

# Appendix D

## Interim Removal Action Reports

# Appendix D

## 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

*Environmental Engineers & Consultants*

201 East Washington Street  
Suite 500  
Phoenix, AZ 85004  
Tel: (602) 567-4000  
Fax: (602) 567-4001

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.

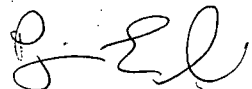
Based on Brown and Caldwell's estimate to date, the cost to comply with the settlement agreement is \$361,000. This estimate includes \$185,000 of Brown and Caldwell's; \$145,000 of Philip Transportation and Remediation's; \$20,000 of resident relocations'; and \$11,000 of backfill material's costs.

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

BROWN AND  
CALDWELL



IRONITE PRODUCTS COMPANY  
REMOVAL ACTION COMPLETION REPORT

TABLE OF CONTENTS

TABLE OF CONTENTS ..... I

LIST OF FIGURES ..... III

LIST OF TABLES ..... III

LIST OF APPENDICES ..... IV

LIST OF ACRONYMS ..... V

1. INTRODUCTION ..... 1-1

    1.1 Purpose and Scope ..... 1-1

    1.2 Site Name or Sampling Area ..... 1-1

    1.3 Responsible Agency ..... 1-1

    1.4 Project Organization ..... 1-2

2. PROJECT BACKGROUND ..... 2-1

    2.1 Decision Statement ..... 2-1

    2.2 Decision Inputs ..... 2-1

        2.2.1 Expected Range of Arsenic Concentrations ..... 2-2

        2.2.2 Decision Errors ..... 2-2

3. PROJECT PLANNING AND REPORTING ..... 3-1

    3.1 Work Plan ..... 3-1

    3.2 Community Involvement Documents ..... 3-1

    3.3 Access Agreement ..... 3-1

    3.4 Site Safety and Health Plan ..... 3-1

    3.5 Field Activity Documentation ..... 3-2

    3.6 Periodic Progress Reports ..... 3-3

    3.7 Removal Action Completion Report ..... 3-3

4. ARSENIC DELINEATION ..... 4-1

    4.1 Study Boundaries ..... 4-1

    4.2 Utility Clearance ..... 4-1

    4.3 Delineation Sample Collection ..... 4-2

        4.3.1 Sample Locations ..... 4-2

        4.3.2 Sample Collection ..... 4-3

    4.4 Backfill Material Sample Collection ..... 4-4

    4.5 Quality Control Samples ..... 4-4

    4.6 Decontamination Procedures ..... 4-4

    4.7 Investigative Derived Waste ..... 4-5

    4.8 Global Positioning System Readings ..... 4-5

    4.9 Significant Deviations from Proposed Activities ..... 4-6

5. LABORATORY ANALYSIS .....	5-1
5.1 Delineation Soil Samples.....	5-1
5.2 Backfill Material Samples .....	5-1
5.3 Field Quality Control Samples.....	5-2
5.4 Laboratory Quality Control.....	5-3
6. DATA VERIFICATION AND VALIDATION.....	6-1
6.1 Field Data Verification .....	6-1
6.2 Internal Laboratory Data Verification .....	6-2
6.3 Laboratory Data Validation .....	6-2
6.3.1 Delineation Samples.....	6-3
6.3.2 Backfill Material Samples.....	6-3
6.3.3 Field Quality Control Samples .....	6-4
7. REMOVAL ACTION DETERMINATION .....	7-1
7.1 Decision Rule .....	7-1
7.2 Data Gap Analysis.....	7-1
7.3 Physical Conditions .....	7-2
7.4 Removal Action Boundaries .....	7-2
7.4.1 Aerial Extent .....	7-3
7.4.2 Vertical Extent .....	7-3
7.5 Removal and Disposal Options .....	7-4
8. ARSENIC REMOVAL ACTION .....	8-1
8.1 Environmental Permits and Prevention Plans .....	8-1
8.2 Site Clearance.....	8-1
8.3 Property Owner/Tenant Relocation .....	8-2
8.4 Dust Control.....	8-2
8.4.1 Encapsulation of Homes.....	8-3
8.4.2 Dust Monitoring .....	8-3
8.5 Excavation Methods .....	8-3
8.6 Property #2 Removal Action.....	8-4
8.7 Property #3 Removal Action.....	8-5
8.8 Property #4 Removal Action.....	8-5
8.9 Property #7 Removal Action.....	8-6
8.10 Disposal.....	8-6
8.11 Backfilling and Compaction .....	8-6
8.11.1 Excavation Backfill and Compaction.....	8-6
8.11.2 Surficial Backfill and Restoration .....	8-7
8.12 Confirmation and Verification Sample Collection.....	8-7
8.13 Revegetation .....	8-7
8.14 GPS Readings.....	8-7
8.15 Heavy Equipment Decontamination .....	8-8
8.16 Significant Deviations from Proposed Activities.....	8-8

9. WASTE MANAGEMENT ..... 9-1

    9.1 PPE Waste ..... 9-1

    9.2 Solid Waste ..... 9-1

    9.3 Liquid Waste..... 9-1

10. REMOVAL ACTION SUMMARY ..... 10-1

    10.1 Site Inspection ..... 10-1

    10.2 Decision Errors ..... 10-1

    10.3 Post-Removal Site Control ..... 10-1

    10.4 Effectiveness ..... 10-2

    10.5 Certification..... 10-2

11. REPORT LIMITATIONS..... 11-1

12. REFERENCES..... 12-1

**LIST OF FIGURES**

---

Figure 1      Vicinity Map

Figure 2      General Site Map and Property Locations

Figure 3      Delineation Sample Map Property #2

Figure 4      Delineation Sample Map Property #3

Figure 5      Delineation Sample Map Property #4

Figure 6      Arsenic Removal Area Map Property #2

Figure 7      Arsenic Removal Area Map Property #3

Figure 8      Arsenic Removal Area Map Property #4

Figure 9      Arsenic Removal Area Map Property #7

**LIST OF TABLES**

---

Table 1      Summary of Field Activities Associated with the Arsenic Removal Actions

Table 2      Summary of Sample Information and Analytical Results for Delineation Sampling

Table 3      Summary of Backfill Material Analytical Results

Table 4      Summary of Physical Conditions for Delineation Samples

Table 5      Summary of GPS Location Coordinates for Delineation Samples, Site Features, and Removal Action Boundaries

Table 6      Summary of Soils and Gravel Transported Out Of and Into Properties

---

## LIST OF APPENDICES

---

- Appendix A EPA Administrative Settlement Agreement and Order on Consent for Removal Action
- Appendix B ADEQ Letter dated April 3, 2006
- Appendix C Copies of Brown and Caldwell Daily Site Safety Briefings
- Appendix D Laboratory Analytical Reports for Delineation Soil, Equipment Blank, and Backfill Soil Samples
- Appendix E Data Validation Reports From LDC
- Appendix F Photographic Log of Activities Conducted During Arsenic Removal Actions King Mine Site

---

## 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
<b>EPA</b>		
On-Scene Coordinator (OSC)	Harry Allen	Office (415) 972-3063 Mobile (415) 218-7406
On-Scene Alternate Coordinator	Daniel Suter	(415) 972-3050
On-Scene Alternate Coordinator	Hedy Salter	(415) 972-3046
<b>CONTRACTOR (BROWN AND CALDWELL)</b>		
Principal In Charge	Eric Mears, R.G.	Office (602) 567-3859 Mobile (602) 615-0433
Project Coordinator	Pejman Eshraghi, P.E.	Office (602) 567-3823 Mobile (602) 370-3443
Field Manager	Mathew Nation, R.G.	Office (602) 567-3866 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 *"... haul, 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 collect 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 ( $\mu\text{g/L}$ ) (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  $\mu\text{g/L}$ . 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

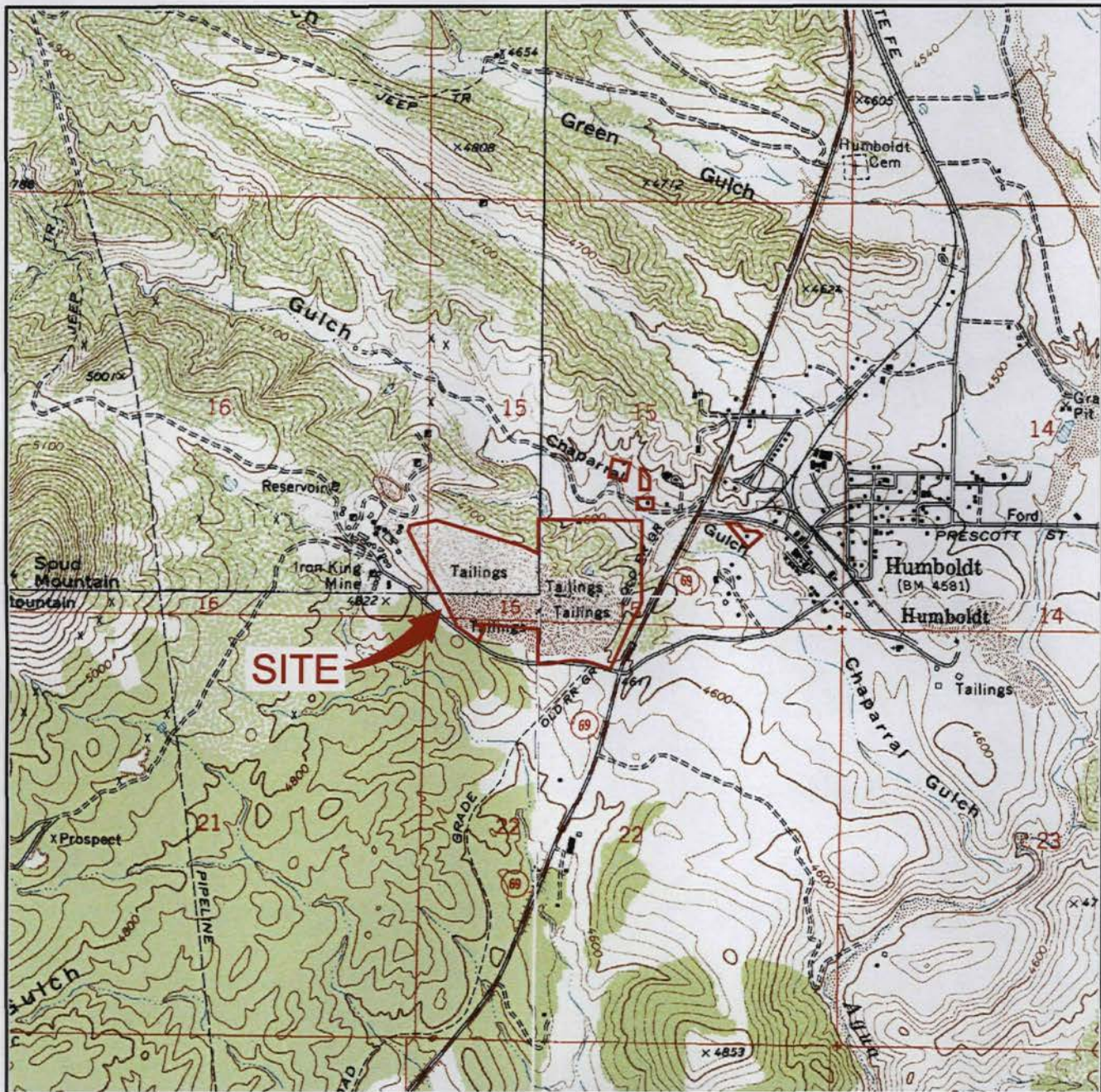
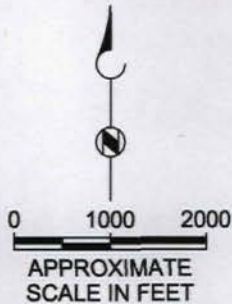
## 11. REPORT LIMITATIONS

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.

## 12. REFERENCES

- Arizona Bureau of Mines, 1958. *Geologic Map of Yavapai County, Arizona, 1:375,000 Scale*. University of Arizona, Tucson, Arizona.
- Brown and Caldwell, 2004. *Groundwater Study, Ironite Products Company, Humboldt, Arizona*. Unpublished Report submitted to Ironite Products Company.
- Hoque and Associates, 2001. *Aquifer Protection Permit Application, Ironite Waste Reduction Facility*. Unpublished Document prepared on behalf of Kuhles Services, Inc. for submittal to the ADEQ Waste Programs Division.
- Ecology and Environment, Inc., October 2005. *Iron King Mine Site, Humboldt, Arizona, Final Report*.
- Richard, S.M., Reynolds, S.J., Spencer, J.E., and Pearthree, P.A., 2000. *Geologic Map of Arizona*. Arizona Geological Survey Map 35, Tucson, Arizona.
- United States Environmental Protection Agency (EPA), April 2002. *Superfund Response Actions: Temporary Relocations Implementation Guidance*, OSWER Directive 9230.0-97.
- EPA, May 2006. *Administrative Settlement Agreement and Order on Consent for Removal Action, US EPA Region 9, CERCLA Docket No. 2006-13*.

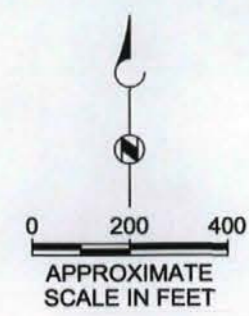
Figures



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

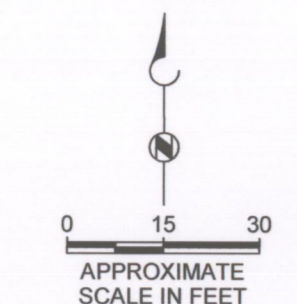
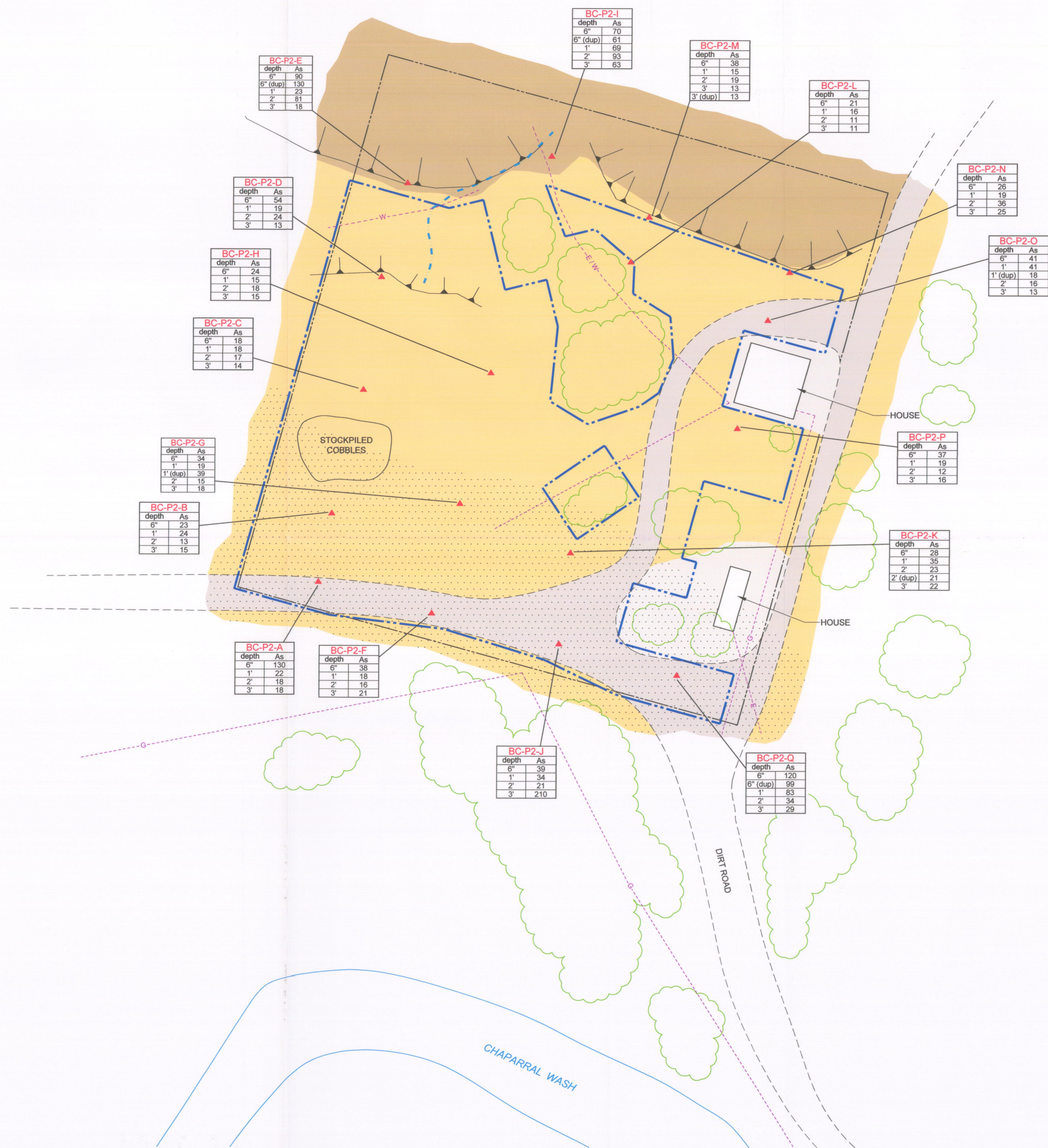


**EXPLANATION**

- IRONITE SITE BOUNDARY
- APPROXIMATE PROPERTY LIMITS SUBJECT TO REMOVAL ACTION

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

**BROWN AND  
 CALDWELL**



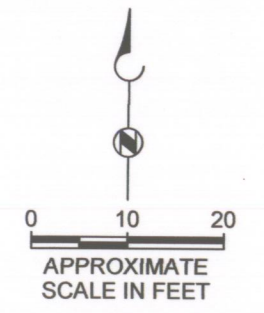
**EXPLANATION**

- ORIGINAL PROPOSED EXCAVATION BOUNDARY
- REVISED PROPOSED EXCAVATION BOUNDARY
- DRAINAGE
- ▲ SLOPE INDICATOR
- - - E - - - UNDERGROUND ELECTRICAL
- - - G - - - UNDERGROUND GAS LINE
- - - L - - - UNDERGROUND LEACH LINE
- - - E/W - - - UNDERGROUND ELECTRICAL & WATER
- ☁ AREAS OF DENSE VEGETATION
- ▲ SAMPLE LOCATION
- █ BACKFILL (MIXED MATERIALS)
- █ ROAD BACKFILL
- █ HILL SLOPE COLLUVIUM
- █ FINE-GRAINED STREAM DEPOSITS / TOPSOIL
- █ APPROXIMATE EXTENT OF STREAM GRAVEL BELOW SURFICIAL MATERIAL

BC-P2-E		SAMPLE ID	
depth	As	depth	As
6"	90	6"	90
6" (dup)	130	6" (dup)	130
1'	23	1'	23
2'	81	2'	81
3'	18	3'	18

DUPLICATE SAMPLE

ALL TOTAL ARSENIC RESULTS SHOWN IN mg/kg



**EXPLANATION**

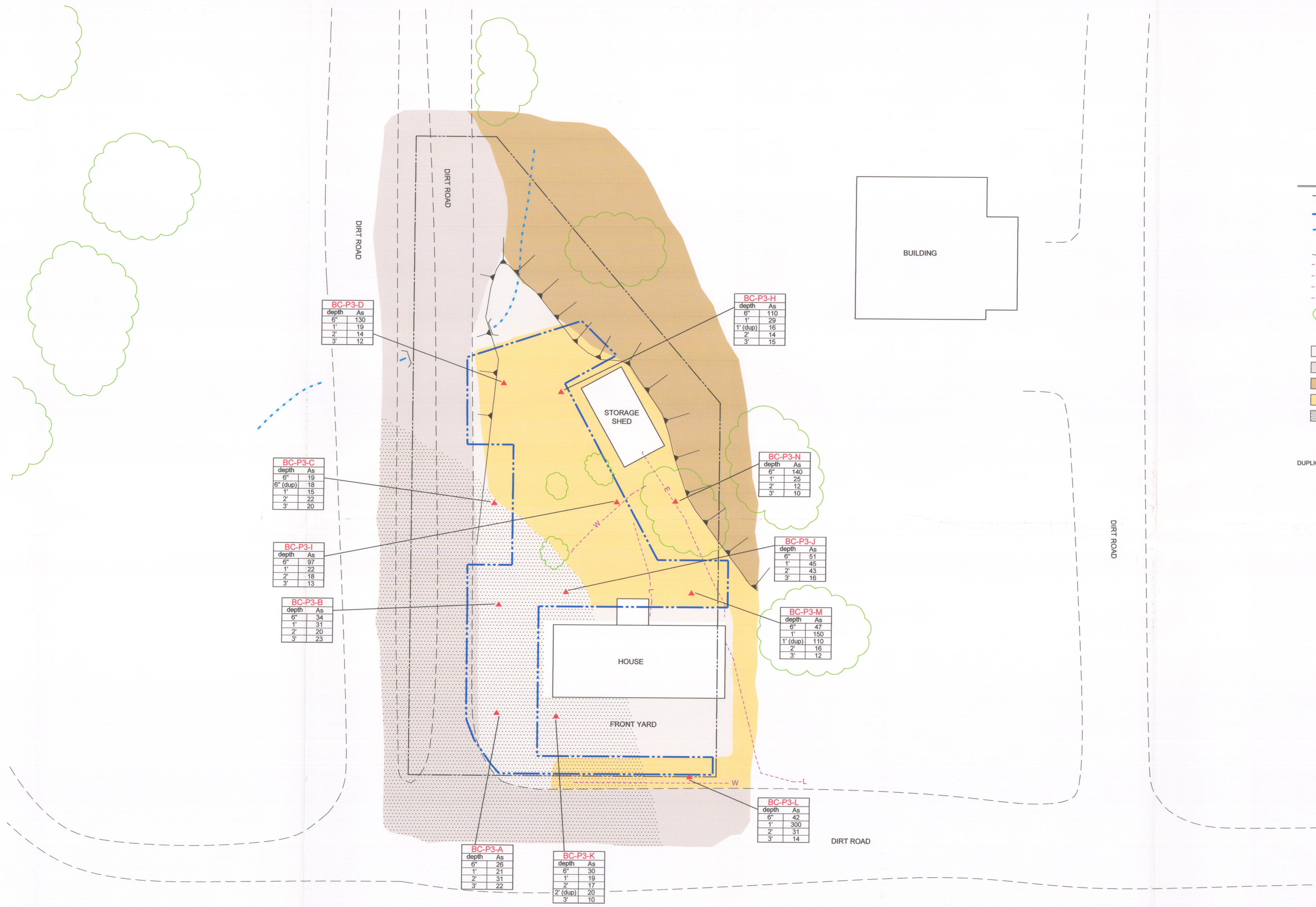
- ORIGINAL PROPOSED EXCAVATION BOUNDARY
- REVISED PROPOSED EXCAVATION BOUNDARY
- DRAINAGE
- ▲ SLOPE INDICATOR
- - - W - - - UNDERGROUND WATER LINE
- - - G - - - UNDERGROUND GAS LINE
- - - L - - - UNDERGROUND LEACH LINE
- - - E - - - UNDERGROUND ELECTRIC LINE
- ☁ AREAS OF DENSE VEGETATION
- ▲ SAMPLE LOCATION
- █ BACKFILL (MIXED MATERIALS)
- █ ROAD BACKFILL
- █ HILL SLOPE COLLUVIUM
- █ FINE-GRAINED STREAM DEPOSITS / TOPSOIL
- █ APPROXIMATE EXTENT OF STREAM GRAVEL BELOW SURFICIAL MATERIAL

BC-P3-C		SAMPLE ID
depth	As	ARSENIC
6"	19	
6" (dup)	18	
1'	15	
2'	22	
3'	20	

DUPLICATE SAMPLE

BC-P3-C		SAMPLE RESULT
depth	As	ARSENIC
6"	19	
6" (dup)	18	
1'	15	
2'	22	
3'	20	

ALL TOTAL ARSENIC RESULTS SHOWN IN mg/Kg



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'	18

BC-P3-B	
depth	As
6"	34
1'	31
2'	20
3'	23

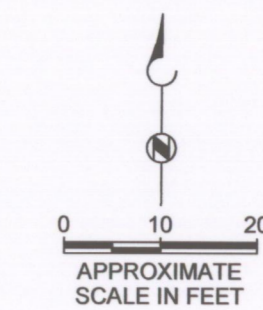
BC-P3-M	
depth	As
6"	47
1'	150
1' (dup)	110
2'	16
3'	12

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





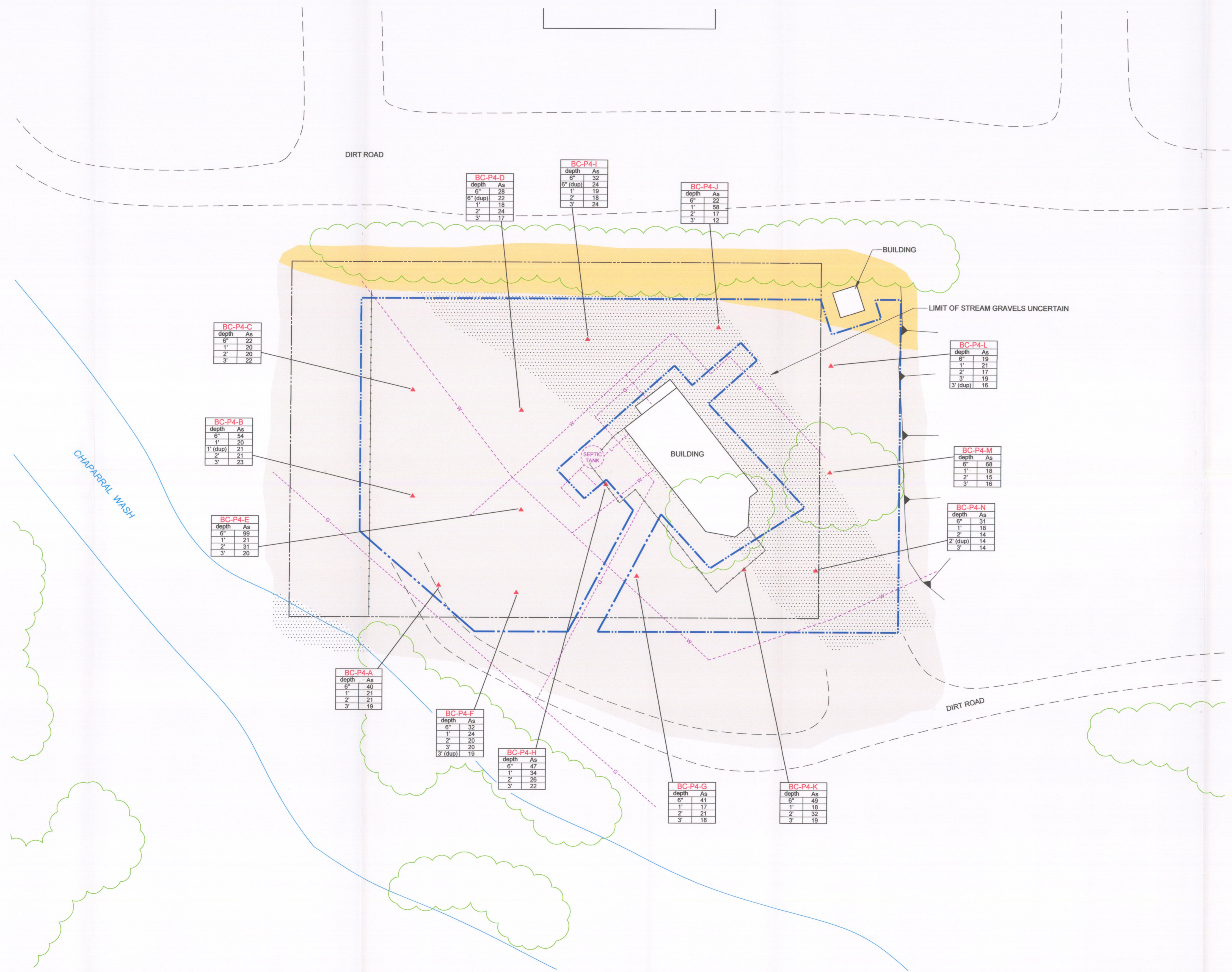
**EXPLANATION**

- ORIGINAL PROPOSED EXCAVATION BOUNDARY
- REVISED PROPOSED EXCAVATION BOUNDARY
- FENCE / PROPERTY BOUNDARY
- ▲ SLOPE INDICATOR
- W--- UNDERGROUND WATER LINE
- G--- UNDERGROUND GAS LINE
- L--- UNDERGROUND LEACH LINE
- ▲ AREAS OF DENSE VEGETATION
- ▲ SAMPLE LOCATION
- BACKFILL (MIXED MATERIALS)
- FINE-GRAINED STREAM DEPOSITS / TOPSOIL
- APPROXIMATE EXTENT OF STREAM GRAVEL BELOW SURFICIAL MATERIAL

BC-P4-B		SAMPLE ID
depth	As	ARSENIC
6"	54	
1'	20	
2'	21	
3'	23	

DUPLICATE SAMPLE → 1' (dup) 21 ← SAMPLE RESULT

ALL TOTAL ARSENIC RESULTS SHOWN IN mg/Kg



BC-P4-D	
depth	As
6"	28
6" (dup)	22
1'	18
2'	24
3'	17

BC-P4-I	
depth	As
6"	32
6" (dup)	24
1'	19
2'	18
3'	24

BC-P4-J	
depth	As
6"	22
1'	58
2'	17
3'	12

BC-P4-C	
depth	As
6"	22
1'	20
2'	20
3'	22

BC-P4-B	
depth	As
6"	54
1'	20
1' (dup)	21
2'	21
3'	23

BC-P4-E	
depth	As
6"	99
1'	21
2'	31
3'	20

BC-P4-L	
depth	As
6"	19
1'	21
2'	17
3' (dup)	16

BC-P4-M	
depth	As
6"	68
1'	18
2'	15
3'	16

BC-P4-N	
depth	As
6"	31
1'	18
2'	14
2' (dup)	14
3'	14

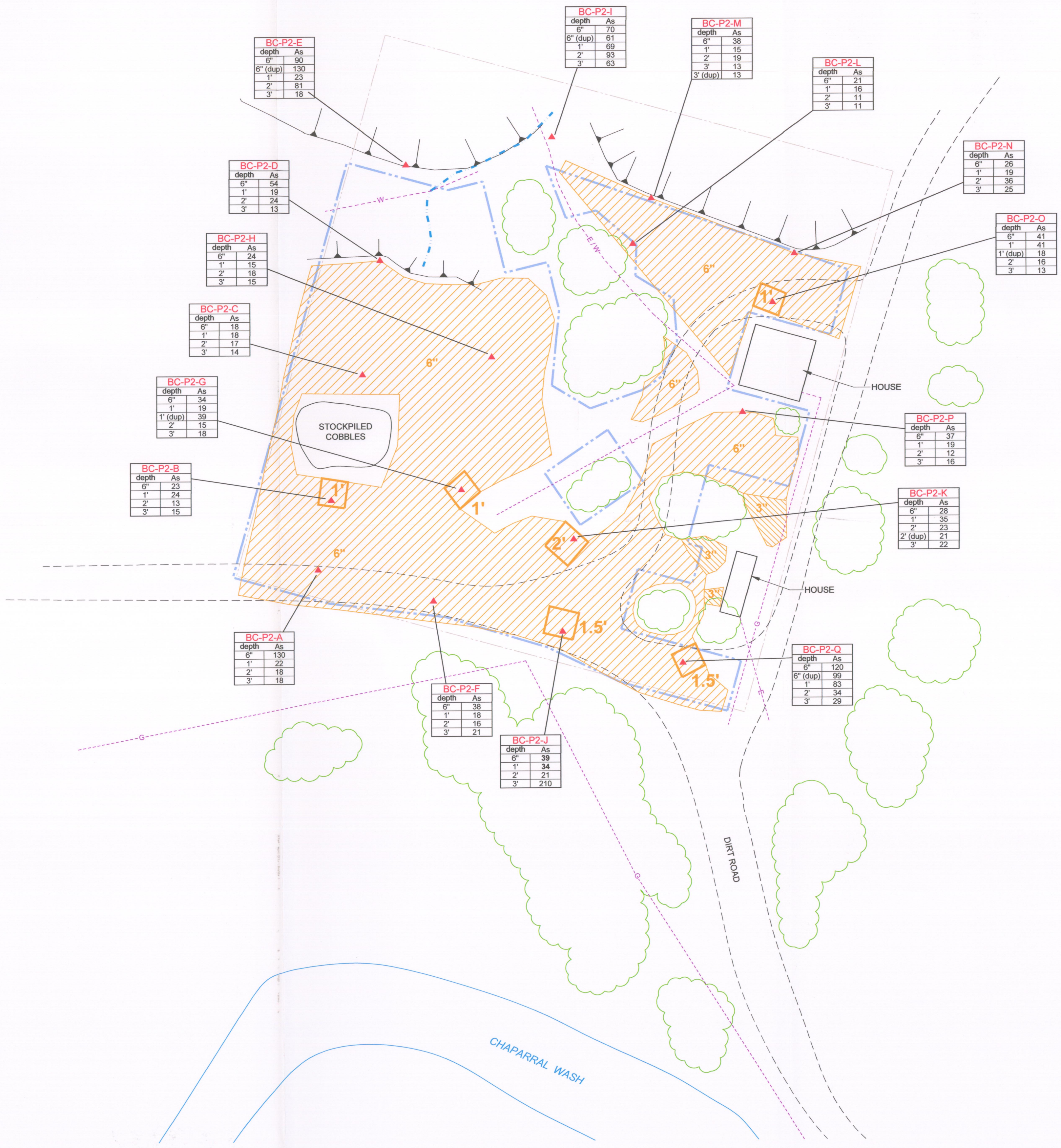
BC-P4-A	
depth	As
6"	40
1'	21
2'	21
3'	19

BC-P4-F	
depth	As
6"	32
1'	24
2'	20
3' (dup)	19

BC-P4-H	
depth	As
6"	47
1'	34
2'	28
3'	22

BC-P4-G	
depth	As
6"	41
1'	17
2'	21
3'	18

BC-P4-K	
depth	As
6"	49
1'	18
2'	32
3'	19



0 15 30  
APPROXIMATE SCALE IN FEET

**EXPLANATION**

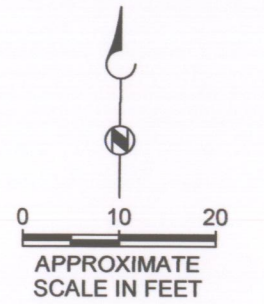
- ORIGINAL PROPOSED EXCAVATION BOUNDARY
- REVISED PROPOSED EXCAVATION BOUNDARY
- ACTUAL REMOVAL AREA AND DEPTH
- ACTUAL HOTSPOT REMOVAL AREA AND DEPTH
- DRAINAGE
- SLOPE INDICATOR
- UNDERGROUND ELECTRICAL
- UNDERGROUND GAS LINE
- UNDERGROUND LEACH LINE
- UNDERGROUND ELECTRICAL & WATER
- AREAS OF DENSE VEGETATION
- SAMPLE LOCATION

