | | |
| | | | | **Analysis of Toxicity Characteristic Leaching Procedure (TCLP) Extracts - Quality Control** | | | | | | |
| **Blank (B13H129-BLK1)** | | | | | | | | | | |
| Mercury | ND | U | 0.00003 | mg/L | | | | | | |
| **Blank (B13H129-BLK2)** | | | | | | | | | | |
| Mercury | 0.00021 | C1, J | 0.0003 | mg/L | | | | | | |
| **LCS (B13H129-BS1)** | | | | | | | | | | |
| Mercury | 0.000228 | | 0.00003 | mg/L | 0.0002( | | 114 | 85-115 | | 200 |
| **Duplicate (B13H129-DUP1)** | | **Source: 1308026-01** | | | | | | | | |
| Mercury | 0.000201 | C1, J | 0.0003 | mg/L | | 0.000284 | | | **34** | 20 |
| **Matrix Spike (B13H129-MS1)** | | **Source: 1308026-01** | | | | | | | | |
| Mercury | 0.00242 | | 0.0003 | mg/L | 0.0020( | 0.000284 | 107 | 70-130 | | 20 |
| **Matrix Spike Dup (B13H129-MSD1)** | | **Source: 1308026-01** | | | | | | | | |
| Mercury | 0.00249 | | 0.0003 | mg/L | 0.0020( | 0.000284 | 110 | 70-130 | 3 | 20 |
| **Batch B13H133 - Leachate Digest - Metals, TCLP, ICP** | | | | | | | | **Prepared: 08/29/13 Analyzed: 08/30/13** | | |
| | | | | **Analysis of Toxicity Characteristic Leaching Procedure (TCLP) Extracts - Quality Control** | | | | | | |
| **Blank (B13H133-BLK1)** | | | | | | | | | | |
| Arsenic | ND | U | 0.2 | mg/L | | | | | | |
| Barium | ND | U | 0.5 | " | | | | | | |
| Cadmium | ND | U | 0.05 | " | | | | | | |
| Chromium | ND | U | 0.1 | " | | | | | | |
| Lead | ND | U | 0.3 | " | | | | | | |
| Selenium | ND | U | 0.2 | " | | | | | | |
| Silver | ND | U | 0.1 | " | | | | | | |
| **LCS (B13H133-BS1)** | | | | | | | | | | |
| Arsenic | 20.6 | | 0.2 | mg/L | 20.0 | | 103 | 80-120 | | 200 |
| Barium | 18.2 | | 0.5 | " | 20.0 | | 91 | 80-120 | | 200 |
| Cadmium | 0.479 | | 0.05 | " | 0.500 | | 96 | 80-120 | | 200 |
| Chromium | 1.95 | | 0.1 | " | 2.00 | | 98 | 80-120 | | 200 |
| Lead | 4.72 | | 0.3 | " | 5.00 | | 94 | 80-120 | | 200 |
| Selenium | 20 | | 0.2 | " | 20.0 | | 100 | 80-120 | | 200 |
| Silver | 0.47 | | 0.1 | " | 0.500 | | 94 | 80-120 | | 200 |
| **Duplicate (B13H133-DUP1)** | | **Source: 1308026-01** | | | | | | | | |
| Arsenic | 0.662 | | 0.2 | mg/L | | 0.656 | | | 1 | 20 |
| Barium | ND | U | 0.5 | " | | ND | | | | 20 |
| Cadmium | ND | U | 0.05 | " | | 0.026 | | | | 20 |
| Chromium | ND | U | 0.1 | " | | ND | | | | 20 |

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| | | | |
|---|---|---|---|
| **Project Manager:** Zi Zi Searles | **California Site Cleanup Section 1** | **SDG:** 13231B | |
| **Project Number:** R13SA1 | **75 Hawthorne Street** | **Reported:** 09/09/13 16:31 | |
| **Project:** Iron King Mine Wells/Jones Street 2013 Sampling | **San Francisco CA, 94105** | | |

## Quality Control

**Batch B13H133 - Leachate Digest - Metals, TCLP, ICP** — **Prepared: 08/29/13 Analyzed: 08/30/13**

**Analysis of Toxicity Characteristic Leaching Procedure (TCLP) Extracts - Quality Control**

| Analyte | Result | Qualifiers / Comments | Quantitation Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| **Duplicate (B13H133-DUP1)** | | **Source: 1308026-01** | | | | | | | | |
| Lead | ND | U | 0.3 | " | | ND | | | | 20 |
| Selenium | ND | U | 0.2 | " | | ND | | | | 20 |
| Silver | ND | U | 0.1 | " | | ND | | | | 20 |
| **Matrix Spike (B13H133-MS1)** | | **Source: 1308026-01** | | | | | | | | |
| Arsenic | 21.2 | | 0.2 | mg/L | 20.0 | 0.656 | 103 | 75-125 | | 20 |
| Barium | 17.7 | | 0.5 | " | 20.0 | ND | 89 | 75-125 | | 20 |
| Cadmium | 0.492 | | 0.05 | " | 0.500 | 0.026 | 93 | 75-125 | | 20 |
| Chromium | 1.94 | | 0.1 | " | 2.00 | ND | 97 | 75-125 | | 20 |
| Lead | 4.63 | | 0.3 | " | 5.00 | ND | 93 | 75-125 | | 20 |
| Selenium | 19.7 | | 0.2 | " | 20.0 | ND | 98 | 75-125 | | 20 |
| Silver | 0.462 | | 0.1 | " | 0.500 | ND | 92 | 75-125 | | 20 |
| **Matrix Spike Dup (B13H133-MSD1)** | | **Source: 1308026-01** | | | | | | | | |
| Arsenic | 20.6 | | 0.2 | mg/L | 20.0 | 0.656 | 99 | 75-125 | 3 | 20 |
| Barium | 17.6 | | 0.5 | " | 20.0 | ND | 88 | 75-125 | 0.7 | 20 |
| Cadmium | 0.479 | | 0.05 | " | 0.500 | 0.026 | 90 | 75-125 | 3 | 20 |
| Chromium | 1.88 | | 0.1 | " | 2.00 | ND | 94 | 75-125 | 3 | 20 |
| Lead | 4.49 | | 0.3 | " | 5.00 | ND | 90 | 75-125 | 3 | 20 |
| Selenium | 19.2 | | 0.2 | " | 20.0 | ND | 96 | 75-125 | 3 | 20 |
| Silver | 0.452 | | 0.1 | " | 0.500 | ND | 90 | 75-125 | 2 | 20 |

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| **Project:** | Iron King Mine Wells/Jones Street 2013 Sampling | **San Francisco CA, 94105** | | |

## Qualifiers and Comments

| | |
|---|---|
| J | The reported result for this analyte should be considered an estimated value. |
| C1 | The reported concentration for this analyte is below the quantitation limit. |
| B1 | The concentration of this analyte found in this sample was less than five times the concentration found in the associated method blank. |
| A2 | The sample was received above the recommended temperature range. |
| U | Not Detected |
| NR | Not Reported |
| RE1, RE2, etc: | Result is from a sample re-analysis. |