BC-P2-E	SAMPLE ID
depth	As
6"	90
6" (dup)	130
1'	23
2'	81
3'	18

ALL TOTAL ARSENIC RESULTS SHOWN IN mg/Kg

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

RFUND RECORDS CTR

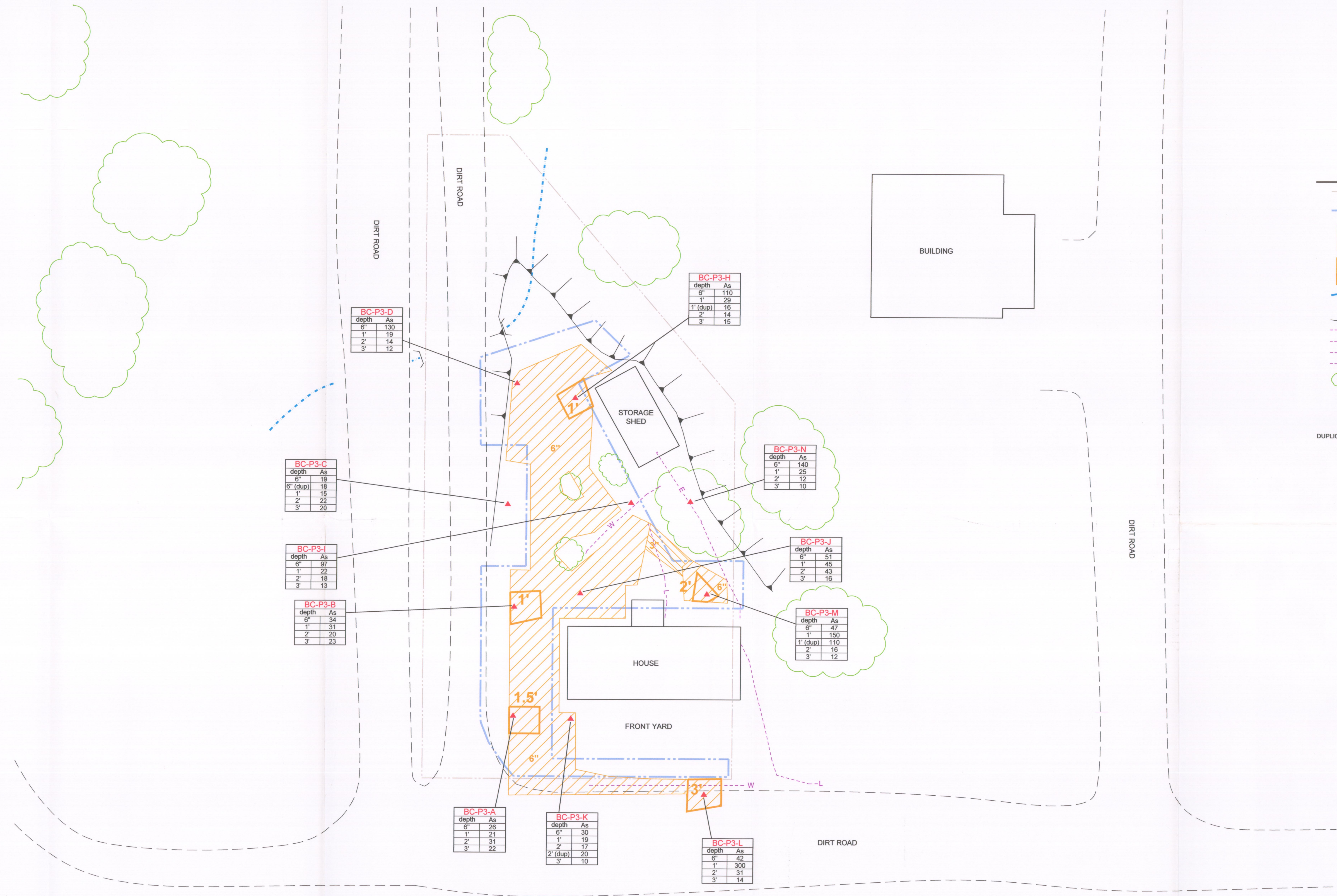


**EXPLANATION**

- ORIGINAL PROPOSED EXCAVATION BOUNDARY
- - - REVISED PROPOSED EXCAVATION BOUNDARY
- 6" ACTUAL REMOVAL AREA AND DEPTH
- 3' ACTUAL HOTSPOT REMOVAL AREA AND DEPTH
- - - DRAINAGE
- ▲ SLOPE INDICATOR
- - - W - UNDERGROUND WATER LINE
- - - G - UNDERGROUND GAS LINE
- - - L - UNDERGROUND LEACH LINE
- - - E - UNDERGROUND ELECTRIC LINE
- ▲ AREAS OF DENSE VEGETATION
- ▲ SAMPLE LOCATION

BC-P3-C		SAMPLE ID
depth	As	ARSENIC
6"	19	
6" (dup)	18	
1'	15	SAMPLE RESULT
2'	22	
3'	20	

ALL TOTAL ARSENIC RESULTS SHOWN IN mg/Kg



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

BC-P3-B	
depth	As
6"	34
1'	31
2'	20
3'	23

BC-P3-N	
depth	As
6"	140
1'	25
2'	12
3'	10

BC-P3-J	
depth	As
6"	51
1'	45
2'	43
3'	16

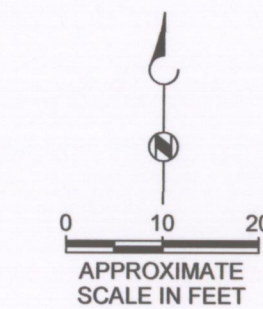
BC-P3-M	
depth	As
6"	47
1'	150
1' (dup)	110
2'	16
3'	12

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

BC-P3-L	
depth	As
6"	42
1'	300
2'	31
3'	14

CHAPARRAL WASH



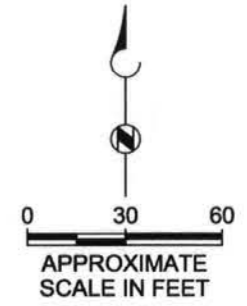
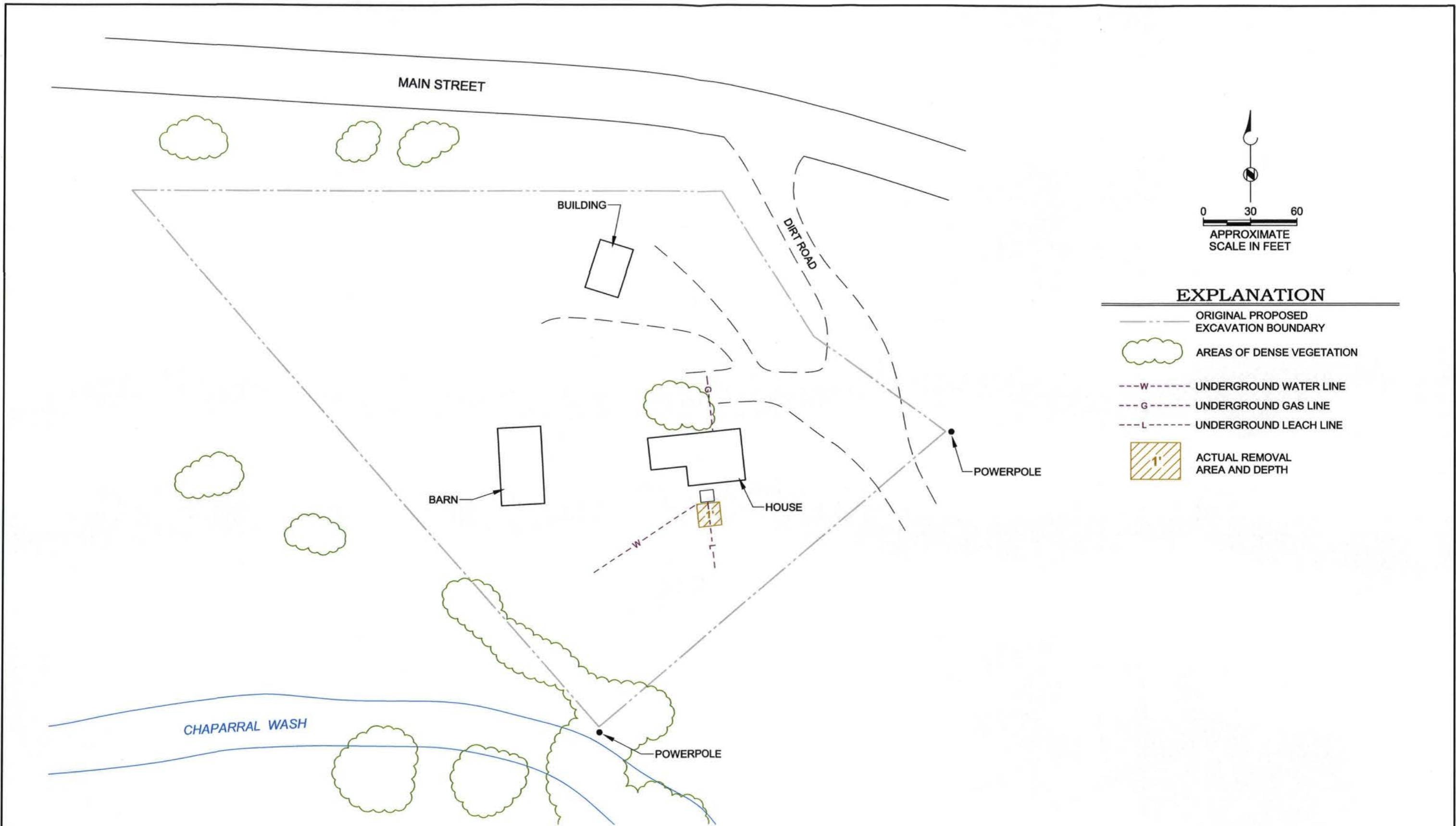
**EXPLANATION**

- ORIGINAL PROPOSED EXCAVATION BOUNDARY
- REVISED PROPOSED EXCAVATION BOUNDARY
- FENCE / PROPERTY BOUNDARY
- ACTUAL REMOVAL AREA AND DEPTH
- ACTUAL HOTSPOT REMOVAL AREA AND DEPTH
- SLOPE INDICATOR
- UNDERGROUND WATER LINE
- UNDERGROUND GAS LINE
- UNDERGROUND LEACH LINE
- AREAS OF DENSE VEGETATION
- SAMPLE LOCATION

BC-P4-B		SAMPLE ID	
depth	As	ARSENIC	
6"	54		
1'	20		
1' (dup)	21	SAMPLE RESULT	
2'	21		
3'	23		

ALL TOTAL ARSENIC RESULTS SHOWN IN mg/Kg





**EXPLANATION**

- ORIGINAL PROPOSED EXCAVATION BOUNDARY
- ☁ AREAS OF DENSE VEGETATION
- W--- UNDERGROUND WATER LINE
- G--- UNDERGROUND GAS LINE
- L--- UNDERGROUND LEACH LINE
- ▨ 1' ACTUAL REMOVAL AREA AND DEPTH

**BROWN AND CALDWELL**

Figure 9  
**ARSENIC REMOVAL AREA MAP**  
**PROPERTY #7**  
 IRONITE PRODUCTS COMPANY  
 HUMBOLDT, ARIZONA



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 collection at Property #4; 35 soil samples, 1 equipment blank.	Backfilled and graded sample areas at Property #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.	
	<b>EXCAVATION ACTIVITIES</b>	<b>BACKFILL ACTIVITIES</b>	<b>OTHER ACTIVITIES</b>
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 activities.	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.

Removal Action Completion Report  
Ironite Products Company  
Humboldt, Arizona

**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		



Removal Action Completion Report  
Ironite Products Company  
Humboldt, Arizona

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			

Removal Action Completion Report  
Ironite Products Company  
Humboldt, Arizona

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		

Removal Action Completion Report  
Ironite Products Company  
Humboldt, Arizona

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	

Removal Action Completion Report  
 Ironite Products Company  
 Humboldt, Arizona

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.

Removal Action Completion Report  
 Ironite Products Company  
 Humboldt, Arizona

**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
<b>Applicable Regulatory Level</b>			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.										

Removal Action Completion Report  
Ironite Products Company  
Humboldt, Arizona

**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	
<b>PROPERTY #2</b>					
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/CaCO <sub>3</sub>	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/CaCO <sub>3</sub> 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).

Removal Action Completion Report  
Ironite Products Company  
Humboldt, Arizona

Sample Location	Classification				Interpretation
	0.5 ft bgs	1 ft bgs	2 ft bgs	3 ft bgs	
<b>PROPERTY #2 (continued)</b>					
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.
<b>PROPERTY #3</b>					
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

Removal Action Completion Report  
Ironite Products Company  
Humboldt, Arizona

Sample Location	Classification				Interpretation
	0.5 ft bgs	1 ft bgs	2 ft bgs	3 ft bgs	
<b>PROPERTY #3 (continued)</b>					
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
<b>PROPERTY #4</b>					
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



Removal Action Completion Report  
 Ironite Products Company  
 Humboldt, Arizona

Sample Location	Classification				Interpretation
	0.5 ft bgs	1 ft bgs	2 ft bgs	3 ft bgs	
<b>PROPERTY #4 (continued)</b>					
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					

Removal Action Completion Report  
Ironite Products Company  
Humboldt, Arizona

**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 SW 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

Removal Action Completion Report  
Ironite Products Company  
Humboldt, Arizona

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

Removal Action Completion Report  
Ironite Products Company  
Humboldt, Arizona

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	Property #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				

Removal Action Completion Report  
Ironite Products Company  
Humboldt, Arizona

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

PROPERTY	MATERIAL VOLUMES (YARDS <sup>3</sup> )		
	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



APPENDIX A

---

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

UNITED STATES  
ENVIRONMENTAL PROTECTION AGENCY  
REGION 9

IN THE MATTER OF:

Iron King Mine Site  
Dewey-Humboldt,  
Yavapai County, Arizona

Ironite Products Company  
Respondent

ADMINISTRATIVE SETTLEMENT  
AGREEMENT AND ORDER ON  
CONSENT FOR REMOVAL ACTION

U.S. EPA Region 9  
CERCLA Docket No. 2006-13

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 .....	3
II.	PARTIES BOUND .....	3
III.	DEFINITIONS .....	4
IV.	FINDINGS OF FACT .....	5
V.	CONCLUSIONS OF LAW AND DETERMINATIONS .....	7
VI.	SETTLEMENT AGREEMENT AND ORDER .....	8
VII.	DESIGNATION OF CONTRACTOR, PROJECT COORDINATOR, AND ON-SCENE COORDINATOR .....	8
VIII.	WORK TO BE PERFORMED .....	9
IX.	SITE ACCESS .....	13
X.	ACCESS TO INFORMATION .....	14
XI.	RECORD RETENTION .....	15
XII.	COMPLIANCE WITH OTHER LAWS .....	15
XIII.	EMERGENCY RESPONSE AND NOTIFICATION OF RELEASES .....	16
XIV.	AUTHORITY OF ON-SCENE COORDINATOR .....	16
XV.	PAYMENT OF RESPONSE COSTS .....	17
XVI.	DISPUTE RESOLUTION .....	18
XVII.	FORCE MAJEURE .....	18
XVIII.	STIPULATED PENALTIES .....	19
XIX.	COVENANT NOT TO SUE BY EPA .....	22
XX.	RESERVATIONS OF RIGHTS BY EPA .....	23
XXI.	COVENANT NOT TO SUE BY RESPONDENTS .....	24
XXII.	OTHER CLAIMS .....	25
XXIII.	CONTRIBUTION .....	26
XXIV.	INDEMNIFICATION .....	26
XXV.	INSURANCE .....	27
XXVI.	FINANCIAL ASSURANCE .....	28
XXVII.	MODIFICATIONS .....	29
XXVIII.	ADDITIONAL REMOVAL ACTIONS .....	30
XXIX.	NOTICE OF COMPLETION OF WORK .....	30
XXX.	SEVERABILITY/INTEGRATION/APPENDICES .....	30
XXXI.	EFFECTIVE DATE .....	31

## 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.

l. "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

of the Iron King Mine. The Iron King Mine is covered with tailings and waste rock which are impacted by erosion, and tailings are susceptible to erosion events. Potential contaminant sources from the mine and the nearby Humboldt Smelter are listed below.

b. The Ironite Mine is located on the Ironite property, the Ironite Products Company. The Ironite property consists of 22 acres. The Ironite plant currently produces Ironite fertilizer. The former fertilizer plant is located on the south side of Iron King Road.

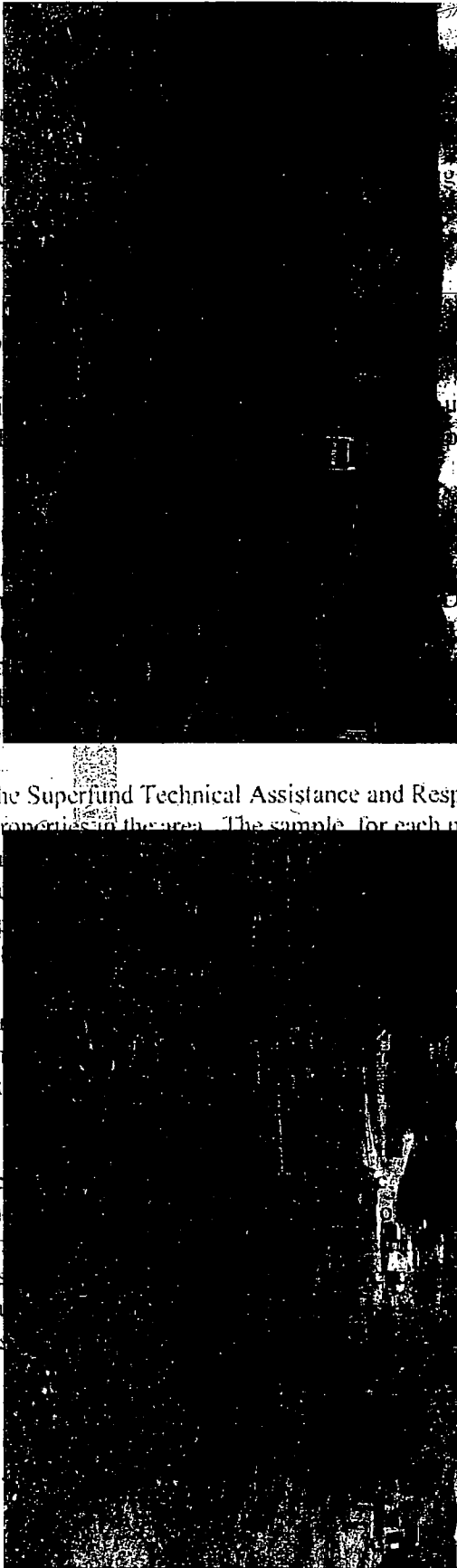
c. During a 1998 National Pollution Discharge Inspection, EPA inspectors found runoff running into the Chaparral Gulch. In a Preliminary Assessment Site Inspection, samples collected from the Chaparral Gulch showed concentrations of arsenic and lead above the Remedial Action Goals (PRGs) and ADEQ Soil Remediation

d. In August 2005, the Superfund Technical Assistance and Response Team conducted a Site assessment of 17 properties in the area. The sample for each property was compared to various background levels. The sample for each property was compared to the Remedial Action Goal (PRG). Based on a visual comparison, 4 properties exceeded the PRG for arsenic. The results for 4 properties are listed below and each exceeded the Site-specific Remedial Action Goal.

e. More specific details are provided in the Action Memorandum for the Chaparral Gulch Residential Site (U.S. EPA, 2005) and the Agreement as Appendix 1.

f. Residential soils contain hazardous substances that pose a potential threat to human health. Heavy rains and winds may cause contaminant dispersal. The materials listed in the Memorandum are "hazardous substances" under CERCLA, § 9601(14), by meeting requirements of 261.22(a)(1), and 261.24.

g. Threats to public health exist for releases of hazardous substances



which are... to be... g-rain and flood... sources from the

the mine... or plant. The... The Ironite... urea and water... erty on the south

(NPDES)... Iron King Mine... DEQ during a... that sediment... had... ation Goals

17 properties in the area. The sample for each property was... on Goal... ded the... arsenic,

conditions are... at the... Settlement

ous substance, ... dous... Site causing... he Action... CLA, 42 U.S.C... (1).

significant potential... in imminent and

Appendix F  
Removal Action Completion Report  
Iron King Products Company  
Humboldt, Arizona

PROPERTY

BROWN AND CALDWELL

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(f) 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 preceding 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 Respondent'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(c) 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. DISPUTE RESOLUTION**

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. FORCE MAJEURE**

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):

<u>Penalty Per Violation Per Day</u>	<u>Period of Noncompliance</u>
\$ 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:

<u>Penalty Per Violation Per Day</u>	<u>Period of Noncompliance</u>
\$ 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), (c), 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.

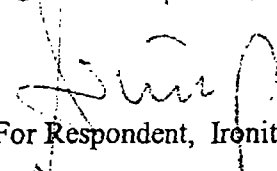
Appendix 2: Site Map


**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 14<sup>th</sup> day of May, 2006.

  
For Respondent, Ironite Products Company by

  
Title

It is so ORDERED and Agreed this 16<sup>th</sup> day of May, 2006.

BY: James C. Spaw

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**



Janet Napolitano  
Governor

# ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

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



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

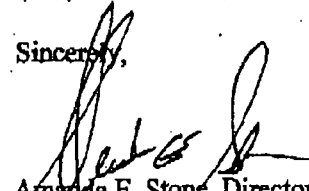
Dear Mr. Takata:

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 data 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

Northern Regional Office  
1515 East Cedar Avenue • Suite F • Flagstaff, AZ 86004  
(928) 779-0313

Southern Regional Office  
400 West Congress Street • Suite 433 • Tucson, AZ 85701  
(520) 628-6733

APPENDIX C

---

**Copies of Brown and Caldwell Daily Site Safety Briefings**

**BROWN AND CALDWELL**

# Attachment 2—Field Work Safety Plan Implementation Checklist

Project Name <i>Ironite URP Soil Sampling</i>	Project Location (city and state) <i>Humbolt AZ</i>	Date <i>6/26/06 - 27</i>
Name of Site Safety Coordinator <i>M. Natten</i>	Weather Conditions <i>Sunny, Warm</i>	Project Number <i>130508</i>

BC Staff Present	Name	Office
	<i>M. Natten</i>	<i>Phoenix</i>
	<i>M. Smith</i>	<i>Phoenix</i>
	<i>P. Esbroughi - initial setup</i>	<i>Phoenix</i>

Indicate the status of each of the following:

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

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 <i>M. Natten</i>		Signature of Site Safety Coordinator <i>M. Natten</i> 6/29/06	
Project Name <i>Limite VRF Soil Sampling</i>		Project Location <i>Humboldt AZ</i>	Project Number <i>150508</i>

**Who attended the briefing?**

**Names of Brown and Caldwell Employees**

*M. Natten* *M. Natten*  
*Meredith Smith* *[Signature]*  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Names of Subcontractor(s) Employees**

*Joshua Vetter P.S.L.*  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**What items were discussed?**

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> Field Work Safety Plan          | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities   |
| <input type="checkbox"/> Specific Accident/Incident                 | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)         |
| <input checked="" type="checkbox"/> Protective Equipment to be Used | <input checked="" type="checkbox"/> Location of Emergency Telephone Number |
| <input checked="" type="checkbox"/> Emergency Hospital Route        | <input checked="" type="checkbox"/> Work Schedule                          |
| <input type="checkbox"/> 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 <i>Irrigate VRRP Soil Sampling</i>		Project Location (city and state) <i>Humboldt AZ</i>	Date <i>6/20/06</i>
Name of Site Safety Coordinator <i>M. Nation</i>		Weather Conditions <i>Sunny warm</i>	Project Number <i>130508</i>
BC Staff Present	Name	Office	
	<i>M. Nation</i>	<i>Phoenix</i>	
	<i>M. Smith</i>	<i>Phoenix</i>	

Indicate the status of each of the following:

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

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 Site Activity and Safety Briefing

Name of Site Safety Officer <i>Matthew Natem</i>	Signature of Site Safety Officer <i>Matthew Natem</i>	Date <i>6/29/06</i>
Project Name <i>Tronka VRP</i>	Project Location <i>Humboldt A2</i>	Project Number <i>130508</i>

### Who attended the briefing?

#### Names of Brown and Caldwell Employees

*M. Natem* *Matthew Natem*  
*M. Smith* *[Signature]*  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

#### Names of Subcontractor(s) Employees

*Gary Moore* *Dan Mason*  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### What items were discussed?

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> Site Safety and Health Plan     | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities   |
| <input checked="" type="checkbox"/> Specific Accident/Incident      | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)         |
| <input checked="" type="checkbox"/> Protective Equipment to be Used | <input checked="" type="checkbox"/> Location of Emergency Telephone Number |
| <input checked="" type="checkbox"/> Emergency Hospital Route        | <input checked="" type="checkbox"/> Work Schedule                          |
| <input type="checkbox"/> 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: Place a copy of the completed form in the project file.**

HS—17 REV. 06/98

**BROWN AND CALDWELL**

# Attachment C—Site Safety and Health Plan Safety Plan Implementation Checklist

Project Name <i>Finite VRP</i>		Project Location (city and state) <i>Humbolt AZ</i>	Date <i>8/29/06</i>
Name of Site Safety Coordinator <i>M. Nathan</i>		Weather Conditions <i>Sunny</i>	Project Number <i>130508</i>
BC Staff Present	Name <i>M. Nathan</i>	Office <i>Phoenix</i>	
	<i>M. Smith</i>	"	

Indicate the status of each of the following:

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



**BROWN AND CALDWELL**

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

Name of Site Safety Coordinator

*M. Naton*

Signature of Site Safety Coordinator

*M. Naton*

Project Name

*Fronte CRP 6/30/06*

Project Location

*Humbolt AZ*

Project Number

*130528*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Matthew Naton*  
*Meredith Smith*

Names of Subcontractor(s) Employees

*Joshua Vetter P.S.C.*

What items were discussed?

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> Field Work Safety Plan          | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident                 | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)       |
| <input checked="" type="checkbox"/> Protective Equipment to be Used | <input type="checkbox"/> Location of Emergency Telephone Number          |
| <input checked="" type="checkbox"/> Emergency Hospital Route        | <input checked="" type="checkbox"/> Work Schedule                        |
| <input type="checkbox"/> 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 <i>Trinle VRP</i>		Project Location (city and state) <i>Humboldt AZ</i>	Date <i>6/30/06</i>
Name of Site Safety Coordinator <i>Matthew Natta</i>		Weather Conditions <i>Sunny</i>	Project Number <i>130508</i>
BC Staff Present	Name <i>Matthew Natta</i> <i>Meredith Smith</i>	Office <i>Phoenix</i>	

Indicate the status of each of the following:

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

TIME ON (minutes): 50      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

Matt Nation

Signature of Site Safety Coordinator

*Matt Nation*

7/5/06

Project Name

Ironite Humboldt

Project Location

Humboldt, AZ

Project Number

130508

## Who attended the briefing?

Names of Brown and Caldwell Employees

Meredith Smith  
Matt Nation  
Gary Adams  
\_\_\_\_\_  
\_\_\_\_\_

Names of Subcontractor(s) Employees

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## What items were discussed?

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> Field Work Safety Plan          | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident                 | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)       |
| <input checked="" type="checkbox"/> Protective Equipment to be Used | <input type="checkbox"/> Location of Emergency Telephone Number          |
| <input type="checkbox"/> Emergency Hospital Route                   | <input checked="" type="checkbox"/> Work Schedule                        |
| <input type="checkbox"/> 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 <u>Ironite Humboldt</u>		Project Location (city and state) <u>Humboldt, AZ</u>	Date <u>7/5/06</u>
Name of Site Safety Coordinator <u>Matt Nation</u>		Weather Conditions <u>Cloudy rainy</u>	Project Number <u>130508</u>
BC Staff Present	Name <u>Matt Nation</u>	Office <u>Phoenix</u>	
	<u>Meredith Smith</u>	<u>Phoenix</u>	
	_____	_____	
	_____	_____	

Indicate the status of each of the following:

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

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: Matt Nation      Signature of Site Safety Coordinator: *Matthew Nation*      7/6/06

Project Name: Ironite Humboldt      Project Location: Humboldt AZ      Project Number: 130508

**Who attended the briefing?**

**Names of Brown and Caldwell Employees**

**Names of Subcontractor(s) Employees**

*Matthew Nation*      *Matthew Nation*  
*Greg Adams*  
*Meredith Smith*  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**What items were discussed?**

- |   |  |
|---|--|
| <input type="checkbox"/> Field Work Safety Plan                     | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident                 | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)       |
| <input checked="" type="checkbox"/> Protective Equipment to be Used | <input type="checkbox"/> Location of Emergency Telephone Number          |
| <input checked="" type="checkbox"/> Emergency Hospital Route        | <input checked="" type="checkbox"/> Work Schedule                        |
| <input type="checkbox"/> 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 <i>Ironite Humboldt</i>	Project Location (city and state) <i>Humboldt, AZ</i>	Date <i>7/6/06</i>
Name of Site Safety Coordinator <i>Matt Nation</i>	Weather Conditions <i>Sunny Warm</i>	Project Number <i>130508</i>

BC Staff Present	Name	Office
	<i>Matt Nation</i>	<i>Phoenix</i>
	<i>Meredith Smith</i>	<i>Phoenix</i>

Indicate the status of each of the following:

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

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

*Matthew Nation*

Signature of Site Safety Coordinator

*Matthew Nation*

*7/7/08*

Project Name

*Frunk VRP*

Project Location

*Humbolt A2*

Project Number

*130508*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Matthew Nation*

*Meredith Smith*

*Gary Adams*

Names of Subcontractor(s) Employees

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 <i>Imite VRP</i>	Project Location (city and state) <i>Humbolt AZ</i>	Date <i>7/7/08</i>
Name of Site Safety Coordinator <i>Matthew Nation</i>	Weather Conditions <i>Rain / High Clouds</i>	Project Number <i>130508</i>
BC Staff Present	Name	Office
	<i>Matthew Nation</i>	<i>Phoenix</i>
	<i>Marcelle Smith</i>	<i>Phoenix</i>

Indicate the status of each of the following:

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

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

*Matthew Nation*

Signature of Site Safety Coordinator

*Matthew Nation* 7/10/08

Project Name

*Ironite VRP Soil Sampling*

Project Location

*Humbolt AZ Property # 4*

Project Number

*130505*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Matthew Nation*  
*Gary Adams*  
*Meredith Smith*

Names of Subcontractor(s) Employees

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

What items were discussed?

- |   |  |
|---|--|
| <input type="checkbox"/> Field Work Safety Plan                     | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident                 | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)       |
| <input checked="" type="checkbox"/> Protective Equipment to be Used | <input type="checkbox"/> Location of Emergency Telephone Number          |
| <input type="checkbox"/> Emergency Hospital Route                   | <input type="checkbox"/> Work Schedule                                   |
| <input type="checkbox"/> 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 <i>Freight VDP</i>		Project Location (city and state) <i>Humbolt AZ</i>	Date <i>7/10/08</i>
Name of Site Safety Coordinator <i>Matthew Natron</i>		Weather Conditions <i>Sunny</i>	Project Number <i>130508</i>
BC Staff Present	Name <i>Matthew Natron</i>	Office	
	_____	_____	
	_____	_____	
	_____	_____	

Indicate the status of each of the following:

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

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 Natson*

Signature of Site Safety Coordinator

*Matthew Natson*

*7/11/08*

Project Name

*Trunk VRP Soil Sampling*

Project Location

*Humbolt AZ*

Project Number

*170508*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Matthew Natson*

*Meredith Smith*

Names of Subcontractor(s) Employees

*Marshall Sauer*

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 <i>Truck VRP Soil Sampling</i>	Project Location (city and state) <i>Humbolt AZ Property #4</i>	Date <i>7/1/08</i>
Name of Site Safety Coordinator <i>Matthew Nutton</i>	Weather Conditions	Project Number <i>130508</i>
BC Staff Present	Name	Office
	<i>Matthew Nutton</i>	<i>Phoenix</i>
	<i>Mercedes Smith</i>	" "

Indicate the status of each of the following:

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

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 <i>Matthew Nakton</i>	Signature of Site Safety Coordinator <i>Matthew Nakton</i> 7/24/08	
Project Name <i>Frank VRP</i>	Project Location <i>Property # 2 Humboldt AZ</i>	Project Number <i>130508</i>

**Who attended the briefing?**

**Names of Brown and Caldwell Employees**

*[Signature]*  
\_\_\_\_\_  
*[Signature]*  
\_\_\_\_\_  
*Megelia Lopez*  
\_\_\_\_\_  
\_\_\_\_\_

**Names of Subcontractor(s) Employees**

*[Signature]*  
\_\_\_\_\_  
*[Signature]*  
\_\_\_\_\_  
*[Signature]*  
\_\_\_\_\_  
**VALENTE BROWN**  
\_\_\_\_\_  
*[Signature]*  
\_\_\_\_\_

**What items were discussed?**

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> Field Work Safety Plan                            | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities   |
| <input type="checkbox"/> Specific Accident/Incident                                   | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)         |
| <input checked="" type="checkbox"/> Protective Equipment to be Used                   | <input checked="" type="checkbox"/> Location of Emergency Telephone Number |
| <input checked="" type="checkbox"/> Emergency Hospital Route                          | <input checked="" type="checkbox"/> Work Schedule                          |
| <input type="checkbox"/> Other <u><i>Excavation procedures / Equipment safety</i></u> |  |

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 <i>Ironik VRF</i>	Project Location (city and state) <i>Property #2 Humbolt AZ</i>	Date <i>7/24/08</i>
Name of Site Safety Coordinator <i>Matthew Nation</i>	Weather Conditions <i>Sunny</i>	Project Number <i>130508</i>

BC Staff Present	Name	Office
	<i>Matthew Nation</i>	<i>BC Phoenix</i>
	<i>Meredith Smith</i>	

Indicate the status of each of the following:

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

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 <i>Matthew Nafise</i>		Signature of Site Safety Coordinator <i>Matthew Nafise</i> 7/25/06	
Project Name <i>Ironite URP</i>		Project Location <i>Property # 2 Humboldt AZ</i>	Project Number <i>130508</i>

**Who attended the briefing?**

**Names of Brown and Caldwell Employees**

*Matthew Nafise*  
*Meredith Smith*  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Names of Subcontractor(s) Employees**

*PSC Richard Gunn*  
*MJC*  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**What items were discussed?**

- |   |  |
|---|--|
| <input type="checkbox"/> Field Work Safety Plan                     | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident                 | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)       |
| <input checked="" type="checkbox"/> Protective Equipment to be Used | <input type="checkbox"/> Location of Emergency Telephone Number          |
| <input type="checkbox"/> Emergency Hospital Route                   | <input checked="" type="checkbox"/> Work Schedule                        |
| <input type="checkbox"/> 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 Site Activity and Safety Briefing

Name of Site Safety Coordinator

*Matthew Nation*

Signature of Site Safety Coordinator

*Matthew Nation*

7/26/06

Project Name

*Trinite VRP*

Project Location

*Property # 2 Humboldt AZ*

Project Number

*130568*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Matthew Nation*  
*Scott Vito*  
*Gary Adams*  
*Richard DAVIS*  
*Richard Davis*  
*Meredith Smith*  
*[Signature]*

Names of Subcontractor(s) Employees

*Joel Nave*

What items were discussed?

- |   |  |
|---|--|
| <input type="checkbox"/> Field Work Safety Plan                     | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident                 | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)       |
| <input checked="" type="checkbox"/> Protective Equipment to be Used | <input type="checkbox"/> Location of Emergency Telephone Number          |
| <input type="checkbox"/> Emergency Hospital Route                   | <input checked="" type="checkbox"/> Work Schedule                        |
| <input type="checkbox"/> 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 <i>Ironite VRP</i>		Project Location (city and state) <i>Property # 2 Humbolt AZ</i>	Date <i>7/26/08</i>
Name of Site Safety Coordinator <i>Matthew Nation</i>		Weather Conditions <i>Cloudy</i>	Project Number <i>130508</i>
BC Staff Present	Name <i>M. Nation, M. Smith</i>	Office <i>Phoenix</i>	

Indicate the status of each of the following:

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

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

*Matthew Nation* 7/24/08

Project Name

*Fronte URP*

Project Location

*Property # 2 Humboldt A2*

Project Number

*130508*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Matthew Nation*  
*Meredith Smith*

Names of Subcontractor(s) Employees

*John*  
*Greg*  
*Richard*

What items were discussed?

- |   |  |
|---|--|
| <input type="checkbox"/> Field Work Safety Plan                     | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident                 | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)       |
| <input checked="" type="checkbox"/> Protective Equipment to be Used | <input type="checkbox"/> Location of Emergency Telephone Number          |
| <input type="checkbox"/> Emergency Hospital Route                   | <input type="checkbox"/> Work Schedule                                   |
| <input type="checkbox"/> 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 <i>Fronte VRP</i>	Project Location (city and state) <i>Property # 2 Humboldt AZ</i>	Date <i>7/27/08</i>
Name of Site Safety Coordinator <i>Matthew Nathan</i>	Weather Conditions <i>CLOUDY</i>	Project Number <i>130508</i>

BC Staff Present	Name	Office
	<i>Matthew Nathan</i>	

Indicate the status of each of the following:

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

TIME ON (minutes): 60

TIME OFF (minutes): 5

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

HS—11 REV. 06/98

**BROWN AND CALDWELL**

# Attachment 2—Field Work Safety Plan Implementation Checklist

Project Name <i>Franchise V RP</i>		Project Location (city and state) <i>Property # 2</i>	Date <i>7/28/06</i>
Name of Site Safety Coordinator <i>Matthew Newton</i>		Weather Conditions <i>Cloudy, humid</i>	Project Number <i>170508</i>
BC Staff Present	Name	Office	
	<i>Matthew Newton</i>	<i>BC Phoenix</i>	
	<i>Meredith Smith</i>	<i>"</i>	

Indicate the status of each of the following:

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

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

*Matthew Nathan*

Signature of Site Safety Coordinator

*Matthew Nathan*

7/31/06

Project Name

*Imite URP*

Project Location

*Property # 2 Humboldt AZ*

Project Number

*130508*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Matthew Nathan*  
*Erin Meredith Smith*  
*James Hill*  
*Pedro Garcia*  
*Maxine Lopez*

Names of Subcontractor(s) Employees

*Dave Michaud PSC*  
*Greg Adams PSC*  
*VALENTE BROWNE*  
*Richard Per PSC*  
*Rose M. Gonzalez*  
*MTG*

What items were discussed?

- |   |  |
|---|--|
| <input type="checkbox"/> Field Work Safety Plan                     | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident                 | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)       |
| <input checked="" type="checkbox"/> Protective Equipment to be Used | <input type="checkbox"/> Location of Emergency Telephone Number          |
| <input type="checkbox"/> Emergency Hospital Route                   | <input checked="" type="checkbox"/> Work Schedule                        |
| <input type="checkbox"/> 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 <i>Frontier VRP</i>		Project Location (city and state) <i>Property # 2 Humboldt A2</i>	Date <i>7/31/08</i>
Name of Site Safety Coordinator <i>Matthew Natter</i>		Weather Conditions <i>Cloudy to Sunny</i>	Project Number <i>170508</i>
BC Staff Present	Name <i>M. Natter</i> <i>M. Smith</i>	Office <i>BC Phoenix</i> <i>"</i>	

Indicate the status of each of the following:

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

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

*Matthew Nation* 8/1/08

Project Name

*Truck VRP*

Project Location

*Property # 2 Humbolt AZ*

Project Number

*130508*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Matthew Nation*  
*Meredith Smith*  
\_\_\_\_\_  
\_\_\_\_\_

Names of Subcontractor(s) Employees

*Joel Ngon*  
*Dave Michael*  
*Richard Jarrin*  
*[Signature]*  
\_\_\_\_\_

What items were discussed?

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> Field Work Safety Plan | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities   |
| <input type="checkbox"/> Specific Accident/Incident        | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)         |
| <input type="checkbox"/> Protective Equipment to be Used   | <input checked="" type="checkbox"/> Location of Emergency Telephone Number |
| <input type="checkbox"/> Emergency Hospital Route          | <input type="checkbox"/> Work Schedule                                     |
| <input type="checkbox"/> 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 3—Field Work Safety Plan Site Activity and Safety Briefing

Name of Site Safety Coordinator

*Matthew Natson*

Signature of Site Safety Coordinator

*[Signature]*

*8/2/08*

Project Name

*Trunk URP*

Project Location

*Property #2 and #3 Humboldt*

Project Number

*130508*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Matthew Natson*

*Meredith Smith*

Names of Subcontractor(s) Employees

*D. Michael L*

*R. Davies*

*PSC*

*PSC*

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 <i>Trinite URP</i>		Project Location (city and state) <i>Humbolt AZ</i>	Date <i>5/2/88</i>
Name of Site Safety Coordinator <i>Matthew Natson</i>		Weather Conditions <i>Partly Cloudy</i>	Project Number <i>130568</i>
BC Staff Present	Name <i>Matthew Natson</i> <i>Meredith Smith</i>	Office <i>Phoenix</i> <i>" "</i>	

Indicate the status of each of the following:

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

TIME ON (minutes): 60


TIME OFF (minutes): 5

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

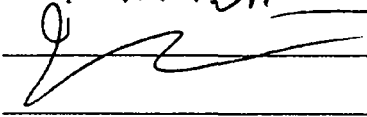
HS—11 REV. 06/98

**BROWN AND CALDWELL**

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

Name of Site Safety Coordinator <i>Meredith Smith</i>		Signature of Site Safety Coordinator 	
Project Name <i>Ironite csp</i>		Project Location <i>Humboldt, Ar</i>	Project Number <i>130508</i>
		Property # <i>#2 + #3</i>	

Who attended the briefing?

Names of Brown and Caldwell Employees	Names of Subcontractor(s) Employees (PSC)
<i>M. Smith</i>	<i>Dave Michael</i>
<i>M. Nation</i>	<i>PEURO GONZALEZ</i>
<i>M. Orcutt</i>	<i>GARY ADAMS</i>
	

What items were discussed?

<input checked="" type="checkbox"/> Field Work Safety Plan	<input checked="" type="checkbox"/> Hazardous Site Conditions/Activities
<input type="checkbox"/> Specific Accident/Incident	<input type="checkbox"/> Changes/Solutions to Specific Accident(s)
<input checked="" type="checkbox"/> Protective Equipment to be Used	<input type="checkbox"/> Location of Emergency Telephone Number
<input checked="" type="checkbox"/> Emergency Hospital Route	<input checked="" type="checkbox"/> Work Schedule
<input type="checkbox"/> 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 Site Activity and Safety Briefing

Name of Site Safety Coordinator <i>Mike Orcutt</i>		Signature of Site Safety Coordinator <i>[Signature]</i> 8/4/06	
Project Name <i>Ironite</i>	Project Location <i>prop #2,3 Humboldt, AZ</i>	Project Number <i>130508</i>	

Who attended the briefing?

Names of Brown and Caldwell Employees	Names of Subcontractor(s) Employees
<i>M. Orcutt</i>	<i>PEDRO GONZALES</i>
<i>Meredith Smith</i>	<i>GARY ADAMS</i>
	<i>D. Michaud</i>
	<i>[Signature]</i>

What items were discussed?

<input checked="" type="checkbox"/> Field Work Safety Plan	<input checked="" type="checkbox"/> Hazardous Site Conditions/Activities
<input type="checkbox"/> Specific Accident/Incident	<input type="checkbox"/> Changes/Solutions to Specific Accident(s)
<input checked="" type="checkbox"/> Protective Equipment to be Used	<input type="checkbox"/> Location of Emergency Telephone Number
<input checked="" type="checkbox"/> Emergency Hospital Route	<input checked="" type="checkbox"/> Work Schedule
<input type="checkbox"/> 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

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**BROWN AND CALDWELL**

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

Name of Site Safety Coordinator

*Matthew Natan*

Signature of Site Safety Coordinator

*Matthew Natan* 8/7/06

Project Name

*Ironite URP*

Project Location

*Property #4 Humboldt AZ*

Project Number

*130508*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Matthew Natan*  
\_\_\_\_\_  
*Meredith Smith*  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Names of Subcontractor(s) Employees

*Joshua A. Elter*  
\_\_\_\_\_  
*Roberto Sanchez*  
\_\_\_\_\_  
*G. Adams*  
\_\_\_\_\_  
*Julie*  
\_\_\_\_\_

What items were discussed?

- |   |  |
|---|--|
| <input type="checkbox"/> Field Work Safety Plan                     | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident                 | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)       |
| <input checked="" type="checkbox"/> Protective Equipment to be Used | <input type="checkbox"/> Location of Emergency Telephone Number          |
| <input type="checkbox"/> Emergency Hospital Route                   | <input checked="" type="checkbox"/> Work Schedule                        |
| <input type="checkbox"/> 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 <i>Frontier VRP</i>		Project Location (city and state) <i>Property # 4 Humboldt AZ</i>	Date <i>8/7/06</i>
Name of Site Safety Coordinator <i>Matthew Nation</i>		Weather Conditions <i>Sunny - Partly Cloudy</i>	Project Number <i>130508</i>
BC Staff Present	Name <i>Matthew Nation</i>	Office <i>Phoenix</i>	
	<i>Meredith Smith</i>	<i>" "</i>	

Indicate the status of each of the following:

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

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

*Mathew Natten*

Signature of Site Safety Coordinator

*Mathew Natten* 5/5/06

Project Name

*Freight VLP*

Project Location

*Property # 4 Humboldt AZ*

Project Number

*130808*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Mathew Natten*  
*Meredith Smith*  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Names of Subcontractor(s) Employees

*Richard Davies PSC*  
*Gary Adams*  
*Ben Spivey*  
*Joshua Vetter*  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

What items were discussed?

- |  |  |
|--|--|
| <input type="checkbox"/> Field Work Safety Plan                              | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident                          | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)       |
| <input checked="" type="checkbox"/> Protective Equipment to be Used          | <input type="checkbox"/> Location of Emergency Telephone Number          |
| <input type="checkbox"/> Emergency Hospital Route                            | <input checked="" type="checkbox"/> Work Schedule                        |
| <input checked="" type="checkbox"/> Other <i>Traffic control / Logistics</i> |  |

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 <i>Fronte VRP</i>	Project Location (city and state) <i>Property # 4 Humboldt AZ</i>	Date <i>8/8/08</i>
Name of Site Safety Coordinator <i>Matthew Nation</i>	Weather Conditions <i>Sunny</i>	Project Number <i>130508</i>
BC Staff Present	Name <i>Matthew Nation</i> <i>Meredith Smith</i>	Office <i>Phoenix</i> " "

Indicate the status of each of the following:

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

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 Nakken*

Signature of Site Safety Coordinator

*Matthew Nakken* 8/4/06

Project Name

*Tronita VRP*

Project Location

*Property # 4 Humboldt AZ*

Project Number

*130508*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Matthew Nakken*  
*Meredith Smith*

Names of Subcontractor(s) Employees

*MFLC*  
*G. Deane*  
*Joshua Seltzer*  
*Richard J. ...*

What items were discussed?

- |   |  |
|---|--|
| <input type="checkbox"/> Field Work Safety Plan   | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident   | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)       |
| <input checked="" type="checkbox"/> Protective Equipment to be Used                             | <input type="checkbox"/> Location of Emergency Telephone Number          |
| <input type="checkbox"/> Emergency Hospital Route   | <input checked="" type="checkbox"/> Work Schedule                        |
| <input checked="" type="checkbox"/> Other <u><i>Traffic control / Logistics for hauling</i></u> |  |

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 <i>Tranite URP</i>		Project Location (city and state) <i>Property # of Humboldt AZ</i>	Date <i>8/7/08</i>
Name of Site Safety Coordinator <i>Matthew Nader</i>		Weather Conditions <i>Cloudy</i>	Project Number <i>130508</i>
BC Staff Present	Name	Office	
	<i>Matthew Nader</i>	_____	
	<i>Moralith Smith</i>	_____	
	_____	_____	
	_____	_____	

Indicate the status of each of the following:

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

**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

*Matthew Napton*

Signature of Site Safety Coordinator

*Matthew Napton* 8/10/06 - 8/11/06 -

Project Name

*Tranite VRP*

Project Location

*Property # 4 Humboldt A2*

Project Number

*130508*

Who attended the briefing?

Names of Brown and Caldwell Employees

*Meredith Smith*  
\_\_\_\_\_  
*Meredith Smith*  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Names of Subcontractor(s) Employees

*Richard Davis PSC*  
\_\_\_\_\_  
*Richard Davis PSC*  
\_\_\_\_\_  
*Joshua Weller*  
\_\_\_\_\_  
\_\_\_\_\_

What items were discussed?

- |   |  |
|---|--|
| <input type="checkbox"/> Field Work Safety Plan   | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident   | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)       |
| <input checked="" type="checkbox"/> Protective Equipment to be Used                                     | <input type="checkbox"/> Location of Emergency Telephone Number          |
| <input type="checkbox"/> Emergency Hospital Route   | <input checked="" type="checkbox"/> Work Schedule                        |
| <input checked="" type="checkbox"/> Other <i>Traffic control, heavy equipment safety, cleanup tasks</i> |  |

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

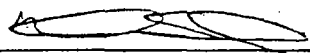
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**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 B—Site Safety and Health Plan Site Activity and Safety Briefing

Name of Site Safety Officer <i>Meredith Smith</i>	Signature of Site Safety Officer 	Date <i>5/15/07</i>
Project Name <i>Ironite Removal Action Plan</i>	Project Location <i>Humboldt, AZ</i>	Project Number <i>130508</i>

**Who attended the briefing?**

**Names of Brown and Caldwell Employees**

*Meredith Smith*  
*GARY ADAMS*  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Names of Subcontractor(s) Employees**

*Gary Adams*  
*Joel NAW*  
*Gary Moore*  
*Richard Jarvis PSC*  
\_\_\_\_\_  
\_\_\_\_\_

**What items were discussed?**

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> Site Safety and Health Plan     | <input checked="" type="checkbox"/> Hazardous Site Conditions/Activities   |
| <input type="checkbox"/> Specific Accident/Incident                 | <input type="checkbox"/> Changes/Solutions to Specific Accident(s)         |
| <input checked="" type="checkbox"/> Protective Equipment to be Used | <input checked="" type="checkbox"/> Location of Emergency Telephone Number |
| <input checked="" type="checkbox"/> Emergency Hospital Route        | <input checked="" type="checkbox"/> Work Schedule                          |
| <input type="checkbox"/> 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: Place a copy of the completed form in the project file.**

<b>BROWN AND CALDWELL</b>	<h2 style="margin: 0;">Attachment 2 - Field Work Safety Plan Implementation Checklist</h2>
---------------------------	--

Project Name <i>Ironite Removal Action Plan</i>	Project Location (city and state) <i>Humboldt, AZ.</i>	Date <i>5/15/07</i>
Name of Site Safety Coordinator <i>Meredith Smith</i>	Weather Conditions <i>Warm, breezy, clear</i>	Project Number <i>B0508</i>

BC Staff Present	Name	Office
	<u><i>Meredith Smith</i></u>	<u><i>Phoenix</i></u>
	<u><i>Pajman Eshraghi</i></u>	<u><i>Phoenix</i></u>
	_____	_____

Indicate the status of each of the following:

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

**TIME ON (minutes):** \_\_\_\_\_      **TIME OFF (minutes):** \_\_\_\_\_

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

*This page intentionally left blank*

# Table of Contents

Section	Page
<b>1</b>	<b>Introduction ..... 1-1</b>
<b>2</b>	<b>Site Description..... 2-1</b>
2.1	Site Location ..... 2-1
2.2	Iron King Mine..... 2-1
2.3	Humboldt Smelter ..... 2-1
2.4	Small Tailings Pile ..... 2-2
<b>3</b>	<b>Previous Investigations ..... 3-1</b>
3.1	Arizona Department of Environmental Quality, 2002 ..... 3-1
3.2	U.S. EPA/START 2005 ..... 3-1
3.3	EA Engineering, Science and Technology, Inc., 2008-2010 ..... 3-2
3.4	U.S. EPA Removal Assessment..... 3-2
<b>4</b>	<b>U.S. EPA and START Removal Assessment Activities ..... 4-1</b>
4.1	Determination of Properties Posing Highest Risk to Residents ..... 4-1
4.2	START Sampling Activities ..... 4-2
4.3	Discussion of Assessment Sampling Results ..... 4-4
4.3.1	OFS-002 ..... 4-4
4.3.2	OFS-101 and OFS-102..... 4-5
4.3.3	OFS-105 ..... 4-5
4.3.4	OFS-114 ..... 4-5
4.3.5	OFS-116 ..... 4-5
4.3.6	OFS-117 ..... 4-6
4.3.7	OFS-133 ..... 4-6
4.3.8	OFS-157 ..... 4-6
4.3.9	OFS-203 ..... 4-7
4.3.10	OFS-208 ..... 4-7
4.3.11	OFS-227 ..... 4-7
4.3.12	OFS-244 ..... 4-7
4.3.13	OFS-260 ..... 4-8
4.3.14	OFS-301 ..... 4-8
4.3.15	OFS-303 ..... 4-8
4.3.16	OFS-306 ..... 4-9
4.3.17	OFS-307 through OFS-311 ..... 4-9
4.3.18	Sweet Pea Lane ..... 4-9



4.4	Additional Properties added to TCRA List .....	4-10
4.4.1	OFS-103 .....	4-10
4.4.2	OFS-119 .....	4-10
4.4.3	OFS-148 .....	4-10
<b>5</b>	<b>Summary.....</b>	<b>5-1</b>
<b>6</b>	<b>References.....</b>	<b>6-1</b>
<b>A</b>	<b>Figures and Tables .....</b>	<b>A-1</b>
<b>B</b>	<b>In-Town Parcel Data Summary.....</b>	<b>B-1</b>
<b>C</b>	<b>Laboratory Data Sheets .....</b>	<b>C-1</b>
<b>D</b>	<b>Photo Documentation .....</b>	<b>D-1</b>

*This page intentionally left blank*

# List of Tables

<b>Table</b>		<b>Page</b>
Table 1	Arsenic and Lead Analytical Results for Samples Collected by the START .....	A-31
Table 2	OFS-002 Soil Sample Results.....	A-32
Table 3	OFS-105 Soil Sample Results.....	A-33
Table 4	OFS-114 Soil Sample Results.....	A-34
Table 5	OFS-116 Soil Sample Results.....	A-35
Table 6	OFS-117 Soil Sample Results.....	A-36
Table 7	OFS-133 Soil Sample Results.....	A-37
Table 8	CAM-17 Metals Results OFS-133.....	A-38
Table 9	OFS-157 Soil Sample Results.....	A-39
Table 10	OFS-203 Soil Sample Results.....	A-40
Table 11	OFS-208 Soil Sample Results.....	A-41
Table 12	OFS-227 Soil Sample Results.....	A-42
Table 13	OFS-244 Soil Sample Results.....	A-43
Table 14	OFS-260 Soil Sample Results.....	A-44
Table 15	TCLP Arsenic and Lead Results OFS-260 .....	A-45
Table 16	OFS-103 Sample Results .....	A-46
Table 17	OFS-119 Sample Results .....	A-2
Table 18	OFS-148 Sample Results .....	A-3
Table 19	Properties Subject to U.S. EPA Time-Critical Removal Action .....	A-4

*This page intentionally left blank*

# List of Figures



<b>Figure</b>		<b>Page</b>
Figure 1	Site Location Map.....	A-3
Figure 2	Site Map.....	A-4
Figure 3	Small Tailings Pile Sample Locations.....	A-5
Figure 4	In-Town Parcel Assessment.....	A-6
Figure 5	OFS-101 and OFS-102 Sample Locations.....	A-7
Figure 6	OFS-105 Sample Locations.....	A-8
Figure 7	OFS-114 Sample Locations.....	A-9
Figure 8	OFS-116 Sample Locations.....	A-10
Figure 9	OFS-117 Sample Locations.....	A-11
Figure 10	OFS-133 Sample Locations.....	A-12
Figure 11	OFS-157 Sample Locations.....	A-13
Figure 12	OFS-203 Sample Locations.....	A-14
Figure 13	OFS-208 Sample Locations.....	A-15
Figure 14	OFS-227 Sample Locations.....	A-16
Figure 15	OFS-244 Sample Locations.....	A-17
Figure 16	OFS-260 Sample Locations.....	A-18
Figure 17	OFS-301 Sample Locations.....	A-19
Figure 18	OFS-303 Sample Locations.....	A-20
Figure 19	OFS-306 Sample Locations.....	A-21
Figure 20	OFS-307 Sample Locations.....	A-22

Figure 21 OFS-308 Sample Locations ..... A-23

Figure 22 OFS-309 Sample Locations ..... A-24

Figure 23 OFS-310 Sample Locations ..... A-25


Figure 24 OFS-311 Sample Locations ..... A-26

Figure 25 Sweet Pea Lane Sample Locations ..... A-27

Figure 26 OFS-103 Sample Locations ..... A-28

Figure 27 OFS-119 Sample Locations ..... A-29

Figure 28 OFS-148 Sample Locations ..... A-30

# 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

*This page intentionally left blank*



# 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.



*This page intentionally left blank*

# 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<sup>1</sup>. 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.

---

<sup>1</sup> 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.

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

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.



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

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

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

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 FOOSC 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.

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

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.

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

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

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

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

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

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, FOOSC 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 FOOSC 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

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

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.





---

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

*This page intentionally left blank*

# 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.



*This page intentionally left blank*

# 6

## References

1. EA Engineering, Science and Technology, Inc. (EA), 2011. *Remedial Investigation Report Addendum, Iron King Mine – Humboldt Smelter Superfund Site, Dewey-Humboldt, Yavapai County, Arizona*. February.
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.



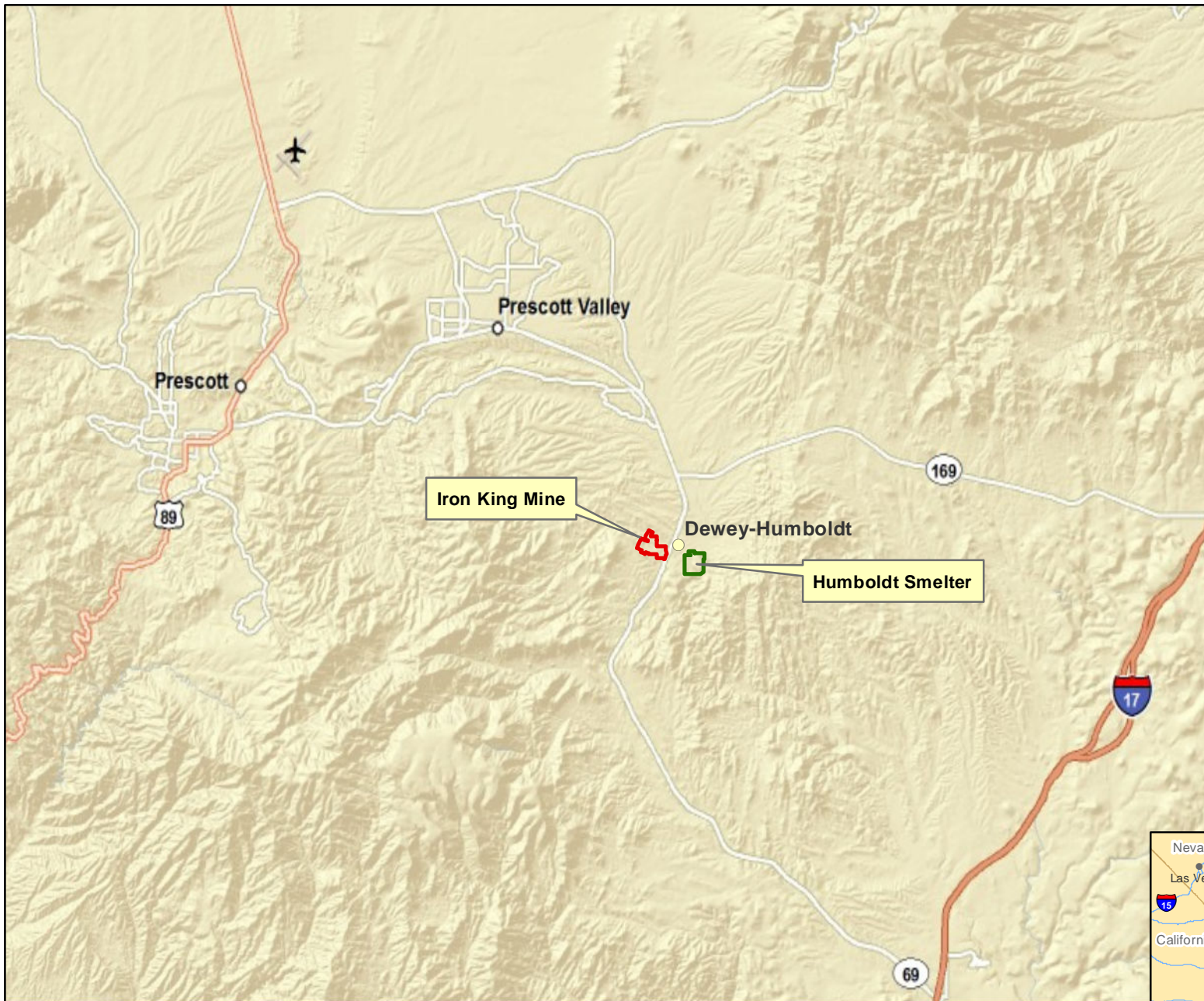
*This page intentionally left blank*

# A

## Figures and Tables

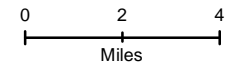


*This page intentionally left blank*



**Legend**

- Iron King Mine
- Humboldt Smelter



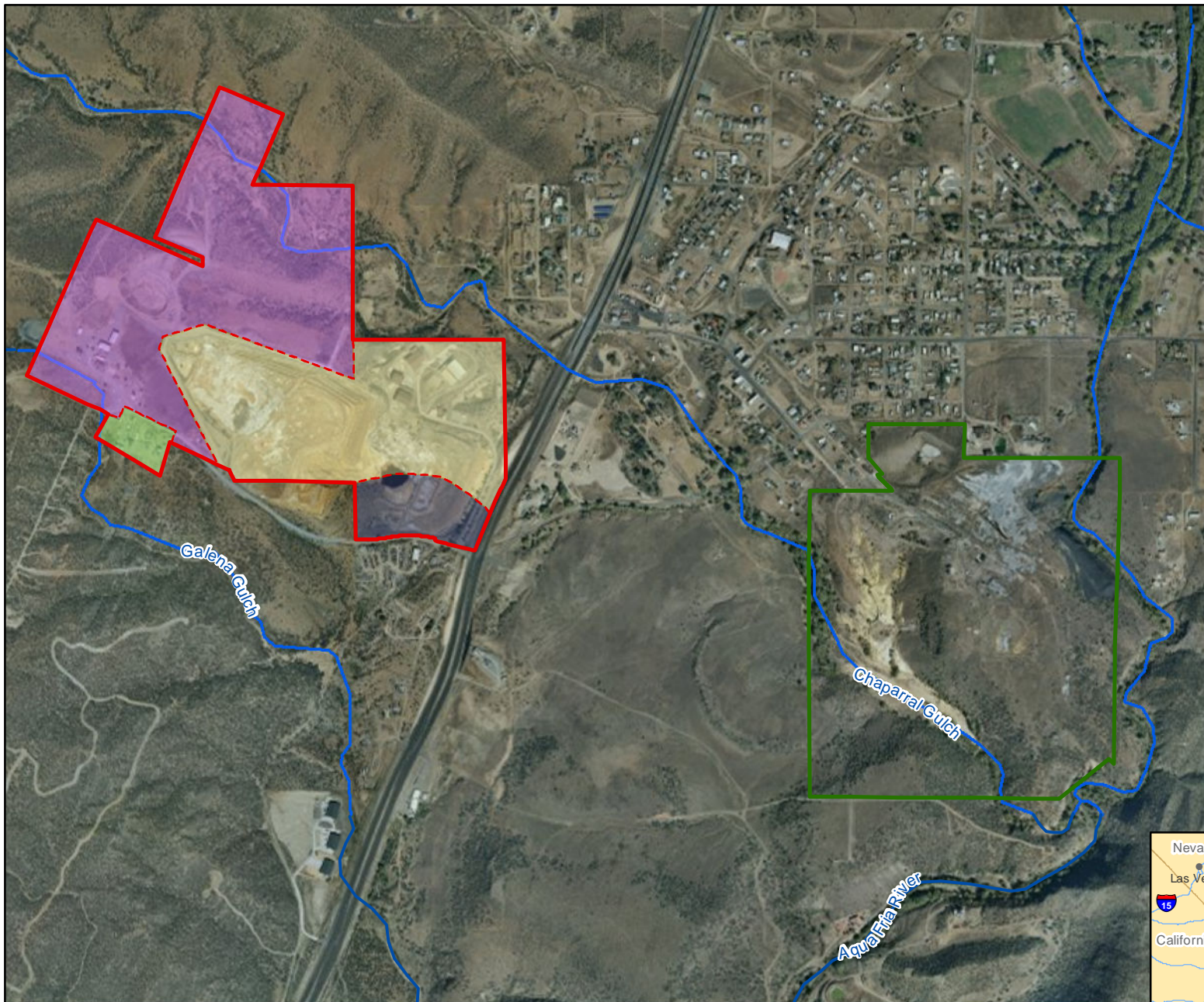
Source:  
Background: ESRI World Street Map



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

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





**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



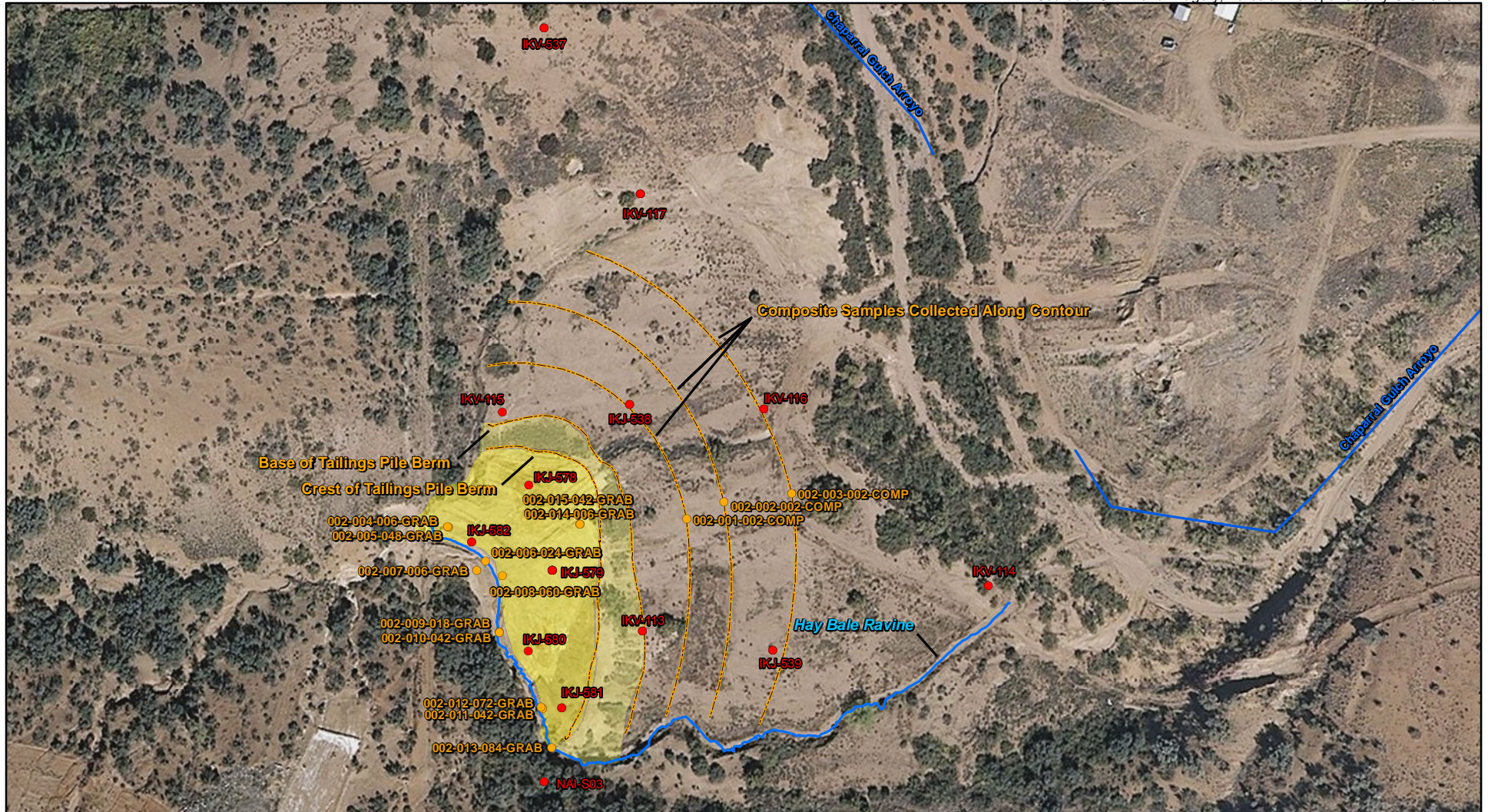
0 500 1,000  
 Feet

Source:  
 Aerial Photo: ESRI World Imagery  
 EA Remedial Investigation Report,  
 Revision 01, March 2010



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

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



**LEGEND**

- E&E Sample Location
- EA Sample Location

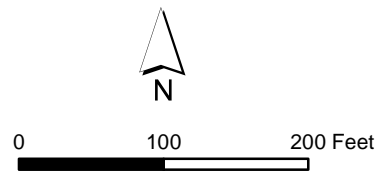
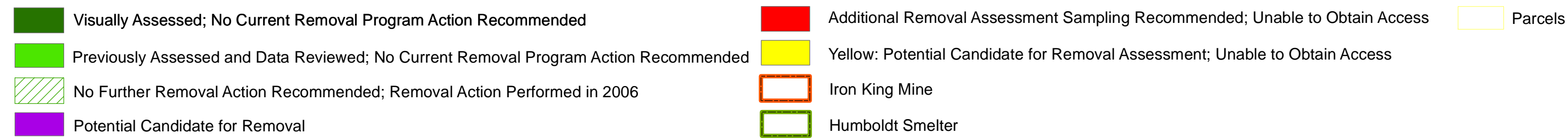
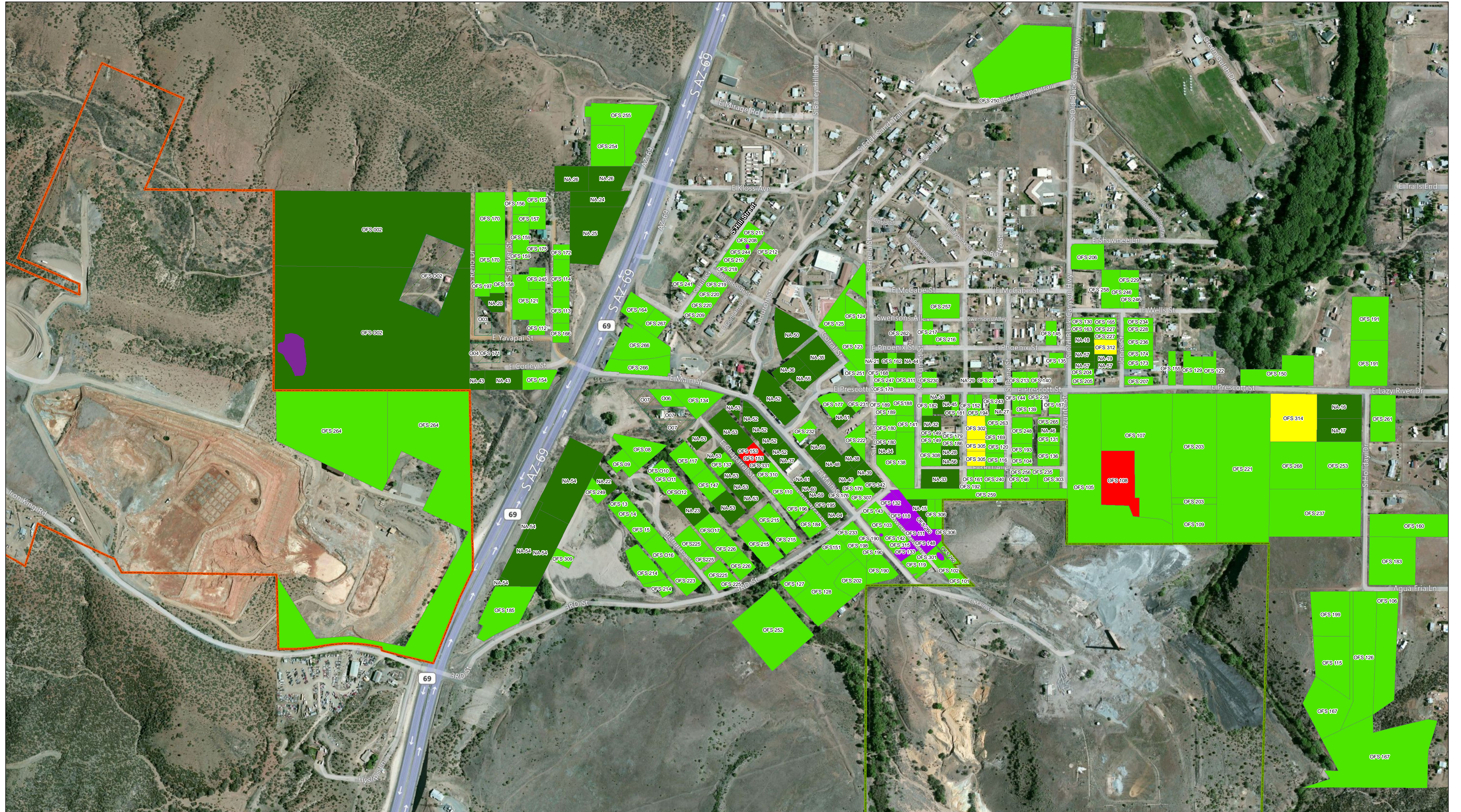
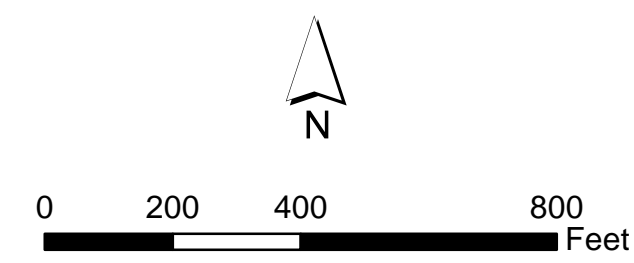


Figure 3  
Small Tailings Pile Sample Locations  
Iron King Mine - Humboldt Smelter Assessment  
Dewey-Humboldt, Yavapai County, AZ



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)







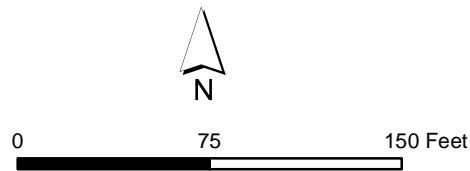
**Figure 4**  
**In-Town Parcel Assessment**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**



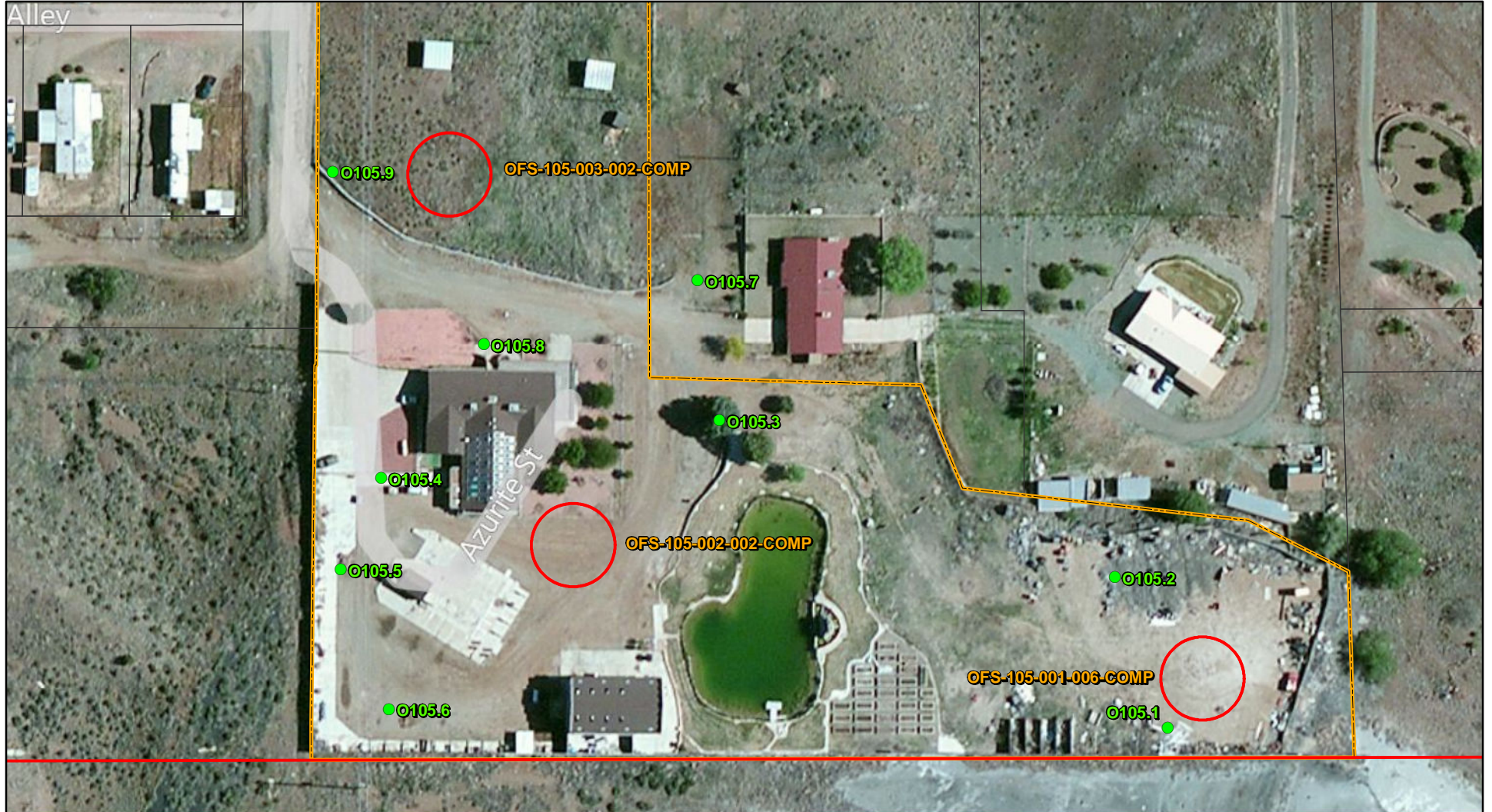





**LEGEND**

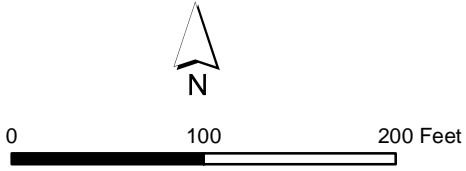
-  START Soil Sample Location
-  EA Soil Sample Location
-  Humboldt Smelter Boundary
-  Parcel boundary



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






- LEGEND**
-  START Composite Soil Sample Location
  -  EA Soil Sample Location
  -  Parcel Boundary

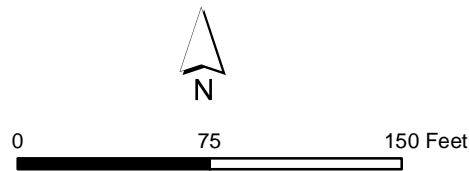


**Figure 6**  
**OFS-105**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**



**LEGEND**




-  START Composite Soil Sample Location
-  EA Soil Sample Location
-  Parcel Boundary

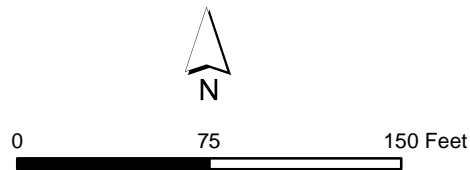


**Figure 7**  
**OFS-114**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**






**LEGEND**

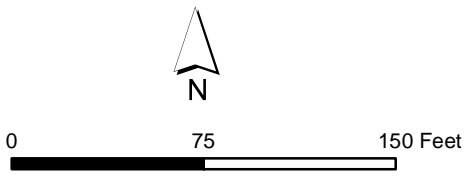
-  START Composite Soil Sample Location
-  EA Soil Sample Location
-  Parcel Boundary



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

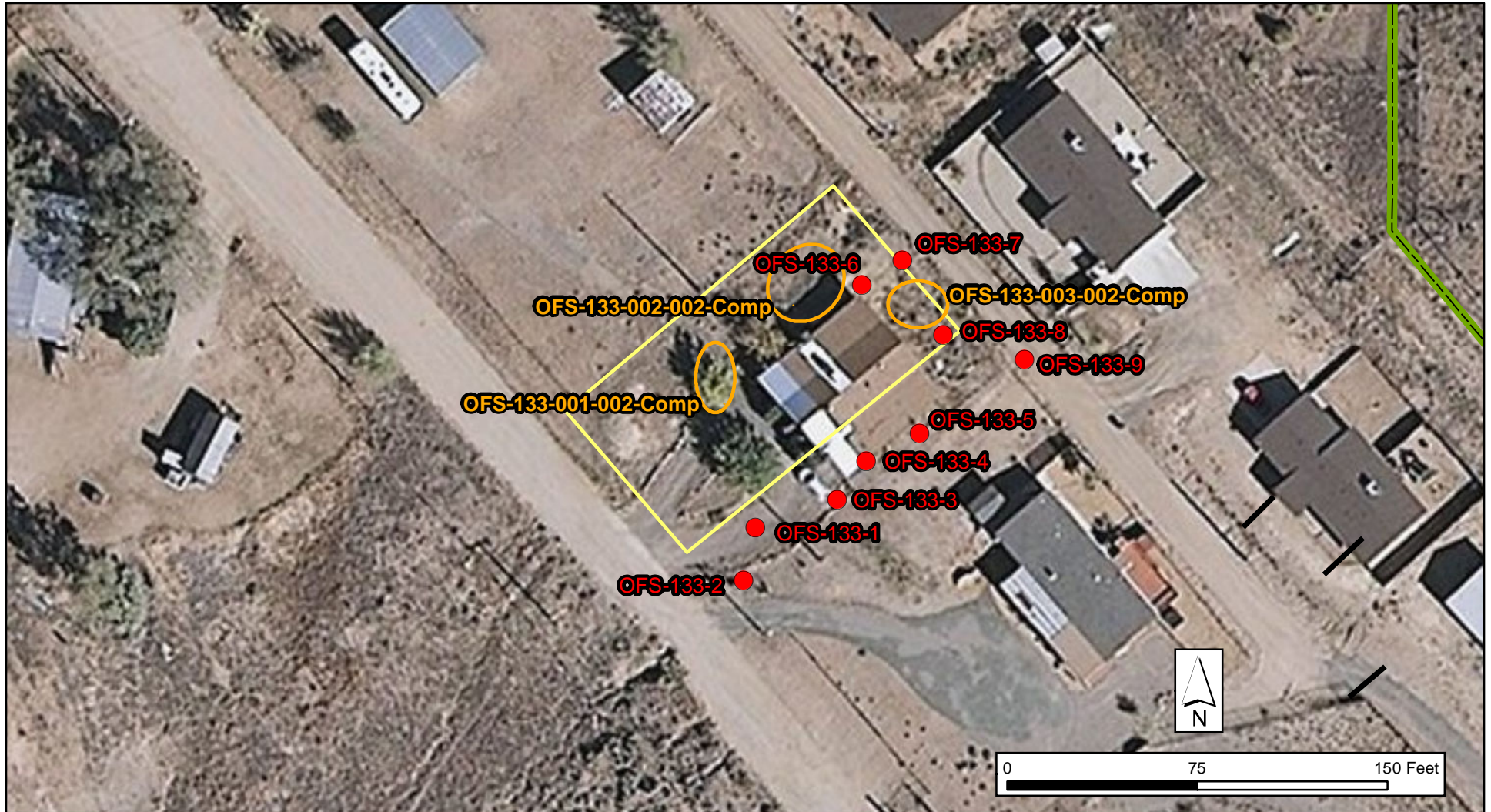


- LEGEND**
-  START Composite Sample Location
  -  EA Soil Sample Location
  -  Parcel Boundary







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

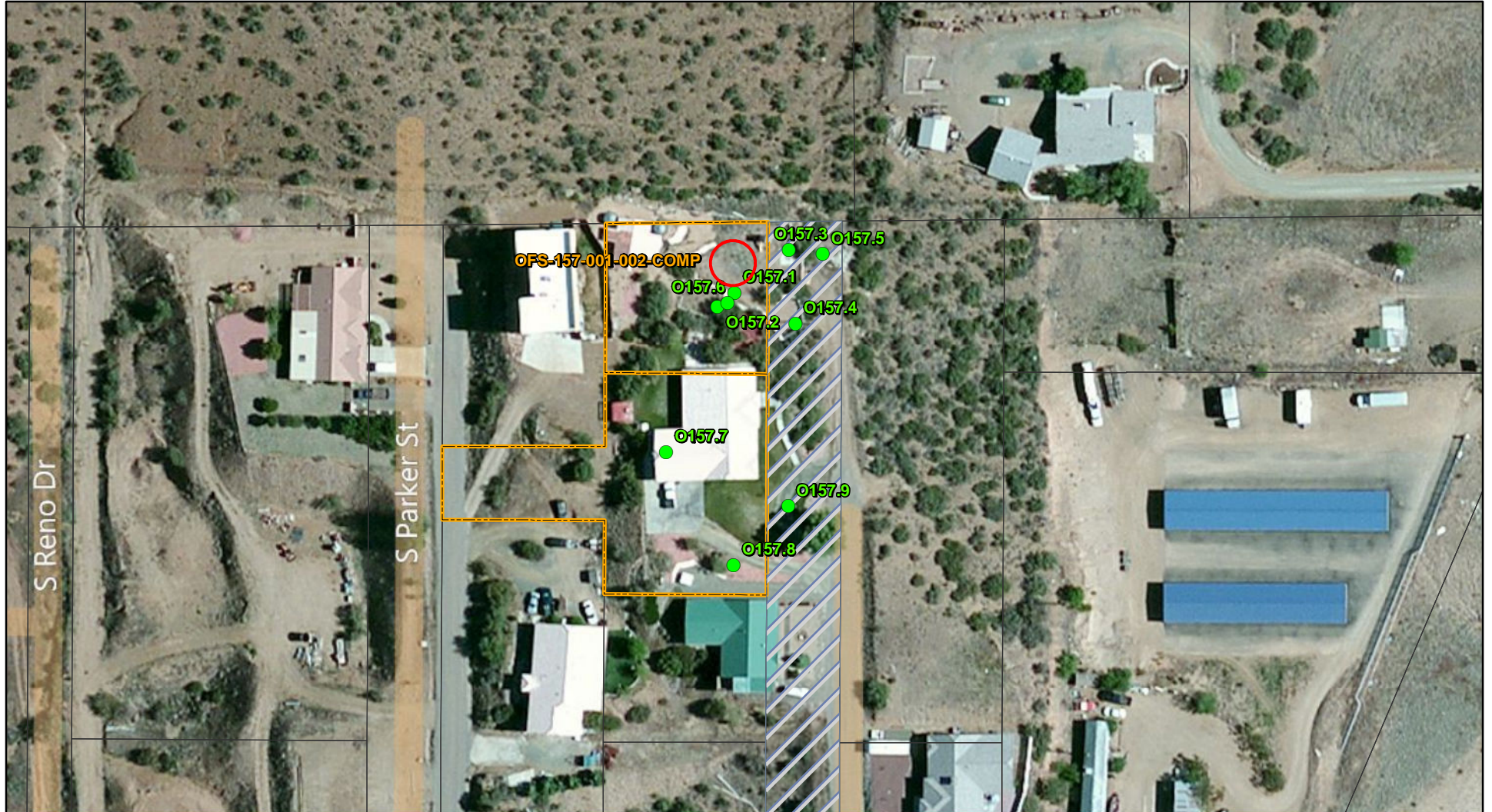




**LEGEND**

-  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**



**LEGEND**

-  START Composite Soil Sample Location
-  EA Soil Sample Location
-  Parcel Boundary
-  Parcel Ownership Other Than Subject Parcel
- 



0 100 200 Feet

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



**LEGEND**



START Composite Soil Sample Location



EA Soil Sample Location



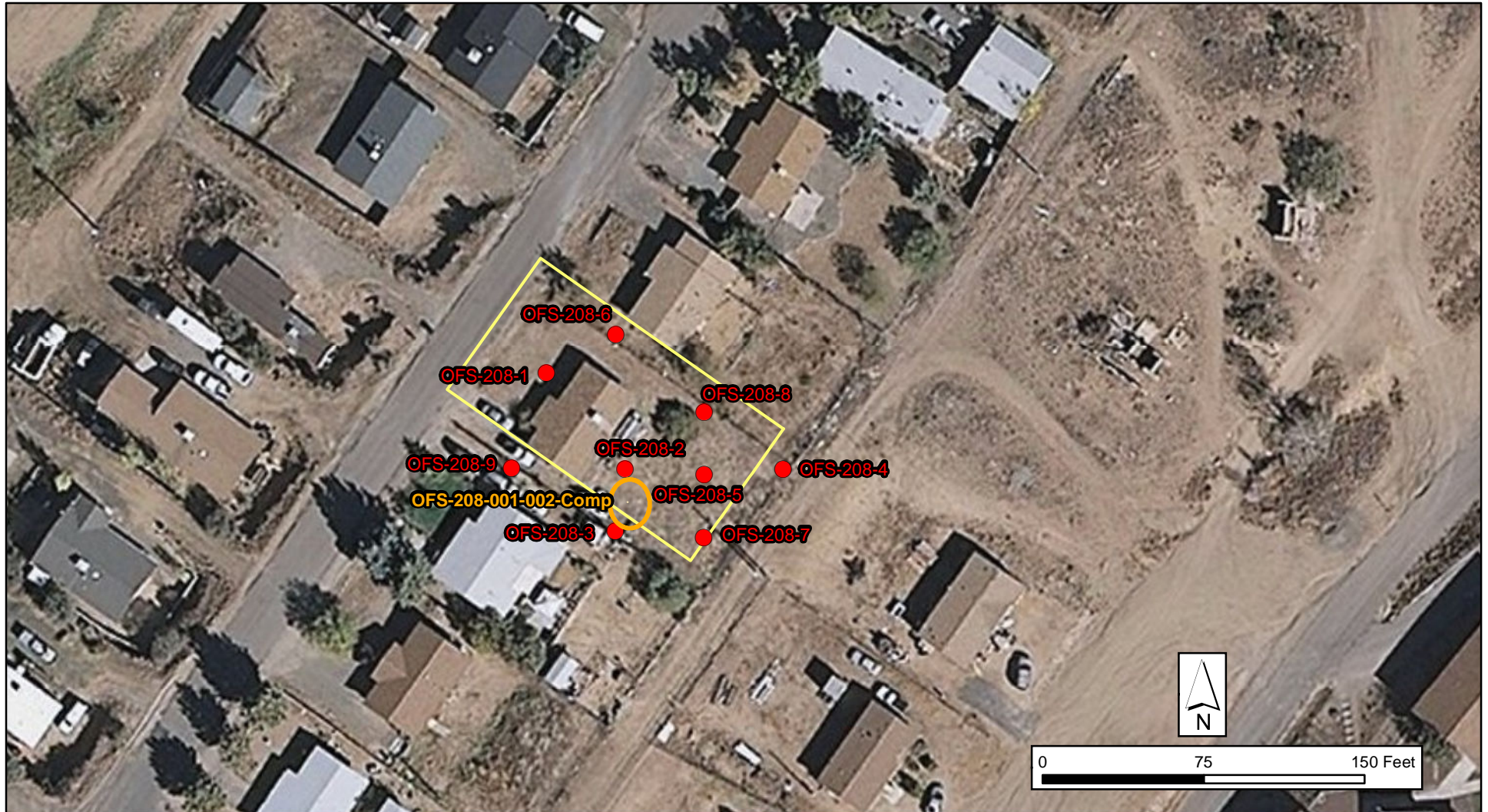
Parcel Boundary






0 200 400 Feet



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






**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**



**LEGEND**

-  START Composite Soil Sample Location
-  EA Soil Sample Location
-  Parcel Boundary






0 50 100 Feet

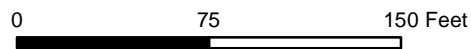


**Figure 14**  
**OFS-227**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**



**LEGEND**





-  START Composite Soil Sample Location
-  EA Soil Sample Location
-  Parcel Boundary

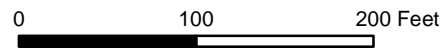


**Figure 15**  
**OFS-244**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**



**LEGEND**




-  START Soil Sample Location
-  EA Soil Sample Location
-  Parcel Boundary
-  Humboldt Smelter



**Figure 16**  
**OFS-260**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**



**LEGEND**

-  START Composite Sample Location
-  Parcel Boundary
-  Humboldt Smelter

**Figure 17**  
**OFS-301 Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**








**LEGEND**

- START Soil Sample Location
- ▭ Parcel Boundary
- ▭ Humboldt Smelter

**Figure 18**  
**OFS-303**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**



**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**



**LEGEND**

- START Soil Sample Location
- ▭ Parcel Boundary

**Figure 20**  
**OFS-307**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**



**LEGEND**

- START Soil Sample Location
- ▭ Parcel Boundary
- ▭ H

**Figure 21**  
**OFS-308**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**



**LEGEND**

- START Soil Sample Location
- ▭ Parcel Boundary

**Figure 22**  
**OFS-309**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**



**LEGEND**

- START Soil Sample Location
- ▭ Parcel Boundary

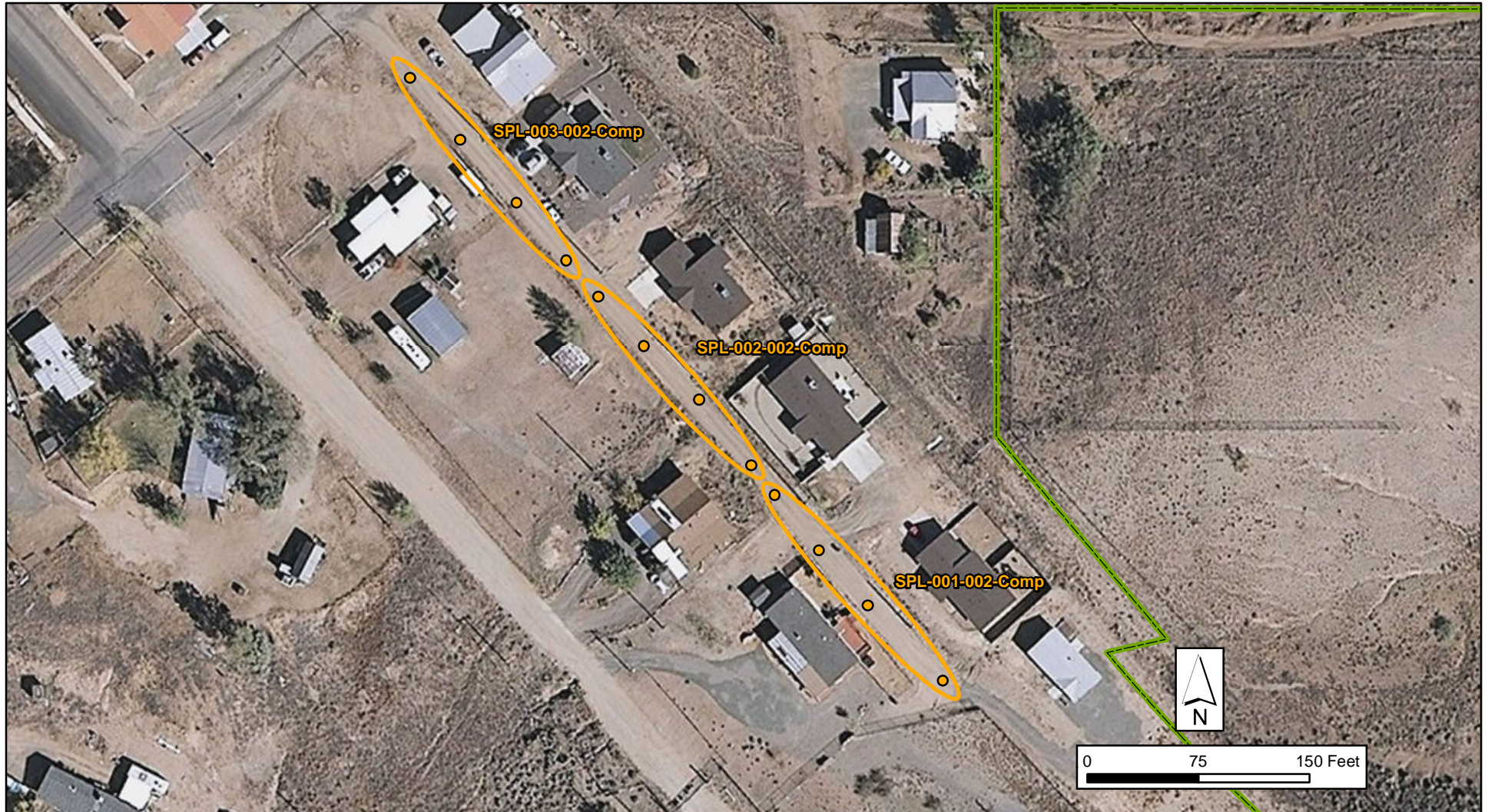
**Figure 23**  
**OFS-310**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**





**LEGEND**

- START Soil Sample Location
- ▭ Parcel Boundary

**Figure 24**  
**OFS-311**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**

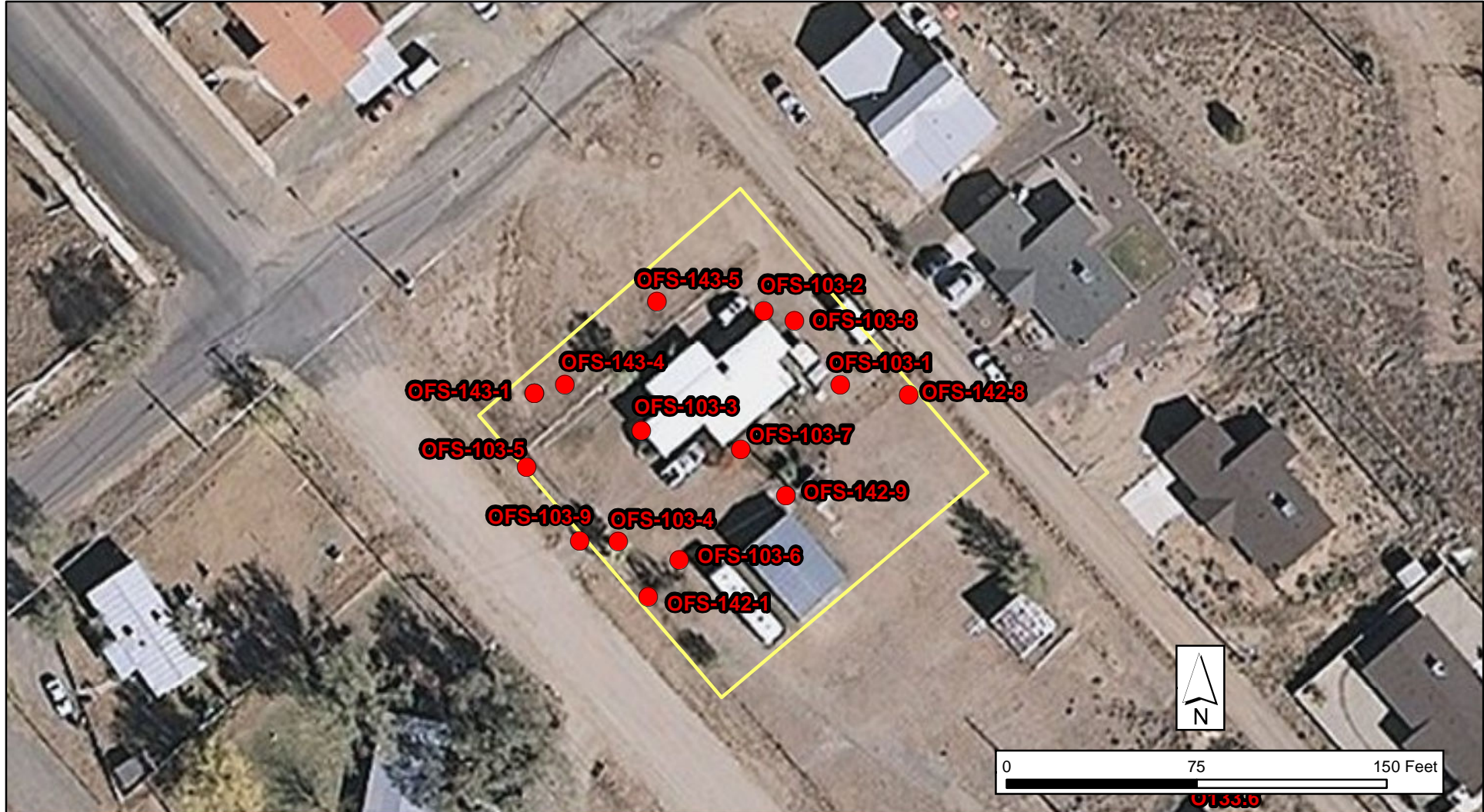


**LEGEND**

-  START Composite Sample Location
-  Humboldt Smelter

**Figure 25**  
**Sweet Pea Lane**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**





**LEGEND**

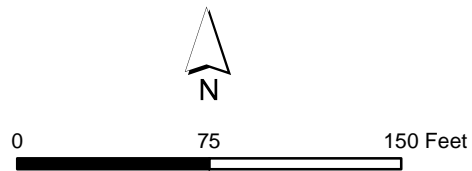
- EA Sample Location
- Parcel Boundary
- H

**Figure 26**  
**OFS-103**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**

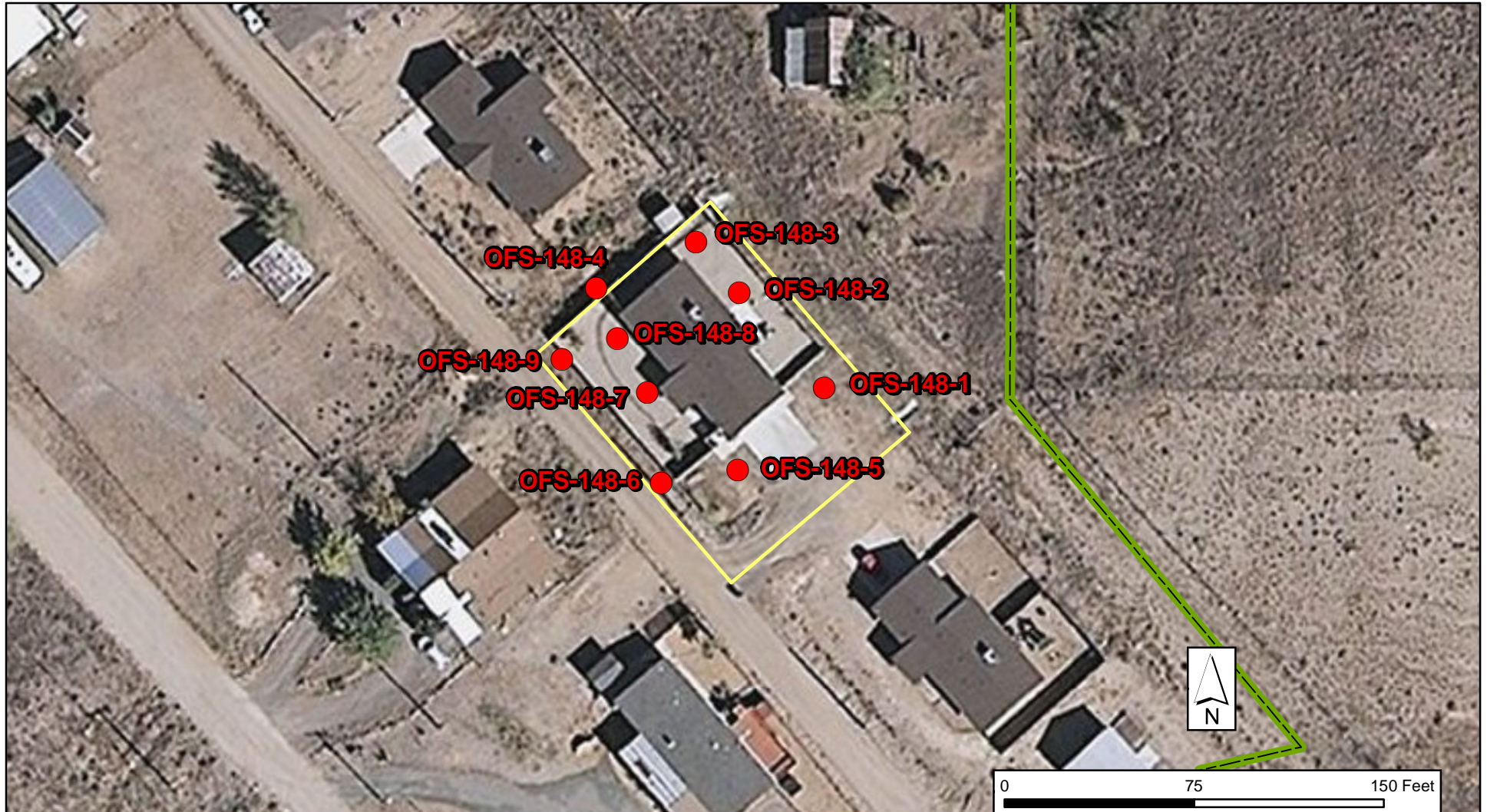


**LEGEND**

- EA Soil Sample Location
- ▭ Parcel Boundary



**Figure 27**  
**OFS-119**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, Arizona**



**LEGEND**

- EA Sample Location
- Parcel Boundary
- Humboldt Smelter

**Figure 28**  
**OFS-148**  
**Sample Locations**  
**Iron King Mine - Humboldt Smelter Assessment**  
**Yavapai County, AZ**

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.

2011 ecology and environment, inc.

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

2011 ecology and environment, inc.

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.

2011 ecology and environment, 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.

2011 ecology and environment, 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.

2011 ecology and environment, 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.

2011 ecology and environment, 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

2011 ecology and environment, inc.

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

2011 ecology and environment, inc.

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.

2011 ecology and environment, 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

2011 ecology and environment, inc.

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

2011 ecology and environment, inc.

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.

2011 ecology and environment, 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.

2011 ecology and environment, 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 through 9): EA Engineering, Science, and Technology, Inc.  
mg/kg: milligrams per kilogram

2011 ecology and environment, inc.

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

<b>Analyte</b>	<b>TCLP*</b>	<b>OFS-260-002-Comp</b>
Arsenic	5	0.0738
Lead	5	0.233

Notes:

2011 ecology and environment, inc.

\*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)

2011 ecology and environment, inc.

\* - 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

2011 ecology and environment, inc.

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.

2011 ecology and environment, 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

	Site ID	Parcel No.	Physical Address	Mailing Address	Acres	Arsenic		Lead	
						Average Concentration (mg/kg)	95% UCL <sup>1</sup>	Average Concentration (mg/kg)	95% UCL <sup>1</sup>
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
	OFS 118	402-06-102K	2905 South Sweet Pea Lane	PO Box 508 Humboldt, AZ 86329	0.27	147.2	198.4	1148	1610
	OFS 132	402-06-102P	2875 South Third Street	PO Box 122 Humboldt, AZ 86329	0.25	102.5	130.7	949.7	1792
	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
	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
Hot-Spot Removal	OFS 133 <sup>2</sup> 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
	OFS-103	402-07-007C	13080 East Main Street	PO Box 552 Humboldt, AZ 86329	0.48 <sup>4</sup>				
	OFS-208 <sup>2</sup> OFS-244 (one hot spot between two parcels)	402-07-002B	13030 East Main Street	PO Box 488 Humboldt, AZ 86329	0.46 <sup>4</sup>	45.77 <sup>5</sup>	92.86 <sup>5,6</sup>	134.5 <sup>5</sup>	605.3 <sup>5,6</sup>
		402-09-016D	2565 Hill Street	PO Box 32 Humboldt, AZ 86329	0.21 <sup>4</sup>	134.9	481 <sup>7</sup>	108.7	355.8 <sup>7</sup>
		402-09-016H	2575 Hill Street	PO Box 548 Humboldt, AZ 86329	0.21 <sup>4</sup>				
		402-08-034A	12470 East Yavapai Road	PO Box 721 Dewey, AZ 86327	0.6 <sup>3</sup>	556.4	727.2	706.2	986.8
		402-06-102N	2965 Sweet Pea Lane	PO Box 905 Humboldt, AZ 86329	0.28 <sup>4</sup>	52.02	128.5 <sup>7</sup>	241	552 <sup>6</sup>
	402-06-026 402-06-027B	13087 E. Main Street 13089 E. Main Street	PO Box 699 Humboldt, AZ 86329	0.19 <sup>4</sup> 0.32 <sup>4</sup>	70.8	111.3 <sup>6</sup>	187	259.7	

<sup>1</sup> - Calculated as student's t-test for normal distribution unless otherwise noted.

<sup>2</sup> - 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.

<sup>3</sup> - The Small Tailings Pile has an area of approximately 0.6 acres and is situated on a parcel of approximately 40 acres.

<sup>4</sup> - These properties will be subjected to hot spot removals only.

<sup>5</sup> - Calculated based on samples listed in Table 15.

<sup>6</sup> - Gamma UCL

<sup>7</sup> - Non-parametric Chebyshev UCL

# B

## In-Town Parcel Data Summary



*This page intentionally left blank*



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 Corey 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 Street	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

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)		
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 Cahumet 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 Cahumet	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	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	2696 E. Hecla 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	2707 E. Hecla Street	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	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	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-N	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	13059 E. Prescott	20.59	32.8		24.41	95% UCLM-N	24.41	49.77	101		64.61	95% UCLM-N	64.61
OFS190	13063 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

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)
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	12707 E. Richards Ln.	36.5	51.6	42.99	95% UCLM-N	42.99	136	274	189	95% UCLM-N	189
OFS215	2918 S. Hill 2010 S. Hill	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	2691 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	12772 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	207	618	336.4	95% UCLM-G	336.4	312.5	904	462.8	95% UCLM-N	462.8
OFS227	12700 Butte St. 2630 E. 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	13290 E WELLS ST. 13218 E. W. Jones 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

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)	
OFS249	2885 S. Omega	12.54	15.4	J	13.63	95%UCLM-N	13.63					
OFS250	2280 Edd's Sand Trail	21.03	35		24.7	95%UCLM-N	24.7					
OFS251	2735 S Corral St	33.06	170		100.1	95%UCLM-C	100.1					
OFS252	3047 S. Third St.	37.45	48.9		43.39	95%UCLM-N	43.39					
OFS253	2846 S. Holiday Dr.	58.01	77.8		65.25	95%UCLM-N	65.25					
OFS254	2480 S. S.R. 69	53.13	119		71.06	95%UCLM-G	71.06					
OFS255	2430 S. S.R. 69	30.4	51.8		37.96	95%UCLM-N	37.96					
OFS256	13220 E THIRD ST .	29.45	36.2		31.66	95%UCLM-N	31.66					
OFS257	2650 Butte St.	23.68	28.9		26.87	95%UCLM-N	26.87					
OFS258	13300 E WELLS ST .	39.47	89.9		52.69	95%UCLM-G	52.69					
OFS259	1111 W. Avey and Sweet Pea Avey	30.44	52.4		35.75	95%UCLM-G	35.75					
OFS260	1111 W. Avey and Sweet Pea Avey (Northwest to Southwest)	157.6	348		205.9	95%UCLM-N	205.9					
OFS261	13625 E. Lazy River Dr.	53.82	70.8		58.24	95%UCLM-N	58.24					
OFS262	13040 E. Phoenix St.	27	44.7		33.29	95%UCLM-N	33.29					
OFS263	2792 Dana Street	20.86	30.7		23.33	95%UCLM-N	23.33					
OFS264	East of NAI Trailer	307.7	741		417.9	95%UCLM-N	417.9					
OFS265	2790 S. Azurite	34.25	66.4		43.32	95%UCLM-G	43.32					
OFS266	Town Hall - Joel Berman	13.32	14.9		14.02	95%UCLM-N	14.02					
OFS267	2689 Hill Street	65.78	128		86.31	95%UCLM-N	86.31					
OFS268	Lazy River Drive	67.49	124		90.58	95%UCLM-G	90.58					

**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



*This page intentionally left blank*

# D

## Photo Documentation



*This page intentionally left blank*



**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.

**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 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)

**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**  
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

*This page intentionally left blank*

# Table of Contents

Section	Page
<b>1</b>	<b>Introduction ..... 1-1</b>
<b>2</b>	<b>Site Description..... 2-1</b>
2.1	Site Location ..... 2-1
2.2	Iron King Mine..... 2-1
2.3	Humboldt Smelter ..... 2-1
2.4	Small Tailings Pile ..... 2-2
<b>3</b>	<b>Previous Investigations ..... 3-1</b>
3.1	Arizona Department of Environmental Quality, 2002 ..... 3-1
3.2	U.S. EPA/START 2005 ..... 3-1
3.3	EA Engineering, Science and Technology, Inc., 2008-2010 ..... 3-2
3.4	U.S. EPA Removal Assessment..... 3-2
<b>4</b>	<b>U.S. EPA and START Removal Activities ..... 4-1</b>
4.1	General Information Regarding Removal Activities..... 4-2
4.1.1	Property Assessment Form and Access Agreements ..... 4-2
4.1.2	Sampling Design ..... 4-3
4.1.3	Sample Analysis and Data Validation..... 4-4
4.1.4	Air Monitoring and Sampling ..... 4-4
4.1.5	Transport and Hydroseeding of Removed Soil ..... 4-5
4.1.5.1	Residential Area Soil ..... 4-5
4.1.5.2	STP Tailings Material ..... 4-5
4.1.6	Determination of Borrow Sources and Borrow Source Sampling ..... 4-6
4.1.7	Photographic Documentation..... 4-6
4.1.8	Information Packets..... 4-6
4.2	Removal of Contaminated Soil at Residential Properties and Municipal Property ..... 4-7
4.2.1	OFS-103 ..... 4-7
4.2.2	OFS-111 ..... 4-7
4.2.3	OFS-118 ..... 4-8
4.2.4	OFS-132 ..... 4-8
4.2.5	OFS-133 and OFS-119..... 4-8
4.2.6	OFS-148 ..... 4-8
4.2.7	OFS-208 and OFS-244..... 4-9
4.2.8	OFS-260 ..... 4-9

## Table of Contents (cont.)

Section	Page
4.2.9 OFS-301 .....	4-10
4.2.10 OFS-306 .....	4-10
4.3 Small Tailings Pile Removal.....	4-10
4.3.1 STP Removal Process .....	4-11
4.3.2 STP Confirmation Sampling .....	4-11
4.3.3 Additional STP Characterization Sampling .....	4-11
4.3.4 STP Gray Sludge Material .....	4-11
4.3.5 Hydrogeologic Restoration of STP Area .....	4-12
4.4 Application of Fixative to Humboldt Smelter Ash Piles.....	4-12
<b>5 Summary.....</b>	<b>5-1</b>
<b>6 References.....</b>	<b>6-1</b>
<b>A Figures and Tables .....</b>	<b>A-1</b>
<b>B Sampling and Analysis Plan.....</b>	<b>B-1</b>
<b>C Laboratory Data Sheets .....</b>	<b>C-1</b>
<b>D START Borrow Material Memorandum .....</b>	<b>D-1</b>
<b>E Photo Documentation .....</b>	<b>E-1</b>
<b>F ERT Site Restoration and Design Implementation Report ....</b>	<b>F-1</b>

# List of Tables



<b>Table</b>		<b>Page</b>
Table 1	Properties Subject to U.S. EPA Time-Critical Removal Action .....	A-21
Table 2	Air Monitoring and Sampling Results .....	A-22
Table 3	Borrow Area Sample Results.....	A-23
Table 4	Analytical Results for Confirmation Samples .....	A-24
Table 5	STP Gray Sludge Material CAM-17 Metals and Total Cyanide Results .....	A-25



*This page intentionally left blank*

# List of Figures

<b>Figure</b>	<b>Page</b>
Figure 1 Site Location Map.....	A-3
Figure 2 Site Map.....	A-4
Figure 3 Former Small Tailings Pile.....	A-5
Figure 4 In-Town Parcel Assessment and Removal .....	A-6
Figure 5 Footprint of Removed Soil Placed on Iron King Mine Main Tailings Pile .....	A-7
Figure 6 OFS-103 Removal Area.....	A-8
Figure 7 OFS-111 Removal Areas .....	A-9
Figure 8 OFS-118 Removal Areas .....	A-10
Figure 9 OFS-132 Removal Areas .....	A-11
Figure 10 OFS-133 and OFS-119 Removal Areas.....	A-12
Figure 11 OFS-148 Removal Areas .....	A-13
Figure 12 OFS-208 and 244 Removal Area.....	A-14
Figure 13 OFS-260 Removal Areas .....	A-15
Figure 14 OFS-301 Removal Areas .....	A-16
Figure 15 OFS-306 Removal Areas .....	A-17
Figure 16 New Diversion Channel and Location of Temporary Road .....	A-18
Figure 17 STP Excavation Progress and Excavation Floor Confirmation Sampling Locations.....	A-19
Figure 18 Application of Fixative to Humboldt Smelter Ash.....	A-20

*This page intentionally left blank*

# 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 <sup>3</sup>	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.



*This page intentionally left blank*

# 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<sup>1</sup>. 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.

---

<sup>1</sup> 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<sup>®</sup> 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, FOOSC 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 ( $\text{mg}/\text{m}^3$ ), 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  $2.5 \text{ mg}/\text{m}^3$ . 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<sup>3</sup>. The current Occupational Safety and Health Administration permissible exposure limit is 0.05 mg/m<sup>3</sup> (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<sup>®</sup>, 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 FOOSC 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 FOOSC Benson and was extended well beyond the original area of the hot spot. FOOSC 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<sup>®</sup>.

### **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<sup>®</sup>. 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.



*This page intentionally left blank*



# 6

## References

1. EA Engineering, Science and Technology, Inc. (EA), 2010. *Remedial Investigation Report Addendum, Iron King Mine – Humboldt Smelter Superfund Site, Dewey-Humboldt, Yavapai County, Arizona*. March.
2. EA, 2011. *Remedial Investigation Report Addendum, Iron King Mine – Humboldt Smelter Superfund Site, Dewey-Humboldt, Yavapai County, Arizona*. February.
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, 2003. *Superfund Lead-Contaminated Residential Sites Handbook (OSWER Directive 9285.7-90)*, August.
7. EPA, 2004. “*USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review*, USEPA-540-R-04-004. October.



*This page intentionally left blank*

# 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:**


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


**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:   
Michael Schwennesen, START Project Manager  
Ecology and Environment, Inc.

Approved by:  9/1/2011  
Howard Edwards, START Quality Assurance Coordinator  
Ecology and Environment, Inc.

Approved by:   
Craig Benson,  
Federal On-Scene Coordinator  
U.S. Environmental Protection Agency, Region IX

Approved by: \_\_\_\_\_  
Eugenia McNaughton, Ph.D., Quality Assurance Officer  
U.S. Environmental Protection Agency, Region IX

# Table of Contents

Section	Page
<b>1</b>	<b>Introduction ..... 1-1</b>
1.1	Project Organization..... 1-2
1.2	Distribution List ..... 1-2
1.3	Statement of the Specific Problem ..... 1-2
<b>2</b>	<b>Site Background.....2-1</b>
2.1	Site Location and Description ..... 2-1
2.2	Previous Investigation and Activities..... 2-2
2.2.1	ADEQ 2-2
2.2.2	U.S. EPA / START 2005 ..... 2-2
2.2.3	U.S. EPA / EA Engineering, Science and Technology, Inc..... 2-2
2.2.4	U.S. EPA / START 2010-2011 ..... 2-3
<b>3</b>	<b>Project Objectives .....3-1</b>
3.1	Data Use Objectives ..... 3-1
3.2	Project Sampling Objectives ..... 3-1
3.3	Action Levels ..... 3-2
3.4	Data Quality Objectives ..... 3-5
3.5	Data Quality Indicators (DQIs) ..... 3-5
3.6	Schedule of Sampling Activities ..... 3-5
3.7	Special Training Requirements/Certifications ..... 3-5
<b>4</b>	<b>Sampling Rationale and Design.....4-1</b>
4.1	Analytes of Concern..... 4-1
4.2	Borrow Material Sampling..... 4-1
4.3	Residential Properties Sampling ..... 4-1
4.4	Small Tailings Pile Sampling ..... 4-2
4.5	Ambient Air Sampling ..... 4-2
<b>5</b>	<b>Request for Analyses.....5-1</b>
5.1	Laboratory Analysis ..... 5-1
<b>6</b>	<b>Field Methods and Procedures .....6-1</b>
6.1	Field Procedures ..... 6-1
6.1.1	Standard Operating Procedures and Equipment..... 6-1
6.1.2	Equipment Maintenance..... 6-1

## Table of Contents (cont.)

Section	Page
6.1.3	Inspection/Acceptance Requirements for Supplies and Consumables ..... 6-1
6.1.4	Logbooks ..... 6-1
6.1.5	Photographs ..... 6-2
6.1.6	Electronic Sample Logging ..... 6-3
6.1.7	Mapping Equipment ..... 6-3
6.2	Soil Sampling Procedures ..... 6-3
6.2.1	Discrete Sampling ..... 6-3
6.2.2	Composite Sampling ..... 6-3
6.2.2.1	Borrow Material Sampling ..... 6-3
6.2.2.2	Pre-Excavation Soil Sampling ..... 6-4
6.2.2.3	Post-Excavation Soil Sampling ..... 6-4
6.3	Air Sampling Procedures ..... 6-4
<b>7</b>	<b>Disposal of Investigation-Derived Waste ..... 7-1</b>
<b>8</b>	<b>Sample Identification, Documentation and Shipment ..... 8-1</b>
8.1	Sample Nomenclature ..... 8-1
8.2	Container, Preservation, and Holding Time Requirements ..... 8-1
8.3	Sample Labeling, Packaging, and Shipping ..... 8-2
8.4	Chain-of-Custody Forms and QA/QC Summary Forms ..... 8-3
<b>9</b>	<b>Quality Assurance and Control (QA/QC) ..... 9-1</b>
9.1	Field Quality Control Samples ..... 9-1
9.1.1	Assessment of Field Contamination (Blanks) ..... 9-1
9.1.1.1	Equipment Blank Samples ..... 9-1
9.1.1.2	Field Blanks ..... 9-1
9.1.2	Assessment of Sample Variability (Field Duplicate or Co-located Samples) ..... 9-1
9.1.3	Laboratory Quality Control (QC) Samples for Soil ..... 9-1
9.2	Analytical and Data Package Requirements ..... 9-2
9.3	Data Management ..... 9-2
9.4	Data Validation ..... 9-3
9.5	Field Variances ..... 9-4
9.6	Assessment of Project Activities ..... 9-4
9.6.1	Assessment Activities ..... 9-4
9.6.2	Project Status Reports to Management ..... 9-5
9.6.3	Reconciliation of Data with DQOs ..... 9-5
<b>10</b>	<b>References ..... 10-1</b>
<b>A</b>	<b>Data Quality Objective Process Document ..... A-1</b>
<b>B</b>	<b>Site Specific Health and Safety Plan ..... B-1</b>

**Table of Contents (cont.)**

<b>Section</b>	<b>Page</b>
<b>C Standard Operating Procedures .....</b>	<b>C-1</b>





# List of Tables

Figure 2-2 Site Location Map..... 2-1

Table 2-1 Properties Subject to U.S. EPA Time-Critical Removal Action ..... 2-2

Table 3-1 3-3

Benchmarks and Data Quality Indicator Goals – ..... 3-3

Definitive Data for EPA Method 6010B/7471A in Borrow Soil Samples and Post-  
Removal Confirmation Samples ..... 3-3

Table 3-2 3-4

Benchmarks and Data Quality Indicator Goals - Definitive Data for..... 3-4

NIOSH Method 7300 Air Sample Analysis..... 3-4

Table 5-1 Assessment Sampling and Analysis Summary ..... 5-2

# List of Figures

Figure 2-1 Site Map..... 2-4

Figure 2-2 Site Location Map..... 2-1

Figure 6-1 Example Air Sampling Form..... 6-1



## 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 <sup>2</sup>	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

---

<sup>1</sup> 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.

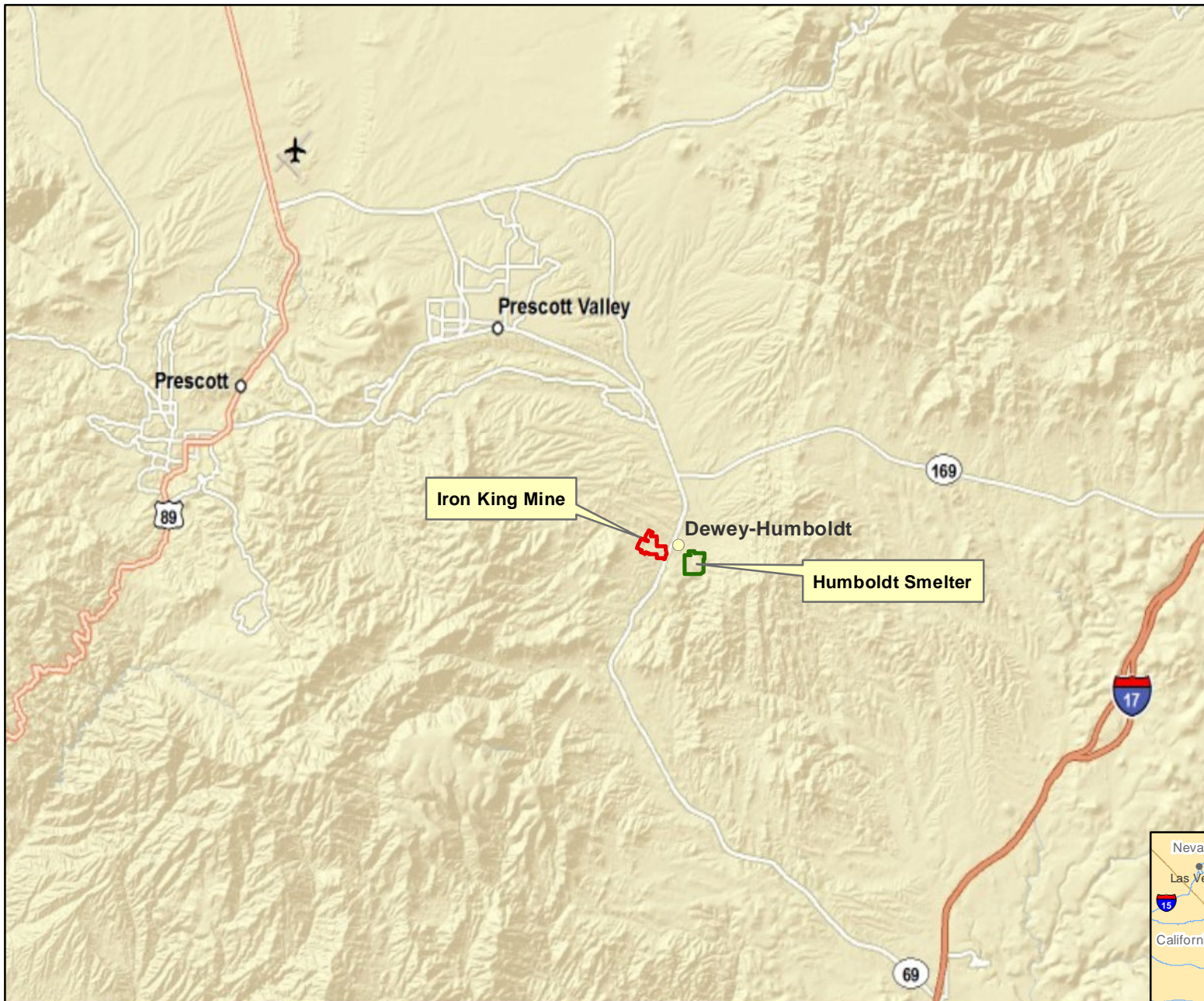
Also as part of the RI, EA collected background soil samples from several different soil types and areas about the site. Background Soil Type 1 was identified as the predominant soil type for the study area, and a background concentration of 48 mg/kg for arsenic and 44 mg/kg for lead was established (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**

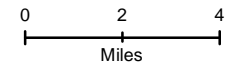
In the fall of 2010, the U.S. EPA Remedial Program requested that the U.S. EPA Emergency Response Section provide support to conduct an RA at the site. To determine which in-town properties to investigate for the RA, the START prepared an interim “hot list” of residential and city-owned properties that 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.



**Legend**

- Iron King Mine
- Humboldt Smelter

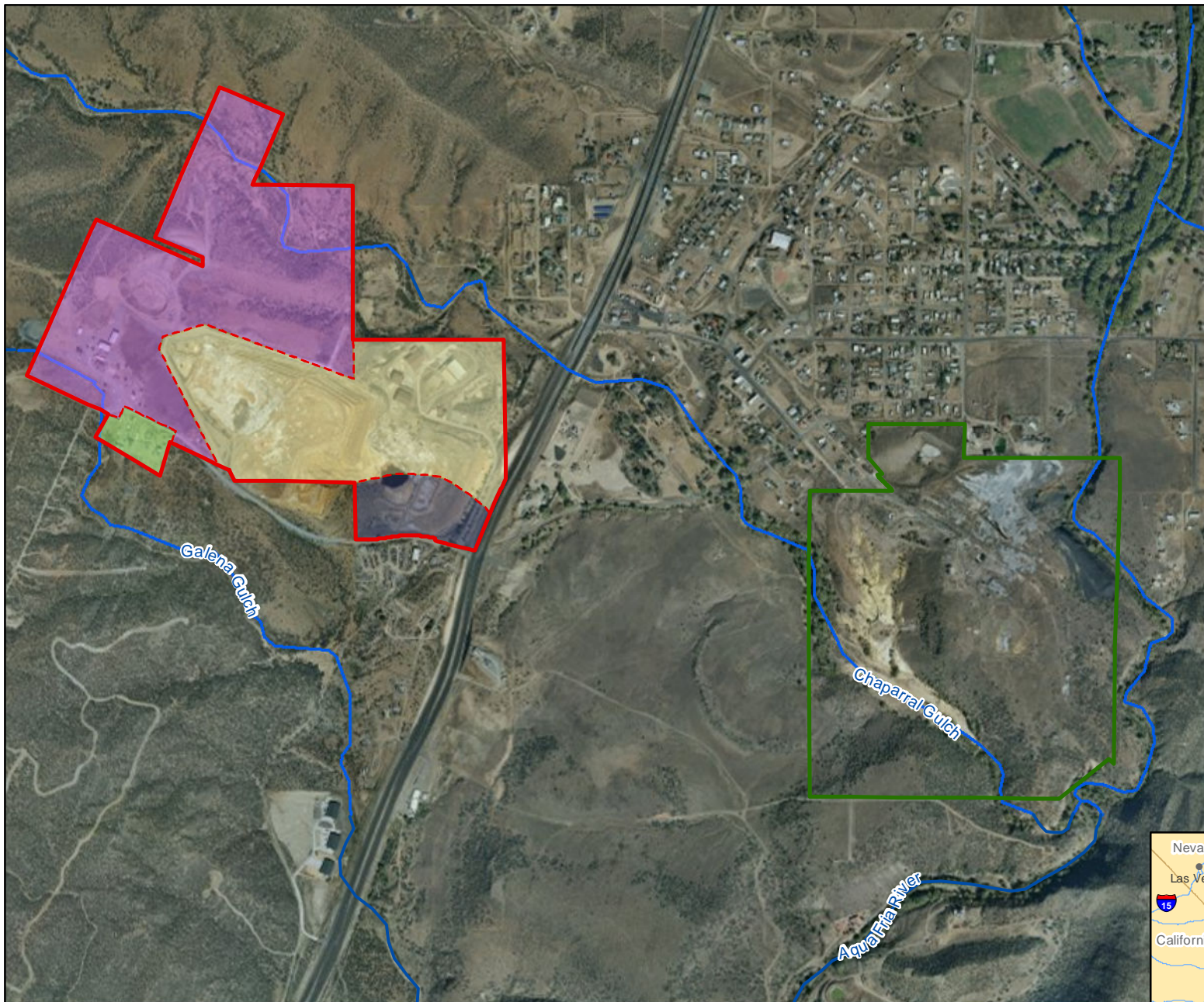


Source:  
Background: ESRI World Street Map



**Figure 2-1**  
**Site Location Map**

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



**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



0 500 1,000  
 Feet

Source:  
 Aerial Photo: ESRI World Imagery  
 EA Remedial Investigation Report,  
 Revision 01, March 2010



**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		Lead	
						Average Concentration (mg/kg)	95% UCL <sup>1</sup>	Average Concentration (mg/kg)	95% UCL <sup>1</sup>
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
	OFS 118	402-06-102K	2905 South Sweet Pea Lane	PO Box 508 Humboldt, AZ 86329	0.27	147.2	198.4	1148	1610
	OFS 132	402-06-102P	2875 South Third Street	PO Box 122 Humboldt, AZ 86329	0.25	102.5	130.7	949.7	1792
	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
	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
	OFS 133 <sup>2</sup> 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 <sup>4</sup>				
	OFS-103	402-07-002B	13030 East Main Street	PO Box 488 Humboldt, AZ 86329	0.46 <sup>4</sup>	45.77 <sup>5</sup>	92.86 <sup>5,6</sup>	134.5 <sup>5</sup>	605.3 <sup>5,6</sup>
	OFS 208 <sup>2</sup> OFS-244 (one hot spot between two parcels)	402-09-016D	2565 Hill Street	PO Box 32 Humboldt, AZ 86329	0.21 <sup>4</sup>	134.9	481 <sup>7</sup>	108.7	355.8 <sup>7</sup>
		402-09-016H	2575 Hill Street	PO Box 548 Humboldt, AZ 86329	0.21 <sup>4</sup>				
	OFS-002 <sup>2</sup> (hot spot is the STP)	402-08-034A	12470 East Yavapai Road	PO Box 721 Dewey, AZ 86327	0.6 <sup>3</sup>	556.4	727.2	706.2	986.8
	OFS-301	402-06-102N	2965 Sweet Pea Lane	PO Box 905 Humboldt, AZ 86329	0.28 <sup>4</sup>	52.02	128.5 <sup>7</sup>	241	552 <sup>6</sup>
OFS-306	402-06-026 402-06-027B	13087 E. Main Street 13089 E. Main Street	PO Box 699 Humboldt, AZ 86329	0.19 <sup>4</sup> 0.32 <sup>4</sup>	70.8	111.3 <sup>6</sup>	187	259.7	

<sup>1</sup> - Calculated as student's t-test for normal distribution unless otherwise noted.

<sup>2</sup> - 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.

<sup>3</sup> - The Small Tailings Pile has an area of approximately 0.6 acres and is situated on a parcel of approximately 40 acres.

<sup>4</sup> - These properties will be subjected to hot spot removals only.

<sup>5</sup> - Calculated based on samples listed in Table 15.

<sup>6</sup> - Gamma UCL

<sup>7</sup> - 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 <sup>1</sup> (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	Precision	Percent Completeness
						(% Recovery for MS/ MSD)	(RPD from MS/MSD and Duplicates)	
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 <sup>2</sup>	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:

<sup>1</sup> - Action levels do not apply to the small tailings pile

<sup>2</sup> - 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 <sup>3</sup> )	TestAmerica (Phoenix) Reporting Limits <sup>1</sup> (mg/m <sup>3</sup> )	Accuracy	Precision	Percent Completeness
			(% Recovery for BS/BSD)	(RPD from BS/BSD and Duplicates)	
Lead	0.050	0.0032	80 – 120	25%	> 90%
Arsenic	0.010	0.0026	80 – 120	25%	> 90%

<sup>1</sup> Assumes sample collected at 2 liters per minute over an 8-hour period

mg/m<sup>3</sup> = 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

2011 ecology & environment, inc.



### **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 FOOSC'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

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

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 be 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).

<b>Table 5-1 Assessment Sampling and Analysis Summary</b> <b>Iron King Mine – Humboldt Smelter</b> <b>Yavapai County, Arizona</b>		
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 <sub>3</sub>	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		

2011 ecology &amp; environment, inc.

## 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.

# 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.

<b>Table 8-1 Soil Sample Numbering System</b> <b>Iron King Mine – Humboldt Smelter</b> <b>Yavapai County, Arizona</b>		
E & E Project No. 002693.2155.01RF		TDD No. TO2-09-11-08-0005
Type of Sample	Site Area	Sample ID
Primary Field Sample  <u>Example:</u>  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>  IKMHSR-OFS-133-002-002
Field Duplicate  <u>Example:</u>  Duplicate soil sample from side yard of OFS-133	All	IKMHSR-<OFS number>-<fictitious number>-<depth in inches>  IKMHSR-OFS-133-007-002

2011 ecology &amp; environment, inc.

## 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. Sample Identification, Documentation and Shipment**

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

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. Sample labels will be affixed to the sample containers and 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).

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

- 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 rinse 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 FOOSC 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

- EA Engineering, Science and Technology, Inc. (EA), 2010. *Remedial Investigation Report Addendum, Iron King Mine – Humboldt Smelter Superfund Site, Dewey-Humboldt, Yavapai County, Arizona*. March.
- EA, 2011. *Remedial Investigation Report Addendum, Iron King Mine – Humboldt Smelter Superfund Site, Dewey-Humboldt, Yavapai County, Arizona*. February.
- Ecology and Environment, Inc. (E & E), 2005. *Iron King Mine Site, Humboldt, Arizona, Draft Final Report*. October.
- U.S. Environmental Protection Agency (EPA), 1990. *Quality Assurance/Quality Control Guidance for Removal Activities, Sampling QA/QC Plan and Data Validation Procedures*.
- EPA, 1991. *Management of Investigation-Derived Wastes During Site Inspections*, Office of Emergency and Remedial Response, OERR Directive 9345.3-02, May.
- EPA, 2001. *U.S. EPA Region IX Superfund Data Evaluation/Validation Guidance R9QA/006*
- EPA, 2001. *Laboratory Documentation Requirements for Data Evaluation* (EPA Region IX R9/QA/00.4.1), March.
- EPA, 2001. *Requirements for Quality Assurance Project Plans* (EPA QA/R 5, EPA/240/B 01/003), March.
- EPA, 2002. *Guidance on Choosing a Sampling Design for Environmental Data Collection* (EPA QA/G 5S, EPA/240/R 02/005), December.
- EPA, 2003. *Superfund Lead-Contaminated Residential Sites Handbook* (OSWER Directive 9285.7-90), August.
2004. “USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review, USEPA-540-R-04-004. October.
- EPA, 2005. *Uniform Federal Policy for Implementing Environmental Quality System* (EPA/505/F-03/001), March.
- EPA, 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA/240/B-06/001), February.
- EPA, 2009. *Regional Screening Levels for Chemical Contaminants at Superfund Sites*, December.



# **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:**

#### Physical Constraints:

- 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.

#### Other Constraints on Data Collection

- The turnaround times on data are always estimated and cannot be assured. Sample and system problems may indiscriminately increase data turnaround times.



## 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

<b><u>Decision Error</u></b>	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.
<b><u>True Nature of Decision Error</u></b>	The sample concentrations are either not representative or are biased high.	The sample concentrations are either not representative or are biased low.
<b><u>The Consequence of Error</u></b>	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. 2) The COPCs in contaminated soil could potentially migrate throughout the area or migrate vertically to impact groundwater. 3) The COPCs in contaminated groundwater could continue to migrate and could potentially impact drinking water. 3) The contaminants could become more exposed and more accessible if the site is in use.
<b><u>Which Decision Error Has More Severe Consequences Near the Screening Level?</u></b>	<b><u>LESS SEVERE</u></b> To human health, but with appreciable economic consequences.	<b><u>MORE SEVERE</u></b> Since the contaminated soil may pose risks to human health and/or the environment.
<b><u>Error Type Based on Consequences</u></b>	<b><u>False Acceptance Decisions</u></b> A decision that the area is contaminated when it is not.	<b><u>False Rejection Decisions</u></b> A decision that the area is not contaminated when it is.
<b><u>Definitions</u></b> 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. <p style="text-align: right;">2011 ecology &amp; environment, inc.</p>		

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

<b>True Average Concentration of Area (% of Screening Level [SL])</b>	<b>Decision Error</b>	<b>Typical Decision Error Probability Goals (Based on Professional Judgment)</b>	<b>Type of Decision Error</b>
<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 <sup>1</sup>	False Acceptance
100 to 150 % SL	A decision that a portion of the site is not contaminated when it is.	10 % <sup>2</sup>	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.**

<sup>1</sup> Gray Area is where relatively large decision errors are acceptable.

<sup>2</sup> 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.

2011 ecology & environment, inc.

## 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 216<sup>th</sup> Street SW, Suite J  
Lynnwood, Washington, 98036

Approved: [Signature]  
On-Scene Coordinator, USEPA Region 9

Date: 9/12/11 11-3-11

Approved: Gary Wofford  
ERRS Response Manager

Date: 6 SEPT 11

Approved: [Signature]  
Program Manager

Date: 9/1/11

Approved: [Signature]  
START Representative

Date: 9/12/11



**A. SITE INFORMATION, ROLES AND RESPONSIBILITIES**

<b>Site Name:</b> Iron King Removal
<b>Site Address:</b> Dewey-Humboldt, Arizona (34° 31' 57.00" N 112° 15' 08.80" W)
<b>Date of Activities:</b> September 12-October 7, 2011
<b>Participants:</b> ☐ USEPA ☐ START ☐ ERRS    PST    Other

<b>Table A-1 Site Roles/Responsibilities</b>			
<b>Site Role/Responsibility</b>	<b>Agency / Entity</b>	<b>Name</b>	<b>Title</b>
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	

## 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 ∃ 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.

<b>Table B-1 Project Tasks and Task Descriptions</b>	
<b>Task Number</b>	<b>Task Description</b>
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.

<b>Overall Hazard Summary</b>		
<b>Hazard (low, med, high)</b>	<b>Task (s)</b>	<b>Discussion</b>
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

<b>Overall Control Measures</b>		
<b>Hazard</b>	<b>PPE</b>	<b>Discussion</b>
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	
<b>Date JHA conducted:</b> 9/12/11-10/07/11		<b>Date(s) JHA updated:</b>	
Biological Hazards			
Name of Biological Hazard	Characteristics	Concentration	Exposure Potential during Task
Desert creatures (insects, spiders, snakes, rodents, Gila monster)/Hantavirus	☐ Infectious/Pathogenic ☐ Toxic	NA	9 High ☐ Low 9 Medium 9 Unknown
Chemical Hazards			
Chemical Name or Type	Characteristics	State/Concentration	Exposure Potential during Task
Lead, arsenic	9 Flammable / Ignitable 9 Corrosive ☐ Poison / Acutely Toxic 9 Air/Water Reactive ☐ Carcinogenic 9 Explosive/Shock Sensitive 9 Volatile	9 Gas/ Vapor ☐ Solid 9 Liquid	9 High ☐ Low 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 9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant X Noise X Heat Stress X Cold Stress X Other – electrocution, traffic, heavy equipment operation, muscle strain			9 High 9 Low ☐ Medium 9 Unknown
9 Ionizing Radiation 9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons			9 High ☐ Low 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 ☐ Low 9 Medium 9 Unknown
Control Measures			
<b>Engineering Controls:</b> 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)

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	

Job Hazard Analysis (JHA)			
JHA Number	Task	Location Where Task Performed	
2	Dust suppression of smelter ash through application of soil sealant	Humboldt Smelter	
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	☒ Infectious/Pathogenic ☒ Toxic	NA	9 High ☒ Low 9 Medium 9 Unknown
Chemical Hazards			
Chemical Name or Type	Characteristics	State/Concentration	Exposure Potential during Task
Lead, arsenic	9 Flammable / Ignitable 9 Corrosive ☒ Poison / Acutely Toxic 9 Air/Water Reactive ☒ Carcinogenic 9 Explosive/Shock Sensitive 9 Volatile	9 Gas/ Vapor ☒ Solid 9 Liquid	9 High ☒ Low 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 9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant X Noise X Heat Stress X Cold Stress X Other – heavy equipment operation			9 High 9 Low ☒ Medium 9 Unknown
9 Ionizing Radiation 9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons			9 High ☒ Low 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 ☒ Low 9 Medium 9 Unknown
Control Measures			
<b>Engineering Controls:</b> 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)

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

<b>Group</b>	<b>PPE Level</b>	<b>Modifications Allowed</b>
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	☒ Infectious/Pathogenic ☒ Toxic	NA	9 High ☒ Low 9 Medium 9 Unknown
Chemical Hazards			
Chemical Name or Type	Characteristics	State/Concentration	Exposure Potential during Task
Lead, arsenic	9 Flammable / Ignitable 9 Corrosive ☒ Poison / Acutely Toxic 9 Air/Water Reactive ☒ Carcinogenic 9 Explosive/Shock Sensitive 9 Volatile	9 Gas/ Vapor ☒ Solid 9 Liquid	9 High 9 Low ☒ 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 9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant X Noise X Heat Stress X Cold Stress X Other – traffic, heavy equipment operation			9 High 9 Low ☒ Medium 9 Unknown
9 Ionizing Radiation 9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons			9 High ☒ Low 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 ☒ Low 9 Medium 9 Unknown
Control Measures			
<b>Engineering Controls:</b> 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)

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

<b>Group</b>	<b>PPE Level</b>	<b>Modifications Allowed</b>
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	
<b>Date JHA conducted:</b> 9/12/11-10/07/11		<b>Date(s) JHA updated:</b>	
Biological Hazards			
Name of Biological Hazard	Characteristics	Concentration	Exposure Potential during Task
Desert creatures (insects, spiders, snakes, rodents, Gila monster)/Hantavirus	☒ Infectious/Pathogenic ☒ Toxic	NA	9 High ☒ Low 9 Medium 9 Unknown
Chemical Hazards			
Chemical Name or Type	Characteristics	State/Concentration	Exposure Potential during Task
Lead, arsenic	9 Flammable / Ignitable 9 Corrosive ☒ Poison / Acutely Toxic 9 Air/Water Reactive ☒ Carcinogenic 9 Explosive/Shock Sensitive 9 Volatile	9 Gas/ Vapor ☒ Solid 9 Liquid	9 High 9 Low ☒ 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 9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant X Noise X Heat Stress X Cold Stress X Other – traffic, heavy equipment operation			9 High 9 Low ☒ Medium 9 Unknown
9 Ionizing Radiation 9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons			9 High ☒ Low 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 ☒ Low 9 Medium 9 Unknown
Control Measures			
<b>Engineering Controls:</b> 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)

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

<b>Group</b>	<b>PPE Level</b>	<b>Modifications Allowed</b>
USEPA	D	
START	D	
ERRS	D	

Job Hazard Analysis (JHA)			
JHA Number	Task	Location Where Task Performed	
5	Creek channel restoration	OFS-002 (residential property with Small Tailings Pile)	
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	<input type="checkbox"/> Infectious/Pathogenic <input type="checkbox"/> Toxic	NA	<input type="checkbox"/> High <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> Unknown
Chemical Hazards			
Chemical Name or Type	Characteristics	State/Concentration	Exposure Potential during Task
Lead, arsenic	<input type="checkbox"/> Flammable / Ignitable <input type="checkbox"/> Corrosive <input type="checkbox"/> Poison / Acutely Toxic <input type="checkbox"/> Air/Water Reactive <input type="checkbox"/> Carcinogenic <input type="checkbox"/> Explosive/Shock Sensitive <input type="checkbox"/> Volatile	<input type="checkbox"/> Gas/ Vapor <input type="checkbox"/> Solid <input type="checkbox"/> Liquid	<input type="checkbox"/> High <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> 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
<input type="checkbox"/> Overhead <input type="checkbox"/> Below Grade <input checked="" type="checkbox"/> Trip/Fall <input type="checkbox"/> Burn <input type="checkbox"/> Puncture <input type="checkbox"/> Cut <input type="checkbox"/> Splash <input checked="" type="checkbox"/> Animal/Insect/Plant <input checked="" type="checkbox"/> Noise <input checked="" type="checkbox"/> Heat Stress <input checked="" type="checkbox"/> Cold Stress <input checked="" type="checkbox"/> Other – heavy equipment operation			<input type="checkbox"/> High <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> Unknown
<input type="checkbox"/> Ionizing Radiation <input type="checkbox"/> Alpha Particles <input type="checkbox"/> Beta Particles <input type="checkbox"/> Gamma Rays <input type="checkbox"/> Neutrons			<input type="checkbox"/> High <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> Unknown
<input type="checkbox"/> 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.			<input type="checkbox"/> High <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> Unknown
Control Measures			
<b>Engineering Controls:</b> 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)

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

<b>Group</b>	<b>PPE Level</b>	<b>Modifications Allowed</b>
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	☒ Infectious/Pathogenic ☒ Toxic	NA	9 High ☒ Low 9 Medium 9 Unknown
Chemical Hazards			
Chemical Name or Type	Characteristics	State/Concentration	Exposure Potential during Task
Lead, arsenic	9 Flammable / Ignitable 9 Corrosive ☒ Poison / Acutely Toxic 9 Air/Water Reactive ☒ Carcinogenic 9 Explosive/Shock Sensitive 9 Volatile	9 Gas/ Vapor ☒ Solid 9 Liquid	9 High 9 Low ☒ 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 9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant X Noise X Heat Stress X Cold Stress X Other – heavy equipment operation			9 High ☒ Low 9 Medium 9 Unknown
9 Ionizing Radiation 9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons			9 High ☒ Low 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 ☒ Low 9 Medium 9 Unknown
Control Measures			
<b>Engineering Controls:</b> 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)

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

<b>Group</b>	<b>PPE Level</b>	<b>Modifications Allowed</b>
USEPA	D	
START	D	
ERRS	D	



Job Hazard Analysis (JHA)			
JHA Number	Task	Location Where Task Performed	
7	Soil sampling	Soil removal areas of 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	<input type="checkbox"/> Infectious/Pathogenic <input type="checkbox"/> Toxic	NA	<input type="checkbox"/> High <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> Unknown
Chemical Hazards			
Chemical Name or Type	Characteristics	State/Concentration	Exposure Potential during Task
Lead, arsenic	<input type="checkbox"/> Flammable / Ignitable <input type="checkbox"/> Corrosive <input type="checkbox"/> Poison / Acutely Toxic <input type="checkbox"/> Air/Water Reactive <input type="checkbox"/> Carcinogenic <input type="checkbox"/> Explosive/Shock Sensitive <input type="checkbox"/> Volatile	<input type="checkbox"/> Gas/ Vapor <input type="checkbox"/> Solid <input type="checkbox"/> Liquid	<input type="checkbox"/> High <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> 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
<input type="checkbox"/> Overhead <input type="checkbox"/> Below Grade <input checked="" type="checkbox"/> Trip/Fall <input type="checkbox"/> Burn <input type="checkbox"/> Puncture <input type="checkbox"/> Cut <input type="checkbox"/> Splash <input checked="" type="checkbox"/> Animal/Insect/Plant <input checked="" type="checkbox"/> Noise <input checked="" type="checkbox"/> Heat Stress <input checked="" type="checkbox"/> Cold Stress <input checked="" type="checkbox"/> Other – heavy equipment operation			<input type="checkbox"/> High <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> Unknown
<input type="checkbox"/> Ionizing Radiation <input type="checkbox"/> Alpha Particles <input type="checkbox"/> Beta Particles <input type="checkbox"/> Gamma Rays <input type="checkbox"/> Neutrons			<input type="checkbox"/> High <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> Unknown
<input type="checkbox"/> 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.			<input type="checkbox"/> High <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> Unknown
Control Measures			
<b>Engineering Controls:</b> 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)

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	☒ Infectious/Pathogenic ☒ Toxic	NA	9 High ☒ Low 9 Medium 9 Unknown
Chemical Hazards			
Chemical Name or Type	Characteristics	State/Concentration	Exposure Potential during Task
Lead, arsenic	9 Flammable / Ignitable 9 Corrosive ☒ Poison / Acutely Toxic 9 Air/Water Reactive ☒ Carcinogenic 9 Explosive/Shock Sensitive 9 Volatile	9 Gas/ Vapor ☒ Solid 9 Liquid	9 High ☒ Low 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 9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant X Noise X Heat Stress X Cold Stress X Other – heavy equipment operation			9 High ☒ Low 9 Medium 9 Unknown
9 Ionizing Radiation 9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons			9 High ☒ Low 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 ☒ Low 9 Medium 9 Unknown
Control Measures			
<b>Engineering Controls:</b> 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)

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

<b>Group</b>	<b>PPE Level</b>	<b>Modifications Allowed</b>
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	
<b>Date JHA conducted:</b> 9/12/11-10/07/11		<b>Date(s) JHA updated:</b>	
Biological Hazards			
Name of Biological Hazard	Characteristics	Concentration	Exposure Potential during Task
Desert creatures (insects, spiders, snakes, rodents, Gila monster)/Hantavirus	☒ Infectious/Pathogenic ☒ Toxic	NA	9 High ☒ Low 9 Medium 9 Unknown
Chemical Hazards			
Chemical Name or Type	Characteristics	State/Concentration	Exposure Potential during Task
Lead, arsenic	9 Flammable / Ignitable 9 Corrosive ☒ Poison / Acutely Toxic 9 Air/Water Reactive ☒ Carcinogenic 9 Explosive/Shock Sensitive 9 Volatile	9 Gas/ Vapor ☒ Solid 9 Liquid	9 High 9 Low ☒ 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 9 Burn 9 Puncture 9 Cut 9 Splash X Animal/Insect/Plant X Noise X Heat Stress X Cold Stress X Other – heavy equipment operation			9 High 9 Low ☒ Medium 9 Unknown
9 Ionizing Radiation 9 Alpha Particles 9 Beta Particles 9 Gamma Rays 9 Neutrons			9 High ☒ Low 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 ☒ Low 9 Medium 9 Unknown
Control Measures			
<b>Engineering Controls:</b> 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)

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

<b>Group</b>	<b>PPE Level</b>	<b>Modifications Allowed</b>
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 <sup>3</sup>	0.002 mg/m <sup>3</sup>  Ceiling (15 minute)	0.01 mg/m <sup>3</sup>	5 mg/m <sup>3</sup>	Inhalation, ingestion, absorption, skin or eye contact	Ulceration of septum, dermatitis, GI disturbances	None
Lead	0.050 mg/m <sup>3</sup>	0.050 mg/m <sup>3</sup>	0.05 mg/m <sup>3</sup>	100 mg/m <sup>3</sup>	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 Site-Specific Action Levels				
Contaminant	Level	Action	Level	Action
Arsenic (OFS-002 property only)	2.53 mg/m <sup>3</sup> (dust concentration)	Cease operations, apply engineering controls		
Total dust	2.5 mg/m <sup>3</sup>	Evaluate necessity of additional engineering controls	5 mg/m <sup>3</sup>	Cease operations, apply engineering controls

Table E-2 General Action Levels				
Contaminant	Level	Action	Level	Action
<b>Oxygen</b>	19.5% - 22%	Continue work in Level D or C	< 19.5% or > 22%	Upgrade to Level B or A
<b>Lower Explosive Limit (LEL)</b>	10 to 25% of LEL	Continuous monitoring	> 25% of LEL	Evacuate immediately
<b>Particulates</b>	≥ 5 mg/m <sup>3</sup> (assume all dust is respirable dust)	Upgrade to Level C		
<b>Radiation</b>	Above background but <1 mR/hr	Continue monitoring	≥1 mR/hr	Withdraw, contact Health Physicist and reassess work plan
<b>Unknown Organic Vapors/Gases</b>	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
<b>Other:</b>				



## 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.

<b>Table F-1 Decontamination Procedures:</b>	
<b>Type</b>	<b>Responsible Entity</b>
<p><b>Personnel:</b> PPE will be removed in the order and manner described in the <i>Guidelines for Removal of Protective Clothing</i> RAG.</p> <p>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.</p> <p>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.</p>	EPA/ERRS/START
<p><b>Equipment/Instruments:</b> Equipment/instruments will be washed with soap (alconox) and rinsed with water. Dedicated contaminated items will be disposed of.</p>	ERRS/START
<p><b>Emergency Decon: Non Life Threatening:</b> Remove PPE, wash with soap and water and transport to hospital</p> <p><b>Life Threatening:</b> Remove PPE and transport to hospital</p>	All
<p><b>Waste Management:</b> Waste will be disposed of in accordance with applicable regulations by ERRS</p>	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:

<b>Table H-1 Personnel Training and Surveillance Requirements</b>				
<b>Regulation</b>	<b>USEPA</b>	<b>START</b>	<b>ERRS</b>	<b>Other</b>
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 designate 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

<b>Company/Resource</b>	<b>Name Contact</b>	<b>Telephone Numbers</b>
USEPA	Region Response Center Harry Allen, ERS Chief  OSC: Craig Benson	(800) 300-2193 (415) 972-3063 (Office) (415) 218-7406 (Cell)  (562) 889-1630 (Cell)
START	Cindy McLeod  Sara Dwight	(415) 238-3379 (Cell) (510) 654-6250 (Home) (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  START: Mike Schwennesen ERRS: Gary Wofford	(562) 889-1630 (Cell)  (760) 689-8000 (714) 269-5979

**Participant Acknowledgment Sheet**

<b><u>Name</u></b>	<b><u>Organization</u></b>	<b><u>Date</u></b>

## Appendix A: Chemical Hazard Sheets





## Search the Pocket Guide

Enter search terms separated by spaces.

# 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)  
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<sup>3</sup> (as As)]  
See: [7440382 \(/niosh/idlh/7440382.html\)](/niosh/idlh/7440382.html)

**Exposure Limits**

**NIOSH REL** : Ca C 0.002 mg/m<sup>3</sup> [15-minute] See [Appendix A \(nengapdxa.html\)](#)

**OSHA PEL** : [1910.1018] TWA 0.010 mg/m<sup>3</sup>

**Measurement Methods**

**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>);

**OSHA ID105** (<http://www.osha.gov/dts/sltc/methods/inorganic/id105/id105.html>)  
See: [NMAM \(/niosh/docs/2003-154/\)](/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)

**FLP:** 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](#)) ([nengapdx.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](#))

Page last reviewed: April 4, 2011

Page last updated: November 18, 2010

Content source: [National Institute for Occupational Safety and Health \(NIOSH\)](#) Education and Information Division

Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA  
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348, New Hours of Operation  
8am-8pm ET/Monday-Friday  
Closed Holidays - [cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov)





## Search the Pocket Guide

Enter search terms separated by spaces.

# Lead

**Synonyms & Trade Names** Lead metal, Plumbum

<b>CAS No.</b> 7439-92-1	<b>RTECS No.</b> <a href="#">OF7525000</a> (/niosh-rtecs/OF72D288.html)	<b>DOT ID &amp; Guide</b>
-----------------------------	--	---------------------------

<b>Formula</b> Pb	<b>Conversion</b>	<b>IDLH</b> 100 mg/m <sup>3</sup> (as Pb) See: <a href="#">7439921</a> (/niosh/idlh/7439921.html)
-------------------	-------------------	--

**Exposure Limits**

**NIOSH REL** \*: TWA (8-hour) 0.050 mg/m<sup>3</sup> See [Appendix C \(nengapdx.html\)](#) [\*Note: The REL also applies to other lead compounds (as Pb) -- see Appendix C.]

**OSHA PEL** \*: [1910.1025] TWA 0.050 mg/m<sup>3</sup> See [Appendix C \(nengapdx.html\)](#) [\*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.

<b>MW:</b> 207.2	<b>BP:</b> 3164°F	<b>MLT:</b> 621°F	<b>Sol:</b> Insoluble	<b>VP:</b> 0 mmHg (approx)	<b>IP:</b> NA
<b>Sp.Gr:</b> 11.34	<b>Fl.P:</b> NA	<b>UEL:</b> NA	<b>LEL:</b> NA		

Noncombustible Solid in bulk form.	
<b>Incompatibilities &amp; Reactivities</b> Strong oxidizers, hydrogen peroxide, acids	
<b>Exposure Routes</b> inhalation, ingestion, skin and/or eye contact	
<b>Symptoms</b> 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	
<b>Target Organs</b> Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue	
<b>Personal Protection/Sanitation</b> (See <a href="#">protection codes (protect.html)</a> ) <b>Skin:</b> Prevent skin contact <b>Eyes:</b> Prevent eye contact <b>Wash skin:</b> Daily <b>Remove:</b> When wet or contaminated <b>Change:</b> Daily	<b>First Aid</b> (See <a href="#">procedures (firstaid.html)</a> ) <b>Eye:</b> Irrigate immediately <b>Skin:</b> Soap flush promptly <b>Breathing:</b> Respiratory support <b>Swallow:</b> Medical attention immediately
<b>Respirator Recommendations</b> (See <a href="#">Appendix E (nengapdx.html)</a> ) <b>NIOSH/OSHA</b>  <b>Up to 0.5 mg/m<sup>3</sup>:</b> (APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators. <a href="#">Click here (pgintrod.html#nrp)</a> for information on selection of N, R, or P filters. (APF = 10) Any supplied-air respirator  <b>Up to 1.25 mg/m<sup>3</sup>:</b> (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.  <b>Up to 2.5 mg/m<sup>3</sup>:</b> (APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter. <a href="#">Click here (pgintrod.html#nrp)</a> 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  <b>Up to 50 mg/m<sup>3</sup>:</b> (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode  <b>Up to 100 mg/m<sup>3</sup>:</b> (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 \(/niosh/docs/2005-110/nmed0127.html\)](#)

Page last reviewed: April 4, 2011

Page last updated: November 18, 2010

Content source: [National Institute for Occupational Safety and Health \(NIOSH\)](#) Education and Information Division

Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA

800-CDC-INFO (800-232-4636) TTY: (888) 232-6348, New Hours of Operation

8am-8pm ET/Monday-Friday

Closed Holidays - [cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov)



## **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.

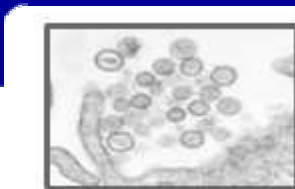
To provide emergency care for heat exhaustion, move the patient to a cool place and remove as much clothing as possible. Have the patient drink cool water, Gatorade, or its equivalent. If possible, fan the patient continually to remove heat by convection, but do not allow chilling or overcooling. Treat 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.



[CDC Home](#)[Search](#)[Health Topics A-Z](#)National Center for Infectious Diseases  
Special Pathogens Branch

## All About Hantaviruses

[All About Hantaviruses Home](#) | [General Information](#)  
[Technical Information](#) | [Contact Us](#)

---

### 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?

---

### 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 fiancée 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.

---

## 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 when they 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:



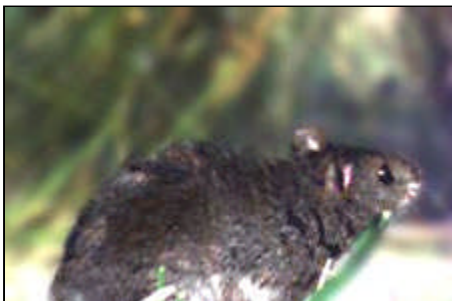
*deer mouse*

**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.

---

## **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.

---

## 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 an ideal 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, and furniture 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.

---

### **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.

---

## **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.
- 

## **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](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.

---

### **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.
- 

## 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)

<i>New classes of filters ††</i>			<i>Characteristics</i>
			<b>Equivalent to HEPA</b>
N-95	N-99	<b>N-100 (99.97)</b>	Not resistant to oil
R-95	R-99	<b>R-100 (99.97)</b>	Resistant to oil
P-95	P-99	<b>P-100 (99.97)</b>	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](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=2275)

(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.

---

## 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

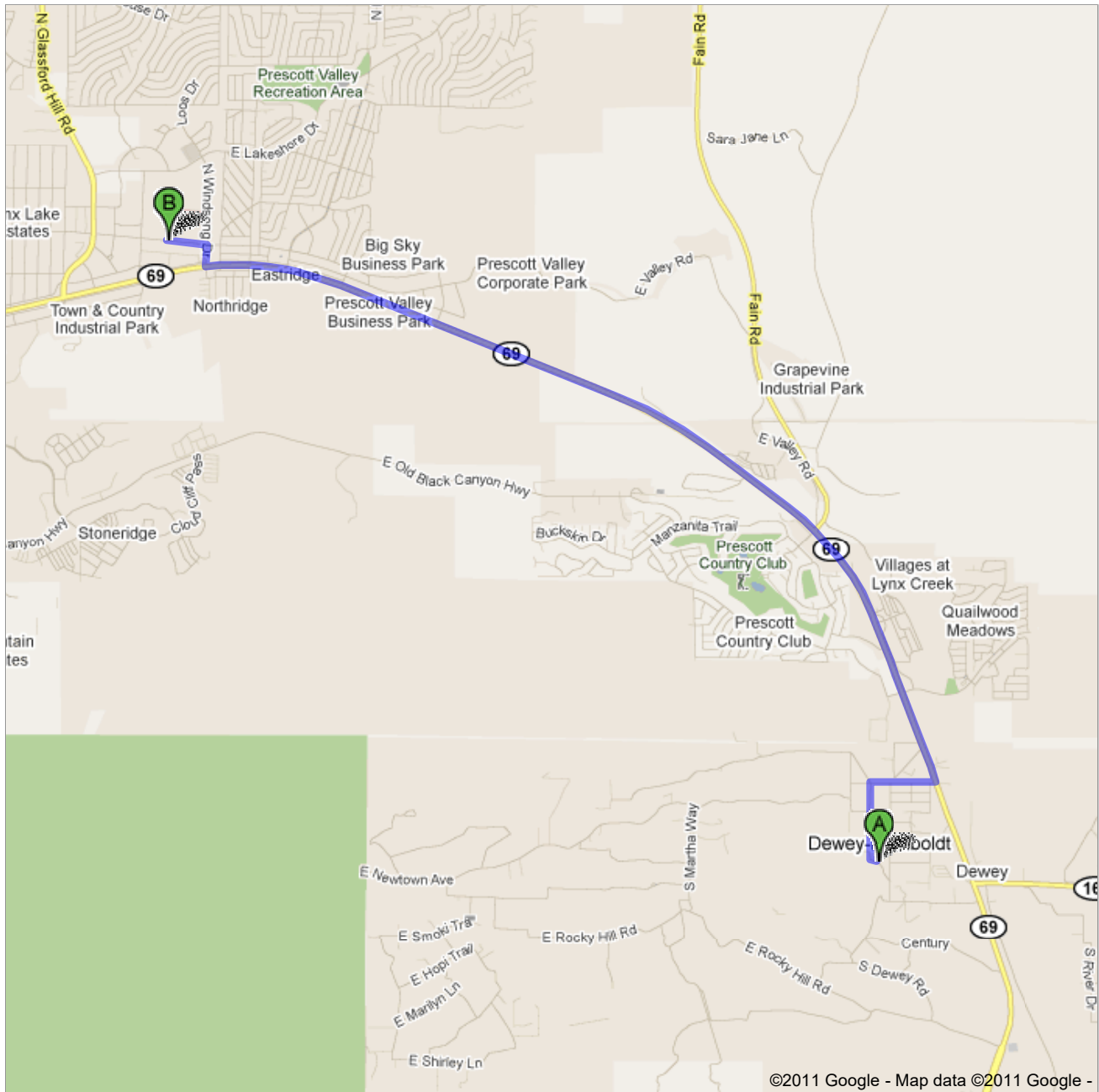



## Appendix B: Hospital Map/Route to Hospital








**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**  
Continue to follow Antelope Dr  
About 2 mins go 0.5 mi  
total 0.5 mi
  -  2. Take the 3rd right onto **Kachina Pl**  
About 1 min go 0.4 mi  
total 0.9 mi
  -  3. Take the 1st left onto **AZ-69 N**  
About 9 mins go 6.0 mi  
total 6.9 mi
  -  4. Turn right at **N Windsong Dr**  
go 0.1 mi  
total 7.1 mi
  -  5. Turn left at **E Florentine Rd**  
Destination will be on the right  
About 1 min go 0.3 mi  
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.

Map data ©2011 Google

Directions weren't right? Please find your route on [maps.google.com](http://maps.google.com) and click "Report a problem" at the bottom left.

# C Standard Operating Procedures



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 2 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

#### 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



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 3 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

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



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 4 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

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:





# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 5 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

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.



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 6 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

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.



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 7 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

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



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 8 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

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.



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 9 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

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



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 10 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

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

#### 10.0 DATA VALIDATION

This section is not applicable to this SOP.

#### 11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and 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.



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 11 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

APPENDIX A  
Figures  
SOP #2012  
February 2000



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

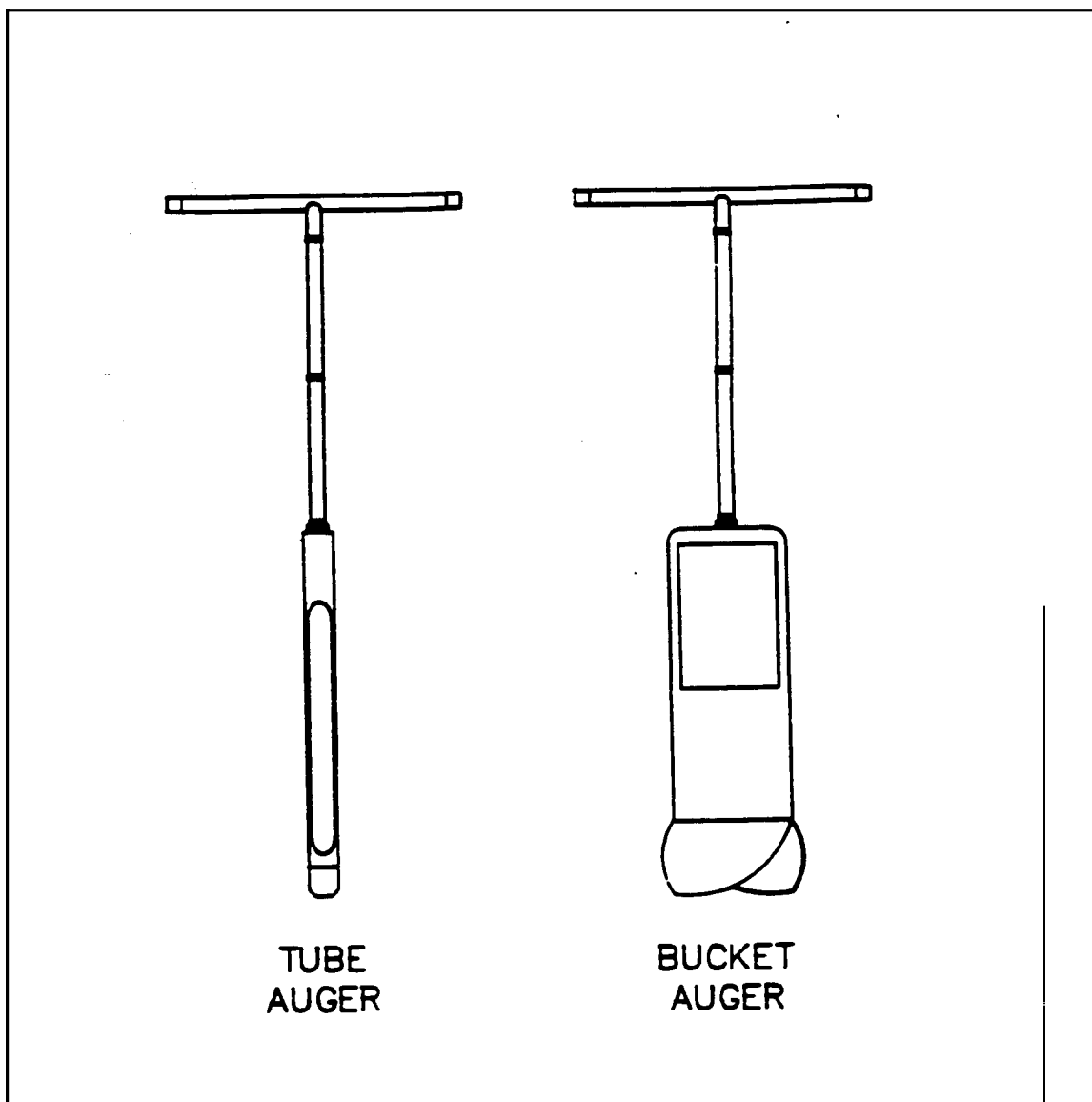
## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 12 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

FIGURE 1. Sampling Augers







# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

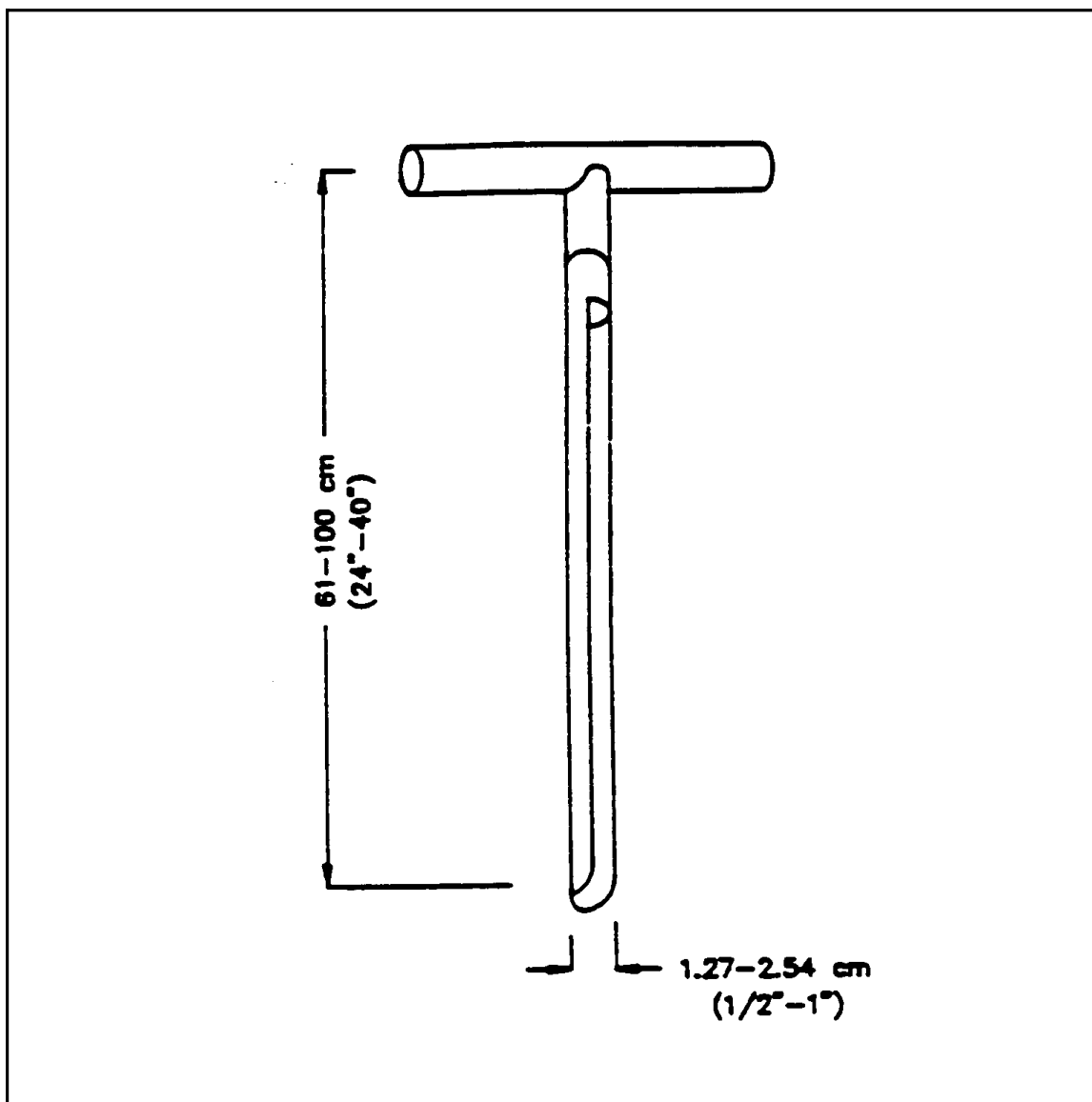
## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 13 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

FIGURE 2. Sampling Trier





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

**STANDARD OPERATING PROCEDURE**

# SOIL SAMPLING

© 1997 Ecology and Environment, Inc.

**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

None of the information contained in this Ecology and Environment, Inc., (E & E) publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use in connection with any method, apparatus, or product covered by letters patent, nor as ensuring anyone against liability for infringement of letters patent.

Anyone wishing to use this E & E publication should first seek permission from the company. Every effort has been made by E & E to ensure the accuracy and reliability of the information contained in the document; however, the company makes no representations, warranty, or guarantee in connection with this E & E publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use; for any violation of any federal, state, or municipal regulation with which this E & E publication may conflict; or for the infringement of any patent resulting from the use of the E & E publication.



<b>TITLE:</b>	SOIL SAMPLING	
<b>CATEGORY:</b>	ENV 3.13	<b>REVISED:</b> August 1997

## TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1. Introduction .....	1
2. Scope .....	1
3. Method Summary .....	1
4. Sample Preservation, Containers, Handling, and Storage.....	1
5. Potential Problems.....	2
6. Soil Sampling Equipment .....	3
6.1 Geophysical Equipment .....	5
7. Reagents .....	5
8. Procedures .....	5
8.1 Office Preparation .....	5
8.2 Field Preparation .....	6
8.3 Representative Sample Collection .....	6
8.3.1 Sampling Approaches.....	6
8.3.2 Surface Soil Samples .....	10
8.3.3 Sampling at Depth with Augers and Thin-Walled Tube Samplers .....	11
8.3.4 Sampling at Depth with a Trier .....	13
8.3.5 Sampling at Depth with a Split-Spoon (Barrel) Sampler .....	14
8.3.6 Test Pit/Trench Excavation.....	15
8.4 Sample Preparation .....	16
8.4.1 Sample Quantity and Volume.....	16
8.4.2 Sample Preservation and Holding Time .....	16
8.4.3 Removing Extraneous Material .....	16
8.4.4 Homogenizing Samples .....	16
8.4.5 Compositing Samples .....	20
8.4.6 Splitting Samples .....	20



<b>TITLE:</b>	SOIL SAMPLING	
<b>CATEGORY:</b>	ENV 3.13	<b>REVISED:</b> August 1997

8.5	Post-Operations .....	20
8.5.1	Field .....	20
8.5.2	Office .....	20
9.	Calculations .....	20
10.	Quality Assurance/Quality Control .....	20
10.1	Sampling Documentation .....	21
10.1.1	Soil Sample Label .....	21
10.1.2	Logbook .....	22
10.1.3	Chain of Custody .....	22
10.2	Sampling Design .....	22
11.	Data Validation .....	22
11.1	Quality Assurance/Quality Control Samples .....	23
11.1.1	Field Duplicates (Replicates) .....	23
11.1.2	Collocated Samples .....	23
11.1.3	Background Samples .....	23
11.1.4	Rinsate (Equipment) Blanks .....	23
11.1.5	Performance Evaluation Samples .....	23
11.1.6	Matrix Spike/Matrix Spike Duplicates (MS/MSDs) .....	23
11.1.7	Field Blanks .....	23
11.1.8	Trip Blanks .....	24
12.	Health and Safety .....	24
12.1	Hazards Associated with On-Site Contaminants .....	24
13.	References .....	24
 <u>Appendix</u>		
A	Sampling Augers .....	26
B	Sampling Trier .....	27
C	Split-Spoon Sampler .....	28



<b>TITLE:</b>	SOIL SAMPLING	
<b>CATEGORY:</b>	ENV 3.13	<b>REVISED:</b> August 1997

## LIST OF TABLES

<u>Table</u>		<u>Page</u>
5-1	Soil Sampling Equipment .....	2
8-1	Representative Sampling Approach Comparison .....	7
8-2	Standard Sampling Holding Times, Preservation Methods, and Volume Requirements.....	17



<b>TITLE:</b>	SOIL SAMPLING	
<b>CATEGORY:</b>	ENV 3.13	<b>REVISED:</b> August 1997

## LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
8-1	Random Sampling.....	8
8-2	Stratified Random Sampling.....	8
8-3	Systematic Grid Sampling.....	8
8-4	Systematic Random Sampling .....	9
8-5	Search Sampling.....	10
8-6	Transect Sampling.....	10
8-7	Quartering to Homogenized and Split Samples.....	21



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

## 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).





<b>TITLE:</b>	SOIL SAMPLING	
<b>CATEGORY:</b>	ENV 3.13	<b>REVISED:</b> August 1997

## 5. Potential Problems

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

**Table 5-1 Soil Sampling Equipment**

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



<b>TITLE:</b>	SOIL SAMPLING	
<b>CATEGORY:</b>	ENV 3.13	<b>REVISED:</b> August 1997

**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



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

- 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



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

## Labeling, Packaging, and Shipping Supplies

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

## 6.1 Geophysical Equipment

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

## 7. Reagents

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

## 8. Procedures

### 8.1 Office Preparation

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



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

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.



<b>TITLE:</b>	SOIL SAMPLING		
<b>CATEGORY:</b>	ENV 3.13	<b>REVISED:</b>	August 1997

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

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

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

### 8.3.1.2 Random Sampling

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

### 8.3.1.3 Stratified Random Sampling

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

### 8.3.1.4 Systematic Grid Sampling

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

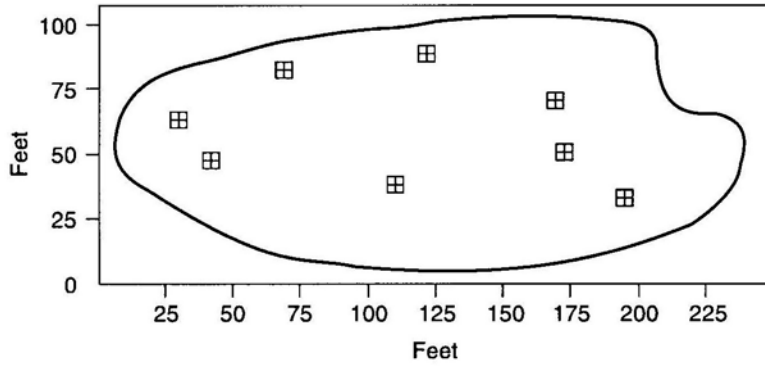


Figure 8-1 Random Sampling\*\*

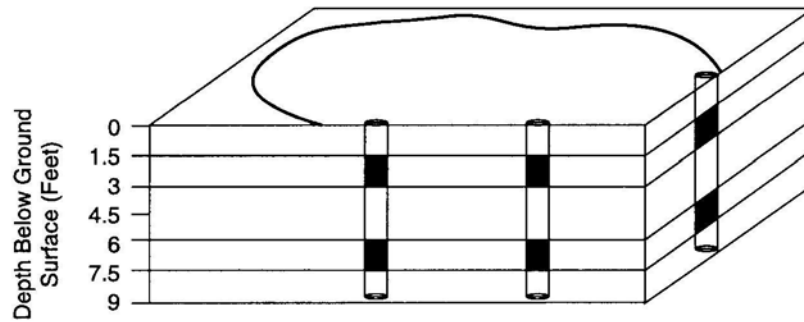


Figure 8-2 Stratified Random Sampling

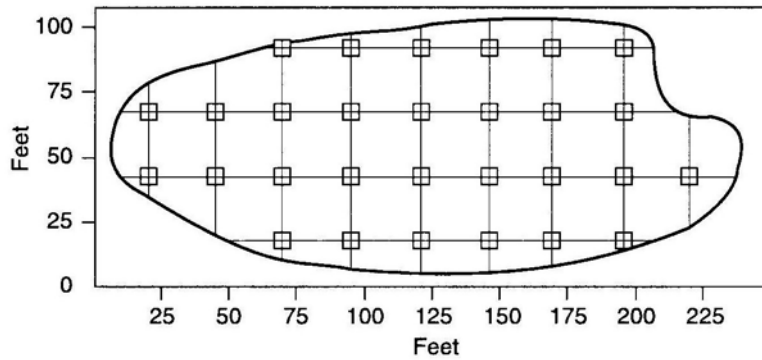


Figure 8-3 Systematic Grid Sampling\*\*

\*\* After EPA, February 1989

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



<b>TITLE:</b>	SOIL SAMPLING	
<b>CATEGORY:</b>	ENV 3.13	<b>REVISED:</b> August 1997

### 8.3.1.5 Systematic Random Sampling

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

### 8.3.1.6 Biased-Search Sampling

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

### 8.3.1.7 Transect Sampling

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

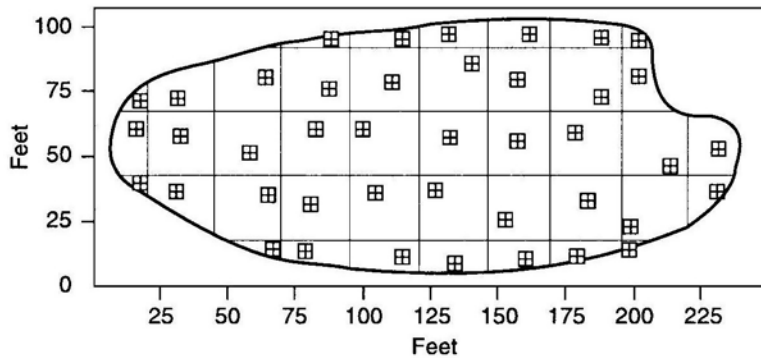
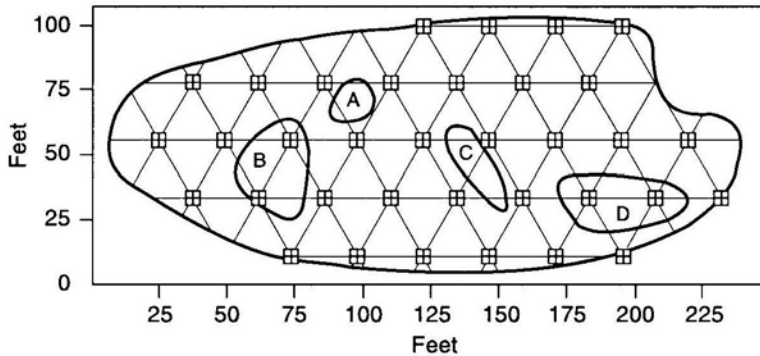
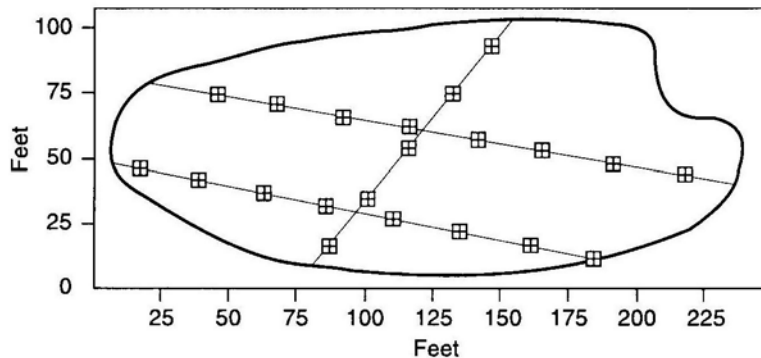


Figure 8-4 Systematic Random Sampling



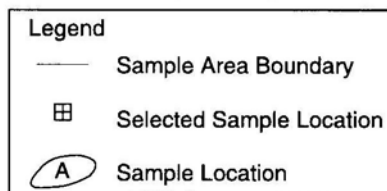


**Figure 8-5 Search Sampling**



**Figure 8-6 Transect Sampling**

After EPA, February 1989



### 8.3.2 Surface Soil Samples

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

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



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

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

Soil samples are collected using the following procedure:

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

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

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

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

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



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

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

The following procedures will be used for collecting soil samples with the hand auger:

1. Attach the auger bit to a drill rod extension, and attach the T-handle to the drill rod.
2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, and litter). It may be advisable to remove the first 3 to 6 inches of surface soil from an area approximately 6 inches in radius around the drilling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a canvas or plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from the boring. When sampling directly from the auger, collect the sample after the auger is removed from the boring and proceed to Step 11.
5. A precleaned stainless-steel auger sleeve can also be used to collect a sample. After reaching the desired sampling depth, remove the auger and place the sleeve inside the auger. Collect the sample with the auger. Remove the auger from the boring. The sample will be collected only from the sleeve. The soil from the auger tip should never be used for the sample.
6. Remove the auger tip from the drill rods and replace with a precleaned thin-walled tube sampler. Install the proper cutting tip.
7. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring, because the vibrations may cause the boring walls to collapse.
8. Remove the tube sampler and unscrew the drill rods.
9. Remove the cutting tip and core from the device.
10. Discard the top of the core (approximately 1 inch), because this represents material collected before penetration of the layer in question. Place the remaining core into the sample container.



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

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).



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

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).



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

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.



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

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

## 8.4 Sample Preparation

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

### 8.4.1 Sample Quantity and Volume

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

### 8.4.2 Sample Preservation and Holding Time

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

### 8.4.3 Removing Extraneous Material

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

### 8.4.4 Homogenizing Samples

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

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

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


**CATEGORY:**

ENV 3.13

**TITLE:**

SOIL SAMPLING

**REVISED:**

August 1997





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

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



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

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

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

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

Key:

NA = Not applicable.



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

### 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

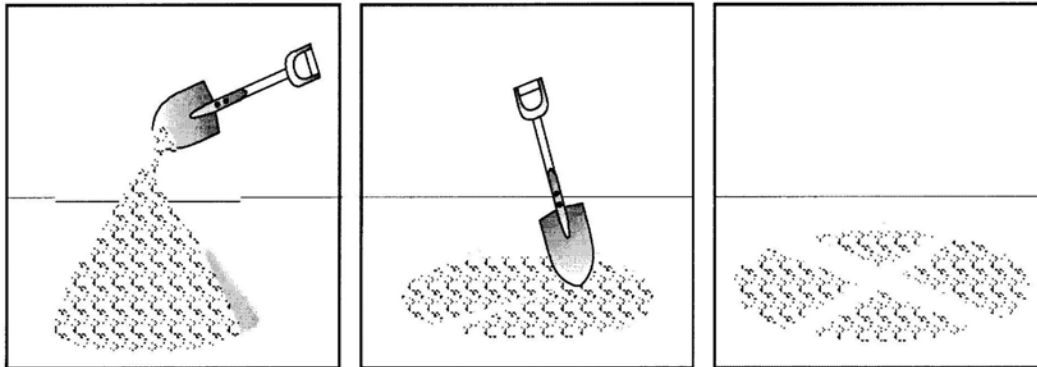
There are no specific calculations required for these procedures.

## 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.



<b>TITLE:</b>	SOIL SAMPLING	
<b>CATEGORY:</b>	ENV 3.13	<b>REVISED:</b> August 1997



**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.



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

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.



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

## 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.



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

### 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.



**TITLE:** SOIL SAMPLING

**CATEGORY:** ENV 3.13

**REVISED:** August 1997

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.





<b>TITLE:</b>	SOIL SAMPLING	
<b>CATEGORY:</b>	ENV 3.13	<b>REVISED:</b> August 1997

## A SAMPLING AUGERS

### A. Sampling Augers



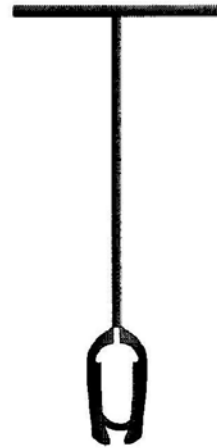
(a)  
Ship Auger



(b)  
Closed-Spiral Auger



(c)  
Open-Spiral Auger

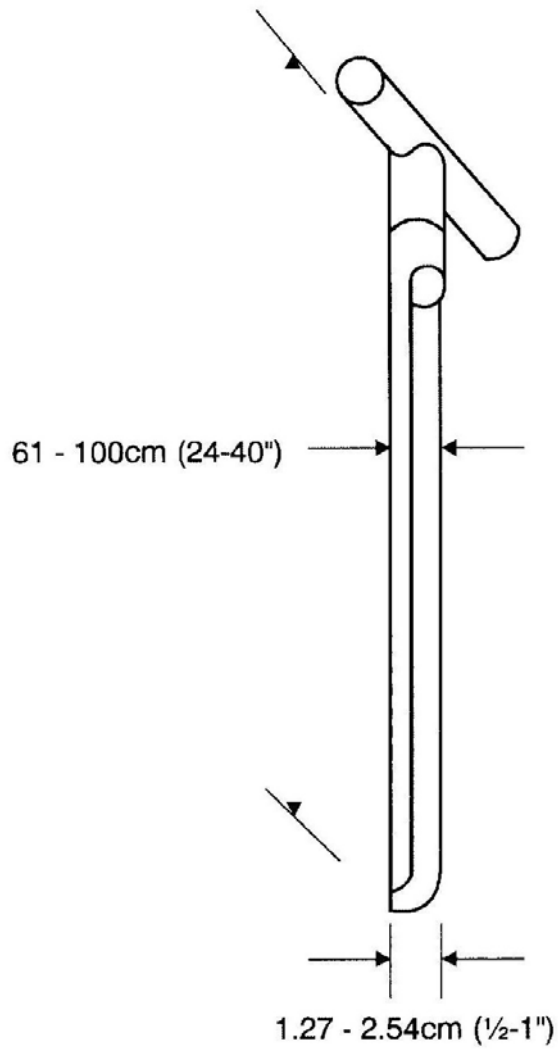


(d)  
Iwan Auger



<b>TITLE:</b>	SOIL SAMPLING	
<b>CATEGORY:</b>	ENV 3.13	<b>REVISED:</b> August 1997

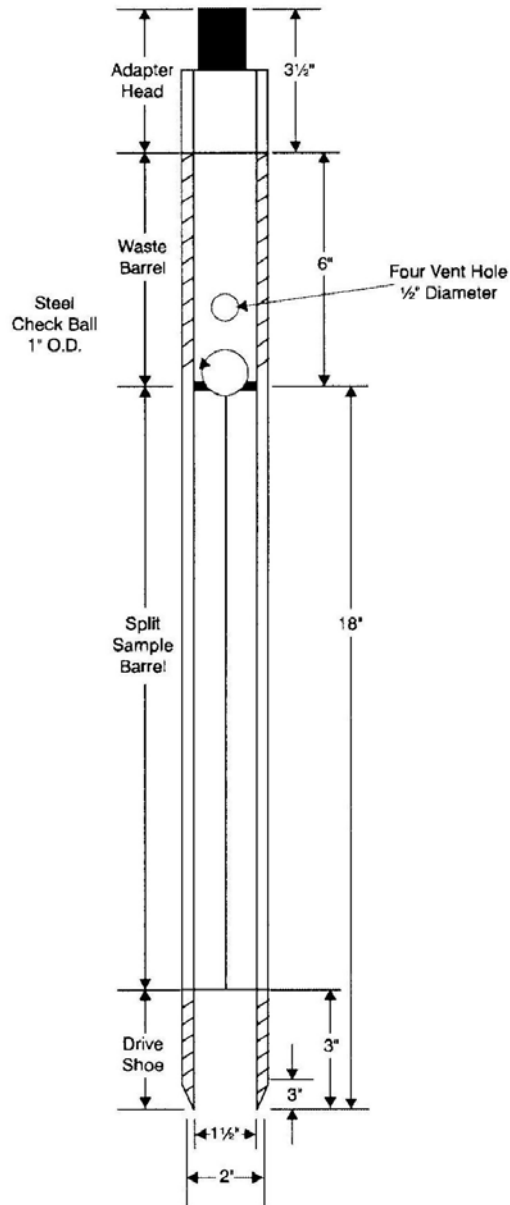
### B SAMPLING TRIER





<b>TITLE:</b>	SOIL SAMPLING	
<b>CATEGORY:</b>	ENV 3.13	<b>REVISED:</b> August 1997

### C SPLIT-SPOON SAMPLER





<b>Title:</b>	<b>SAMPLING EQUIPMENT DECONTAMINATION</b>
<b>Category:</b>	ENV 3.15
<b>Revised:</b>	March 1999

**STANDARD OPERATING PROCEDURE**

## **SAMPLING EQUIPMENT DECONTAMINATION**

© 1999 Ecology and Environment, Inc.

**ecology and environment, inc.**

368 Pleasant View Drive / Lancaster, New York 14086 / (716) 684-8060



**TITLE:** SAMPLING EQUIPMENT DECONTAMINATION

**CATEGORY:** ENV 3.15

**REVISED:** March 1999

None of the information contained in this Ecology and Environment, Inc., (E & E) publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use in connection with any method, apparatus, or product covered by letters patent, nor as ensuring anyone against liability for infringement of letters patent.

Anyone wishing to use this E & E publication should first seek permission from the company. Every effort has been made by E & E to ensure the accuracy and reliability of the information contained in the document; however, the company makes no representations, warranty, or guarantee in connection with this E & E publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use; for any violation of any federal, state, or municipal regulation with which this E & E publication may conflict; or for the infringement of any patent resulting from the use of the E & E publication.



<b>TITLE:</b>	SAMPLING EQUIPMENT DECONTAMINATION		
<b>CATEGORY:</b>	ENV 3.15	<b>REVISED:</b>	March 1999

## TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1. Scope and Application .....	1
2. Method Summary.....	1
3. Interferences.....	1
4. Equipment/Apparatus .....	2
5. Reagents .....	3
6. Procedures.....	3
6.1 Abrasive Cleaning Methods.....	5
6.2 Non-abrasive Cleaning Methods.....	5
6.3 Field Sampling Equipment Cleaning Procedures .....	7
7. Quality Assurance/Quality Control.....	8
8. Health and Safety .....	9
9. References.....	9



<b>TITLE:</b>	SAMPLING EQUIPMENT DECONTAMINATION		
<b>CATEGORY:</b>	ENV 3.15	<b>REVISED:</b>	March 1999

## LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Decontamination Solvents .....	8



**TITLE:** SAMPLING EQUIPMENT DECONTAMINATION

**CATEGORY:** ENV 3.15

**REVISED:** March 1999

## 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.





**TITLE:** SAMPLING EQUIPMENT DECONTAMINATION

**CATEGORY:** ENV 3.15

**REVISED:** March 1999

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<sub>2</sub>O;
- Pressurized sprayers, solvents;
- Trash bags;
- Aluminum foil;
- Sample containers;



**TITLE:** SAMPLING EQUIPMENT DECONTAMINATION

**CATEGORY:** ENV 3.15

**REVISED:** March 1999

- 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)<sup>a</sup>;
- Acetone (pesticide grade)<sup>b</sup> ;
- Hexane (pesticide grade)<sup>b</sup>;
- Methanol; and
- Methylene chloride<sup>b</sup>.

<sup>a</sup> Only if sample is to be analyzed for trace metals.

<sup>b</sup> 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);



**TITLE:** SAMPLING EQUIPMENT DECONTAMINATION

**CATEGORY:** ENV 3.15

**REVISED:** March 1999

- 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).



**TITLE:** SAMPLING EQUIPMENT DECONTAMINATION

**CATEGORY:** ENV 3.15

**REVISED:** March 1999

## 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.



**TITLE:** SAMPLING EQUIPMENT DECONTAMINATION

**CATEGORY:** ENV 3.15

**REVISED:** March 1999

## 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 (trichlorotrifluoroethane) 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.



**TITLE:** SAMPLING EQUIPMENT DECONTAMINATION

**CATEGORY:** ENV 3.15

**REVISED:** March 1999

## 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.



<b>TITLE:</b>	SAMPLING EQUIPMENT DECONTAMINATION	
<b>CATEGORY:</b>	ENV 3.15	<b>REVISED:</b> March 1999

**Table 1 Decontamination Solvents**

Solvent	Soluble Contaminants
Water	Low-chain compounds Salts Some organic acids and other polar compounds
Dilute Bases For example: <ul style="list-style-type: none"> <li>■ detergent</li> <li>■ soap</li> </ul>	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents: For example: <ul style="list-style-type: none"> <li>■ alcohols (methanol)</li> <li>■ ethers</li> <li>■ ketones</li> <li>■ aromatics</li> <li>■ straight-chain alkanes (e.g., hexane)</li> <li>■ common petroleum products (e.g., fuel oil, kerosene)</li> </ul>	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.



**TITLE:** SAMPLING EQUIPMENT DECONTAMINATION

**CATEGORY:** ENV 3.15

**REVISED:** March 1999

## 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

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 LABS  
RS  
10/3/12

*[Signature]* 1/12/12

TestAmerica Phoenix  
Erik Aasen  
Project Manager

The results pertain only to the samples tested in the laboratory. This report shall not be reproduced, except in full, without written permission from TestAmerica.

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

## 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	
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	

BLIND  
DUPLICATES  
TO LAB  
VS  
1/25/12

*[Handwritten signature]* 1/25/12

TestAmerica Phoenix

Erik Aasen  
Project Manager

Ecology and Environment - Lakewood 3700 Industry Ave, Suite 102 Lakewood, CA 90712 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 RS 11/29/12
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	
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	

*MS* 1/25/12

TestAmerica Phoenix

Erik Vaasen  
Project Manager

Ecology and Environment - Lakewood 3700 Industry Ave, Suite 102 Lakewood, CA 90712 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	

*[Handwritten Signature]*  
1/25/12

TestAmerica Phoenix  
Erik Aasen  
Project Manager

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) <i>BLIND DUPLICATE w/ 002-005-072 8, 1-29-12</i>								
Reporting Units: mg/kg								
Antimony	EPA 6010B	11J1199	5.0	40 J	1	10/31/2011	11/4/2011	
Arsenic	EPA 6010B	11J1199	5.0	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

*MTA* 1/25/12

TestAmerica Phoenix  
 Erik Aasen  
 Project Manager

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: PUJ1827-05 (1KMHSR-OFS-002-005-072 - Soil)								
Reporting Units: mg/kg								
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

*BLIND DUPLICATE W/ 002-004-072* *MS 1-29-12*

*m. A. 1/25/12*

TestAmerica Phoenix  
 Erik Vaasen  
 Project Manager

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	

*Mindy Song* 11/20/12

TestAmerica Phoenix

Erik Vaasen  
Project Manager



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

TestAmerica Phoenix

Erik Aasen  
Project Manager

7 of 101

*The results pertain only to the samples tested in the laboratory. This report shall not be reproduced, except in full, without written permission from TestAmerica.*

PUI1139 <Page 2 of 5>

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	
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	

BLIND  
DUPLICATES  
TO LAB  
IS 1-28-12

*Mindy Song* 1/25/12

TestAmerica Phoenix  
Erik 'aasen  
Project Manager

The results pertain only to the samples tested in the laboratory. This report shall not be reproduced, except in full, without written permission from TestAmerica.

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	

*Mindy Song* 1/25/12

TestAmerica Phoenix

Erik Aasen  
Project Manager

10 of 213

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	

 1/25/12

TestAmerica Phoenix

Erik Aasen  
Project Manager

11 of 213

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	11I0654	5.0	100	0.996	9/19/2011	9/20/2011	
Lead	EPA 6010B	11I0654	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	11I0654	5.0	20	0.996	9/19/2011	9/20/2011	
Lead	EPA 6010B	11I0654	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	11I0654	5.0	130	0.999	9/19/2011	9/20/2011	
Lead	EPA 6010B	11I0654	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	11I0654	5.0	200	0.999	9/19/2011	9/20/2011	
Lead	EPA 6010B	11I0654	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	11I0654	5.0	100	0.996	9/19/2011	9/20/2011	
Lead	EPA 6010B	11I0654	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	11I0654	5.0	23	0.996	9/19/2011	9/20/2011	
Lead	EPA 6010B	11I0654	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	11I0654	5.0	54	0.998	9/19/2011	9/20/2011	
Lead	EPA 6010B	11I0654	5.0	81	0.998	9/19/2011	9/20/2011	

BLIND DUPLICATES TO LAB  
MS 09/29/12

m A 1/12/12

TestAmerica Phoenix  
Erik Aasen  
Project Manager

Ecology and Environment - Lakewood  
3700 Industry Ave, Suite 102  
Lakewood, CA 90712  
Attention: Mike Schwennesen

Project ID: T02-09-11-08-0005

Report Number: PUK0002

Sampled: 10/24/11  
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	

*MA 11/25/12*

TestAmerica Phoenix

Erik Aasen  
Project Manager

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	11I0831	5.0	69 J	0.997	9/23/2011	9/23/2011	M2
Lead	EPA 6010B	11I0831	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	11I0831	5.0	39 J	0.979	9/23/2011	9/23/2011	BLIND DUPLICATES TO LAB RS 1/29/12
Lead	EPA 6010B	11I0831	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	11I0831	5.0	120 J	0.954	9/23/2011	9/23/2011	
Lead	EPA 6010B	11I0831	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	11I0831	5.0	290 J	0.962	9/23/2011	9/23/2011	
Lead	EPA 6010B	11I0831	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	11I0831	5.0	93 J	1	9/23/2011	9/23/2011	
Lead	EPA 6010B	11I0831	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	11I0831	5.0	9.0 J	1	9/23/2011	9/23/2011	
Barium	EPA 6010B	11I0831	5.0	110	1	9/23/2011	9/23/2011	
Cadmium	EPA 6010B	11I0831	0.50	ND	1	9/23/2011	9/23/2011	
Chromium	EPA 6010B	11I0831	2.0	24	1	9/23/2011	9/23/2011	
Lead	EPA 6010B	11I0831	5.0	8.2 J	1	9/23/2011	9/23/2011	
Mercury	EPA 7471A	11I0809	0.10	ND	1.09	9/22/2011	9/23/2011	
Selenium	EPA 6010B	11I0831	5.0	ND	1	9/23/2011	9/23/2011	
Silver	EPA 6010B	11I0831	2.5	ND	1	9/23/2011	9/23/2011	

*ms* 1/12/12

TestAmerica Phoenix

Erik Aasen  
Project Manager

7 of 100

The results pertain only to the samples tested in the laboratory. This report shall not be reproduced, except in full, without written permission from TestAmerica.

PUI1385 <Page 2 of 7>

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: PUI1385-07 (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	

*m A* 1/12/12

TestAmerica Phoenix

Erik Aasen  
Project Manager

8 of 100



Ecology and Environment - Lakewood  
 3700 Industry Ave, Suite 102  
 Lakewood, CA 90712  
 Attention: Mindy Song

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	} BLIND DUPLICATES TO LAB MS 1/29/12
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	} BLIND DUPLICATES TO LAB MS 1/29/12
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	} BLIND DUPLICATES TO LAB MS 1/29/12
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	} BLIND DUPLICATES TO LAB MS 1/29/12
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	} BLIND DUPLICATES TO LAB MS 1/29/12
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	} BLIND DUPLICATES TO LAB MS 1/29/12
Lead	EPA 6010B	11J0041	5.0	660	1	10/3/2011	10/4/2011	

*[Handwritten Signature]* 1/20/12

TestAmerica Phoenix  
 Erik Aasen  
 Project Manager

Ecology and Environment - Lakewood  
3700 Industry Ave, Suite 102  
Lakewood, CA 90712  
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	

 1/20/12

TestAmerica Phoenix

Erik Aasen  
Project Manager

7 of 158

Ecology and Environment - Lakewood  
3700 Industry Ave, Suite 102  
Lakewood, CA 90712  
Attention: Mindy Song

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		

NOT PART OF ICMHSR TCRA 10/3/11

*[Signature]*  
11/12/12

TestAmerica Phoenix

Erik 'aasen  
Project Manager

8 of 180

The results pertain only to the samples tested in the laboratory. This report shall not be reproduced, except in full, without written permission from TestAmerica.

PUI0034 <Page 3 of 10>

Ecology and Environment - Lakewood  
 3700 Industry Ave, Suite 102  
 Lakewood, CA 90712  
 Attention: Mindy Song

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
<b>Sample ID: PUI0034-06 (BA-1-2 - Soil)</b>				<b>Sampled: 08/31/11</b>				
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	
<b>Sample ID: PUI0034-07 (BA-2-1 - Soil)</b>				<b>Sampled: 08/31/11</b>				
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	
<b>Sample ID: PUI0034-08 (BA-2-2 - Soil)</b>				<b>Sampled: 08/31/11</b>				
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	

*Mindy Song*  
 11/12/12

TestAmerica Phoenix

Erik Aasen  
 Project Manager

Ecology and Environment - Lakewood  
3700 Industry Ave, Suite 102  
Lakewood, CA 90712  
Attention: Mindy Song

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		

NOT PART OF IKMHSR TCRA  
NS 10/3/11

*[Signature]* 1/12/12

TestAmerica Phoenix  
Erik Vaasen  
Project Manager

10 of 180

The results pertain only to the samples tested in the laboratory. This report shall not be reproduced, except in full, without written permission from TestAmerica.

PUI0034 <Page 5 of 10>

Ecology and Environment - Lakewood  
3700 Industry Ave, Suite 102  
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	1111033	5.0	69	0.999	9/28/2011	9/29/2011	
Lead	EPA 6010B	1111033	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	1111033	5.0	62	0.996	9/28/2011	9/29/2011	
Lead	EPA 6010B	1111033	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	1111033	5.0	220	0.998	9/28/2011	9/29/2011	
Lead	EPA 6010B	1111033	5.0	870	0.998	9/28/2011	9/29/2011	M3

 1/20/12

TestAmerica Phoenix

Erik Vaasen  
Project Manager

7 of 147

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
<b>Sample ID: PUI1573-01 (IKMHSR-OFS-301-001-002 - Soil)</b>								
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
<b>Sample ID: PUI1573-02 (IKMHSR-OFS-111-007-002 - Soil)</b>								
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	
<b>Sample ID: PUI1573-03 (IKMHSR-OFS-111-008-002 - Soil)</b>								
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	

*m* 1/20/12

TestAmerica Phoenix  
Erik Aasen  
Project Manager

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	

*[Handwritten Signature]* 1/20/12

TestAmerica Phoenix

Erik Aasen  
Project Manager

7 of 161



Ecology and Environment - Lakewood  
 3700 Industry Ave, Suite 102  
 Lakewood, CA 90712  
 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
<b>Sample ID: PUI0848-01 (BA-2-3 - Soil)</b>								
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	
<b>Sample ID: PUI0848-02 (BA-2-4 - Soil)</b>								
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	
<b>Sample ID: PUI0848-03 (BA-2-5 - Soil)</b>								
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	

*[Handwritten Signature]* 1/12/12

TestAmerica Phoenix

Erik Aasen  
 Project Manager

7 of 138

Ecology and Environment - Lakewood  
3700 Industry Ave, Suite 102  
Lakewood, CA 90712  
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	

*M. A.* 1/12/12

TestAmerica Phoenix

Erik Aasen  
Project Manager

8 of 138

Ecology and Environment - Lakewood  
 3700 Industry Ave, Suite 102  
 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
<b>Sample ID: PUI0643-01 (BA-3-2 - Soil)</b>								
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	
<b>Sample ID: PUI0643-02 (BA-3-3 - Soil)</b>								
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	
<b>Sample ID: PUI0643-03 (BA-6-1 - Soil)</b>								
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	

*Mindy Song* 11/12/12

TestAmerica Phoenix

Erik Aasen  
 Project Manager

7 of 167

Ecology and Environment - Lakewood  
 3700 Industry Ave, Suite 102  
 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
<b>Sample ID: PUI0617-01 (BA-4-1 - Soil)</b>								
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	
<b>Sample ID: PUI0617-02 (BA-4-2 - Soil)</b>								
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	
<b>Sample ID: PUI0617-03 (BA-5-1 - Soil)</b>								
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	

*M.A.* 1/12/12

TestAmerica Phoenix

Erik Aasen  
 Project Manager

7 of 149

Ecology and Environment - Lakewood  
3700 Industry Ave, Suite 102  
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: PUI0617-04 (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	

*Mindy Song* 1/12/12

TestAmerica Phoenix

Erik Aasen  
Project Manager

8 of 149

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 Smelter  
 Report Number: PUII047

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
<b>Sample ID: PUII047-01 (BA-7-2 - Soil)</b>								
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	
<b>Sample ID: PUII047-02 (BA-7-3 - Soil)</b>								
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	
<b>Sample ID: PUII047-03 (IKMHSR-OFS-148-004-002 - Soil)</b>								
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	

*[Handwritten Signature]* 1/12/12

TestAmerica Phoenix

Erik Aasen  
 Project Manager

Ecology and Environment - Lakewood 3700 Industry Ave, Suite 102 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 Vaasen  
Project Manager

7 of 161

The results pertain only to the samples tested in the laboratory. This report shall not be reproduced, except in full, without written permission from TestAmerica.

PUK0352 <Page 2 of 5>

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
<b>Sample ID: PUI1808-01 (Arrowhead-Common-001 - Soil)</b>				<b>Sampled: 09/29/11</b>				
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	
<b>Sample ID: PUI1808-02 (Arrowhead-Common-002 - Soil)</b>				<b>Sampled: 09/29/11</b>				
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	
<b>Sample ID: PUI1808-03 (MDI-GD-Common-001 - Soil)</b>				<b>Sampled: 09/28/11</b>				
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	
<b>Sample ID: PUI1808-04 (MDI-GD-Common-002 - Soil)</b>				<b>Sampled: 09/28/11</b>				
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	
<b>Sample ID: PUI1808-05 (NCLS-Topsoil-001 - Soil)</b>				<b>Sampled: 09/29/11</b>				
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	

*MA 1/20/12*

TestAmerica Phoenix

Erik Aasen  
 Project Manager



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	

*MA* 1/20/12

TestAmerica Phoenix

Erik Aasen  
Project Manager

7 of 167

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: PUI1474-04 (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	

 1/20/12

TestAmerica Phoenix  
Brik 'aasen  
Project Manager

8 of 167

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: PUK0099-04RE1 (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	

*[Handwritten Signature]* 11/25/12

TestAmerica Phoenix

Erik Aasen  
Project Manager

7 of 127

Ecology and Environment - Lakewood  
 3700 Industry Ave, Suite 102  
 Lakewood, CA 90712  
 Mindy Song

Work Order: PUI1583  
 Project: Iron King Mine - Humboldt Smelter Removal  
 Project Number: T02-09-11-08-0005

Received: 09/27/11  
 Reported: 09/28/11 17:01

## ANALYTICAL REPORT

Analyte	Result	Qual	Date Analyzed	Analyst	Rpt Limit ug, Total	Method
<b>Metals using ICP-AES by NIOSH 7300 (Modified)</b>						
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

*M. Song* 11/10/12

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
<b>Metals using ICP-AES by NIOSH 7300 (Modified)</b>						
<b>Sample ID: PUJ1805-01 (1 KMHSR-10/10/11-AIR-1)</b>		<b>Filter</b>		<b>Sample Air Volume: 1165L</b>		<b>Sampled: 10/10/11 08:00</b>
	ug, Total	mg/m3	ppm			<b>Prepared: 11/02/11 19:20</b>
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
<b>Sample ID: PUJ1805-02 (1 KMHSR-10/10/11-AIR-2)</b>		<b>Filter</b>		<b>Sample Air Volume: 1109L</b>		<b>Sampled: 10/10/11 08:00</b>
	ug, Total	mg/m3	ppm			<b>Prepared: 11/02/11 19:20</b>
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
<b>Sample ID: PUJ1805-03 (1 KMHSR-10/10/11-AIR-3)</b>		<b>Filter</b>		<b>Sample Air Volume: 1112L</b>		<b>Sampled: 10/10/11 08:00</b>
	ug, Total	mg/m3	ppm			<b>Prepared: 11/02/11 19:20</b>
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
<b>Sample ID: PUJ1805-04 (1 KMHSR-10/10/11-AIR-4)</b>		<b>Filter</b>		<b>Sample Air Volume: 1106L</b>		<b>Sampled: 10/10/11 08:00</b>
	ug, Total	mg/m3	ppm			<b>Prepared: 11/02/11 19:20</b>
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
<b>Sample ID: PUJ1805-05 (1 KMHSR-10/10/11-AIR-FB)</b>		<b>Filter</b>		<b>Sample Air Volume: L</b>		<b>Sampled: 10/10/11 08:00</b>
	ug, Total	mg/m3	ppm			<b>Prepared: 11/02/11 19:20</b>
Arsenic	<2.50	--	--	11/3/2011	bb	2.50 NIOSH 7300
Lead	<0.312	--	--	11/3/2011	bb	0.312 NIOSH 7300

*MA* 11/10/12

Ecology and Environment - Lakewood 3700 Industry Ave, Suite 102 Lakewood, CA 90712 Mike Schwennesen	Work Order: PUK0100 Project: Iron King Mine - Humboldt Smelter Removal Project Number: T02-09-11-08-0005	Received: 11/02/11 Reported: 11/09/11 17:13
--	--	--

## ANALYTICAL REPORT

Analyte	Result	Qual	Date Analyzed	Analyst	Rpt Limit ug, Total	Method
<b>Metals using ICP-AES by NIOSH 7300 (Modified)</b>						
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

*[Handwritten Signature]* 11/10/12

Ecology and Environment - Lakewood 3700 Industry Ave, Suite 102 Lakewood, CA 90712 Mike Schwennesen	Work Order: PUK0709 Project: Iron King Mine - Humboldt Smelter Removal Project Number: T02-09-11-08-0005	Received: 11/09/11 Reported: 11/17/11 08:58
--	--	--

## ANALYTICAL REPORT

Analyte	Result	Qual	Date Analyzed	Analyst	Rpt Limit ug, Total	Method
<b>Metals using ICP-AES by NIOSH 7300 (Modified)</b>						
<b>Sample ID: PUK0709-01 (IKMHSR-11/8/11-AIR-1)</b>		<b>Filter</b>		<b>Sample Air Volume: 1281L</b>		<b>Sampled: 11/08/11</b>
	ug, Total	mg/m3	ppm			<b>Prepared: 11/14/11 18:50</b>
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
<b>Sample ID: PUK0709-02 (IKMHSR-11/8/11-AIR-2)</b>		<b>Filter</b>		<b>Sample Air Volume: 1212L</b>		<b>Sampled: 11/08/11</b>
	ug, Total	mg/m3	ppm			<b>Prepared: 11/14/11 18:50</b>
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
<b>Sample ID: PUK0709-03 (IKMHSR-11/8/11-AIR-3)</b>		<b>Filter</b>		<b>Sample Air Volume: 1283L</b>		<b>Sampled: 11/08/11</b>
	ug, Total	mg/m3	ppm			<b>Prepared: 11/14/11 18:50</b>
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
<b>Sample ID: PUK0709-04 (IKMHSR-11/8/11-AIR-FB)</b>		<b>Filter</b>		<b>Sample Air Volume: L</b>		<b>Sampled: 11/08/11</b>
	ug, Total	mg/m3	ppm			<b>Prepared: 11/14/11 18:50</b>
Arsenic	<2.50	--	--	11/15/2011	bb	2.50 NIOSH 7300
Lead	<0.312	--	--	11/16/2011	MDD	0.312 NIOSH 7300

*[Handwritten Signature]* 11/10/12

**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.

<b>Common Soil</b>				
<b>Date</b>	<b>Origin</b>	<b>Load Count</b>	<b>Weight (tons)</b>	<b>Total Import (tons)</b>
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.



**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 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.

**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 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.

**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 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.

**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 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 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 *DM*  
Rick Leuser, SERAS Deputy Program Manager *RL*

FROM: David Aloysius, PG/CPG, SERAS Task Leader *DA*

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 (Maynard *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:

### Diversion Channel Construction Materials

- 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 stormwater 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.

#### TSP Design Summary

- 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.

#### TSP Materials Summary

- 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

#### Photo-Documentation

A number of photos obtained during the on-site construction activities are presented in Appendix A.

## REFERENCES

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.

Creasey, S.C., 1952. Geology of the Iron King Mine, Yavapai County, Arizona. Economic Geology, Vol. 47, No. 1, pp. 24-56. January 1952.

Federal Highway Administration (FHWA), 2001. Urban Drainage Design Manual. Hydrologic Engineering Circular No. 22, 2<sup>nd</sup> edition. Publication No. FHWA-NHI-01-021. U.S. Department of Transportation. Prepared in cooperation with the National Highway Institute. August 2001.

McCuen, R.H., 1998. Hydrologic Analysis and Design. Prentice Hall. 2<sup>nd</sup> edition.

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.

Maynard, 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

Watershed-Hydrologic Data

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

Diversion Channel Hydraulic Data

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

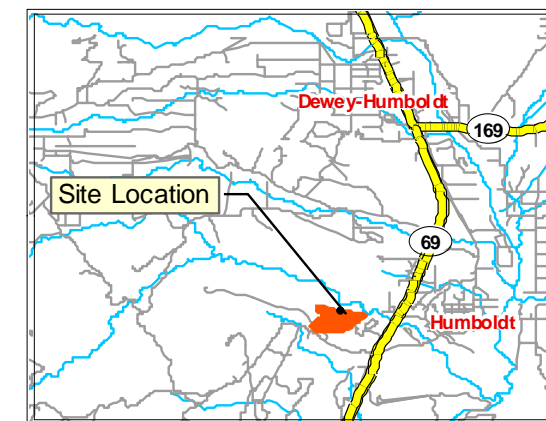
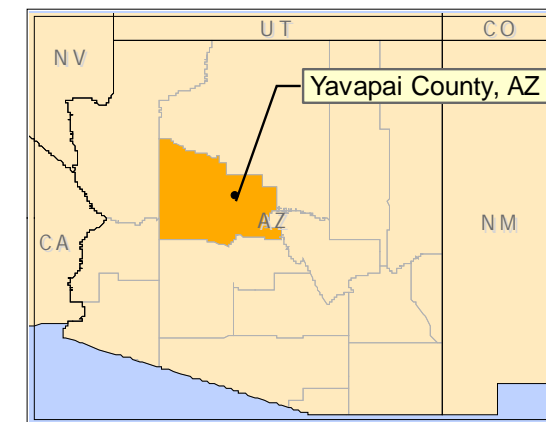
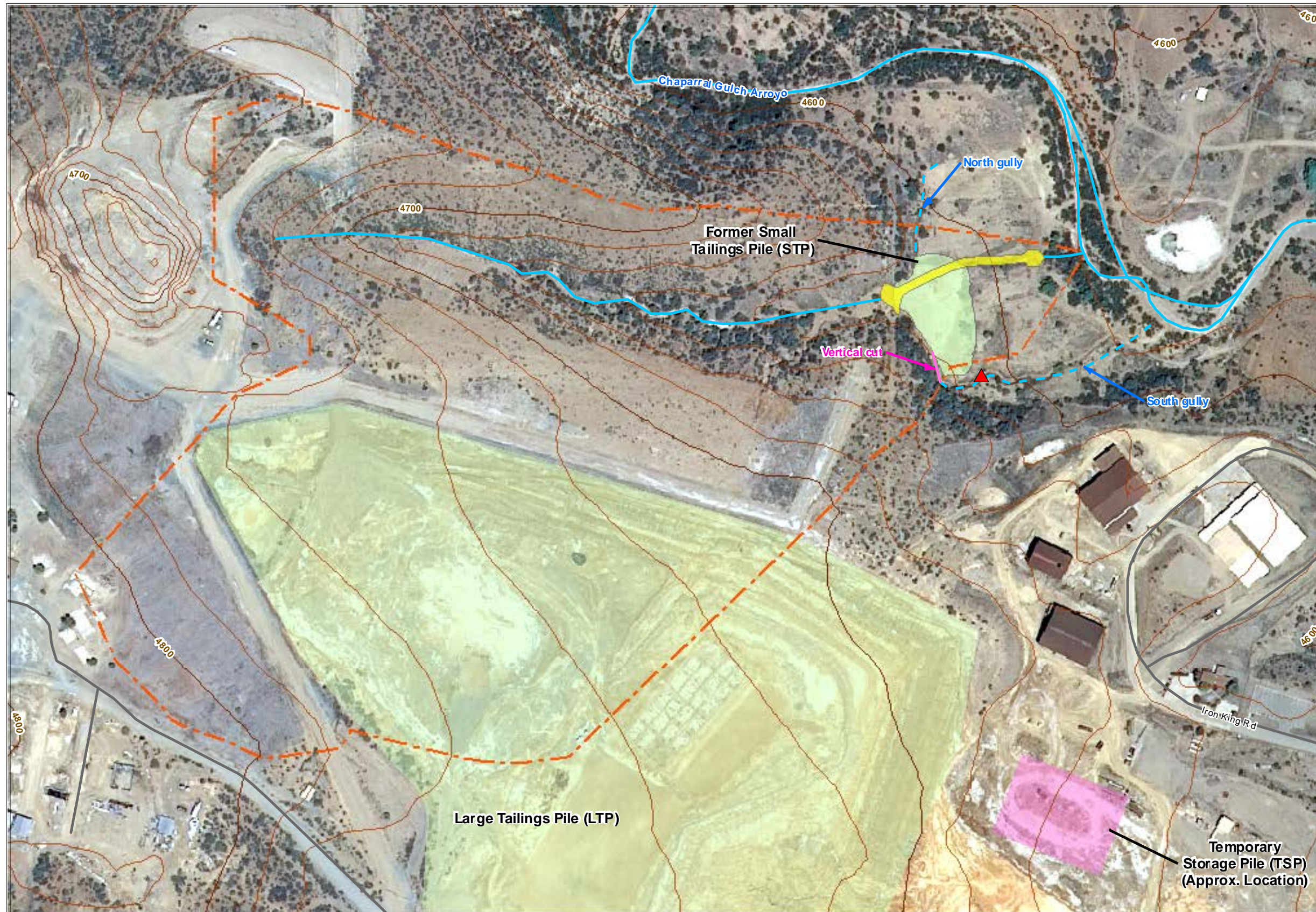
Channel Riprap Specifications

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





**Legend**

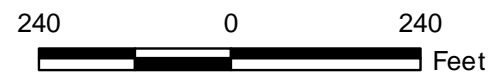
- ▲ Riprap Outfall
- Drainage Channel
- - - Gully Drainage
- Index Contour  
(C.I. = 100 feet)
- - - Intermediate Contour  
(C.I. = 20 feet)
- Riprap-Lined Diversion Channel  
(Channel Length = 402.4 feet)
- - - Sub-Watershed  
(48.08 Acres)

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

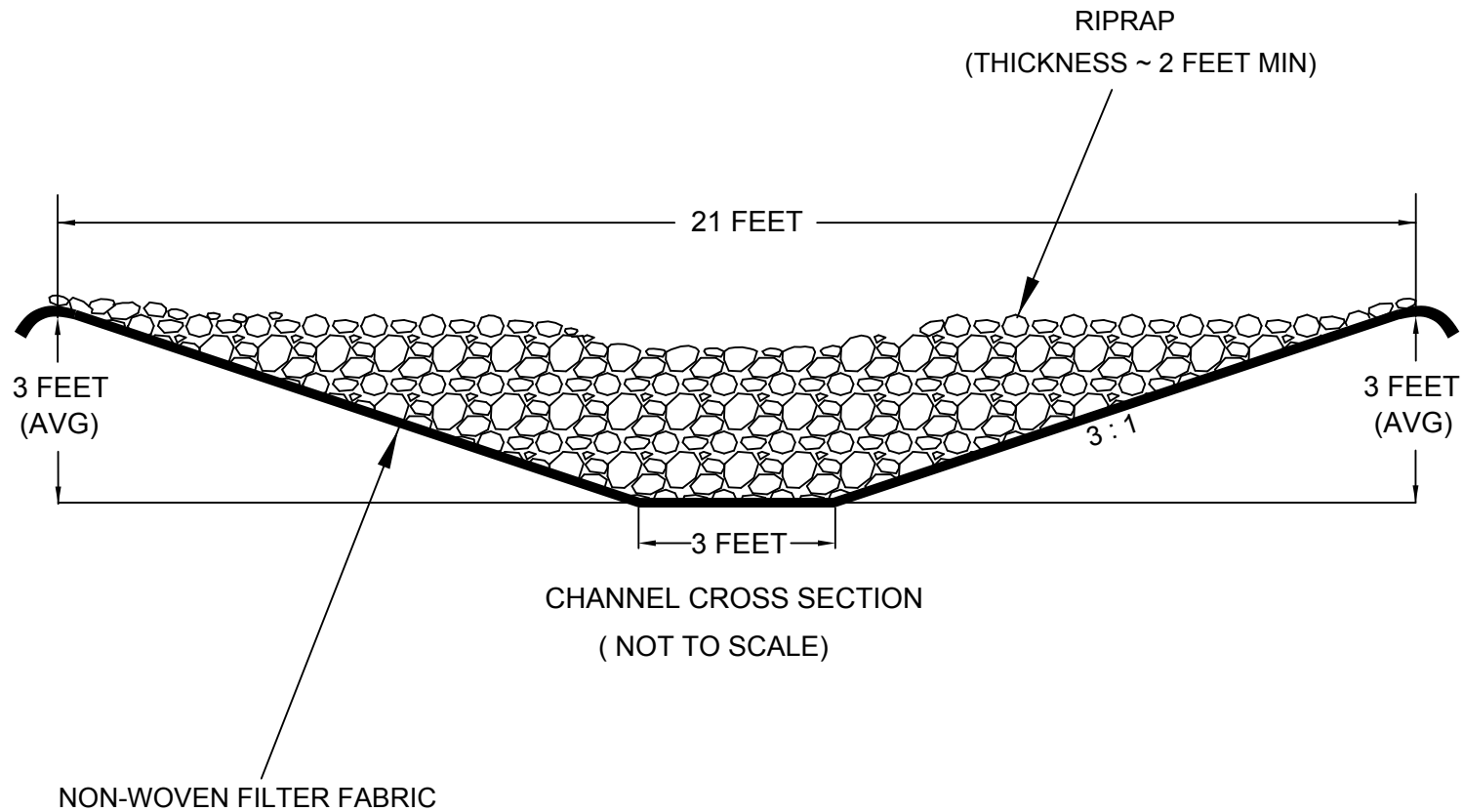
Coordinate system: Arizona State Plane  
FIPS: 0202  
Datum: NAD83  
Units: Feet

Data: g:\arcview\projects\SERAS01\00-146  
MXD file: g:\arcview\projects\SERAS01\SER00146\_IronKingMineSite\146\_TM2011\_Investigation\_Area\_FinalDesign\_f1



U.S EPA Environmental Response Team  
Scientific Engineering Response and Analytical Services  
EP-W-09-031  
W.A. # 0-146

Figure 1  
Investigation Area: Final Design  
Iron King Mine Site Hydrologic Restoration  
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

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



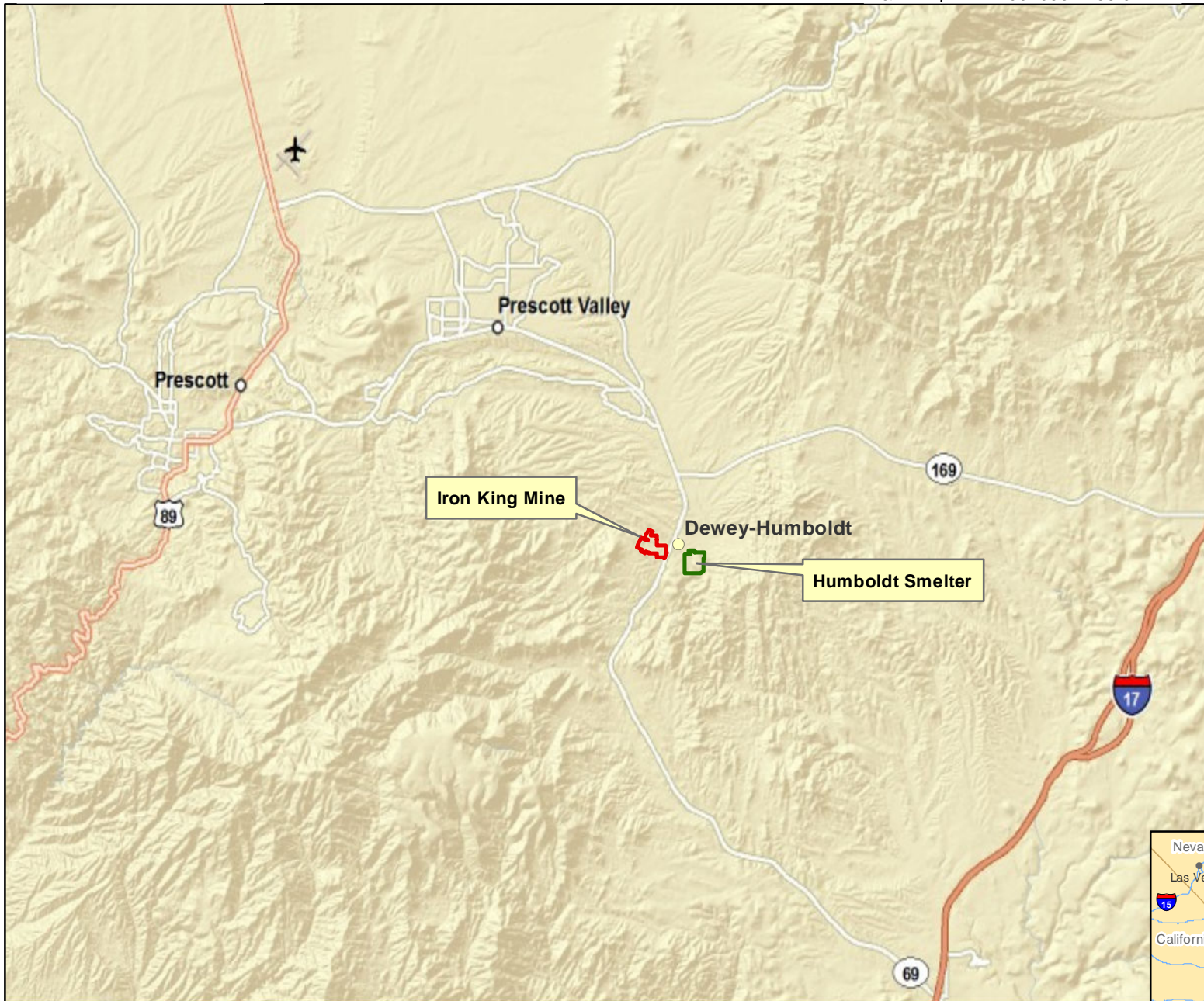
Completed diversion channel, looking downstream from NP area





Temporary storage pile (tailings repository)

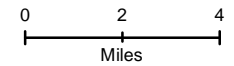
# A

## Figures and Tables



**Legend**

-  Iron King Mine
-  Humboldt Smelter

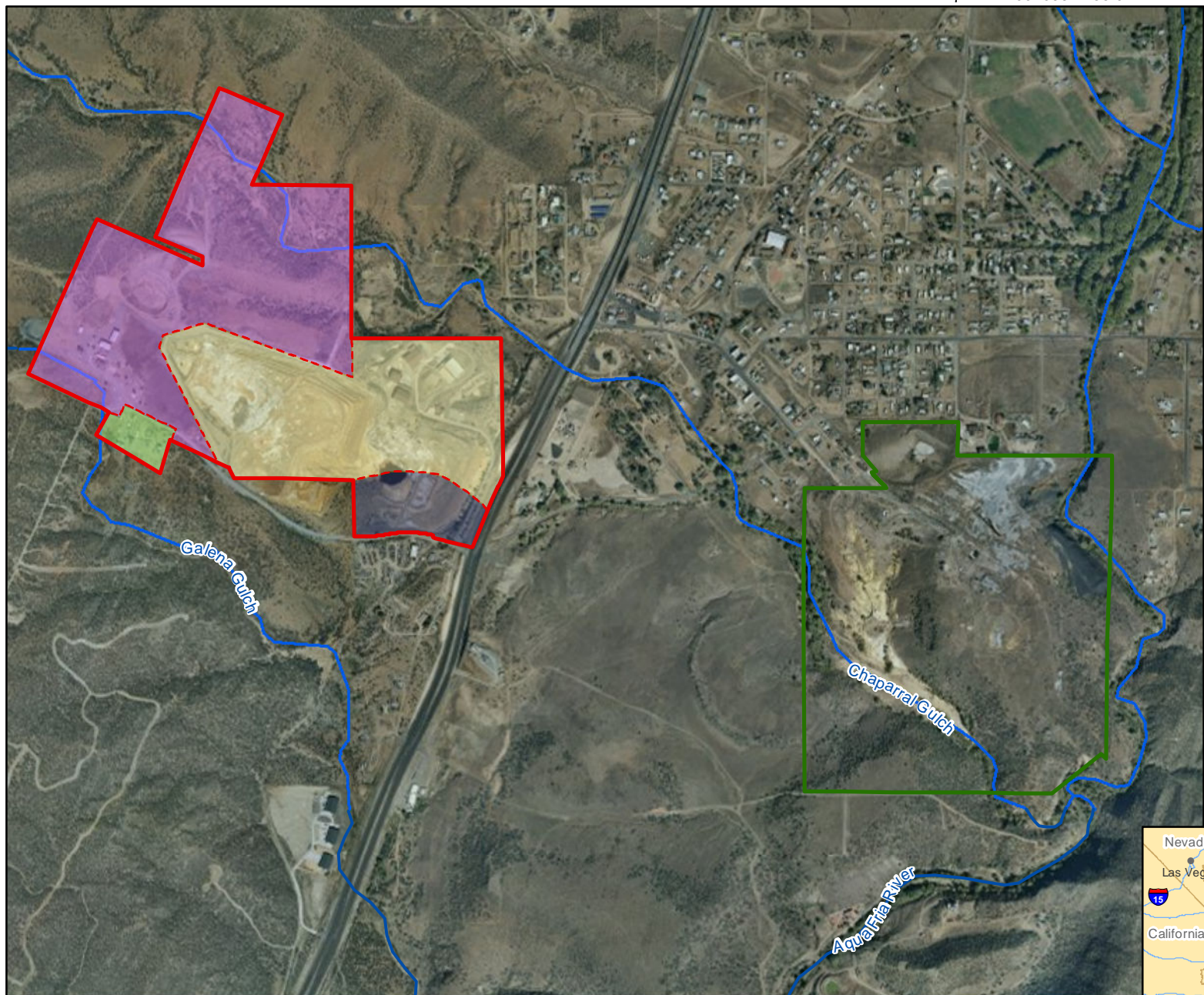


Source:  
Background: ESRI World Street Map




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

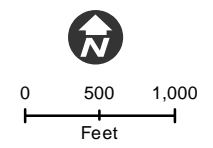
Iron King Mine - Humboldt Smelter Removal Site  
Dewey-Humboldt, Yavapai County, Arizona



**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



Source:  
Aerial Photo: ESRI World Imagery  
EA Remedial Investigation Report,  
Revision 01, March 2010



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

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

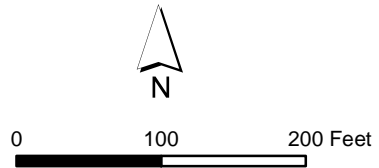
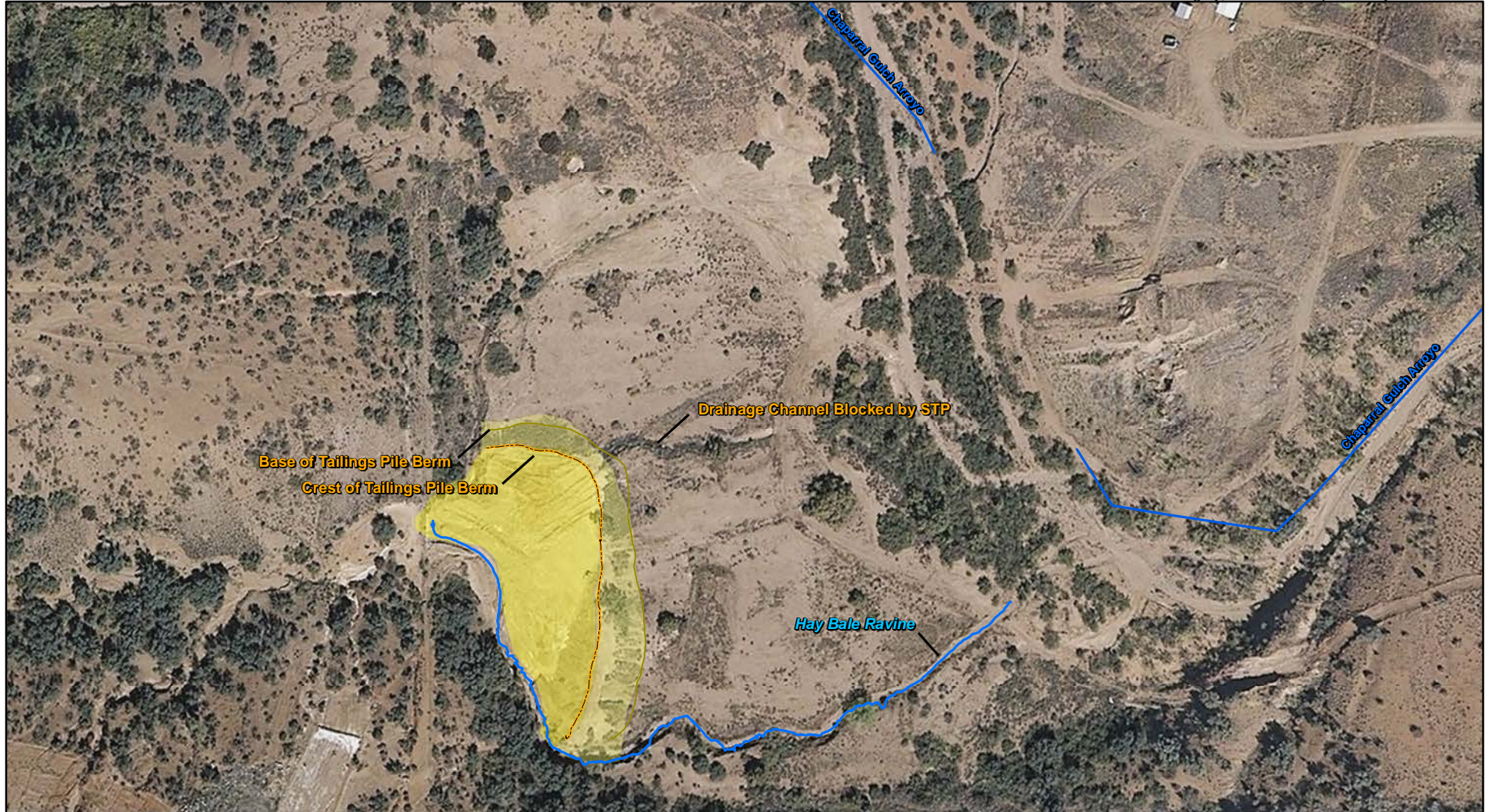
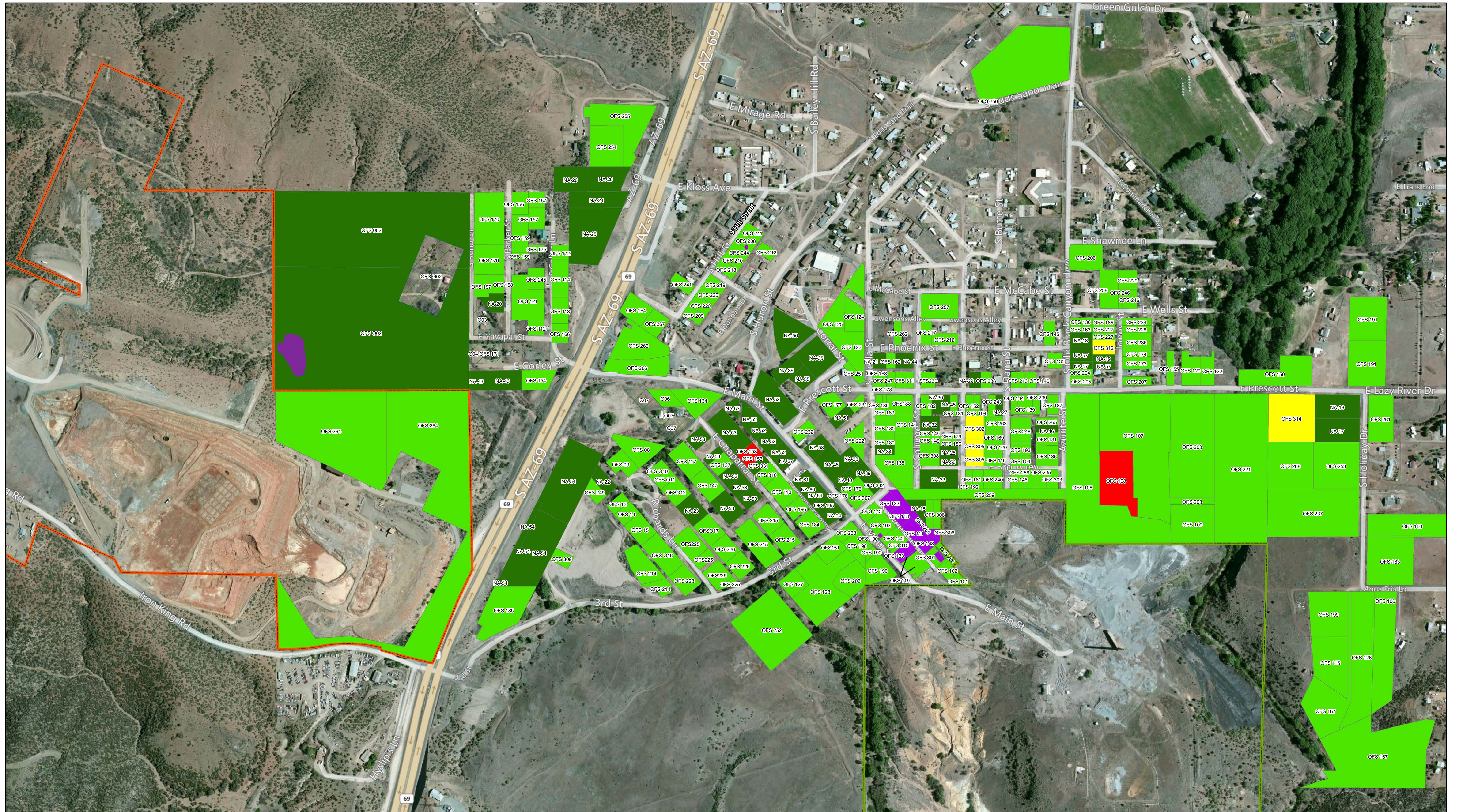


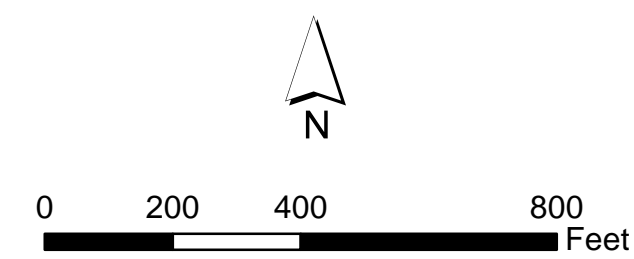
Figure 3  
Former Small Tailings Pile  
Iron King Mine - Humboldt Smelter Removal  
Dewey-Humboldt, Yavapai County, AZ





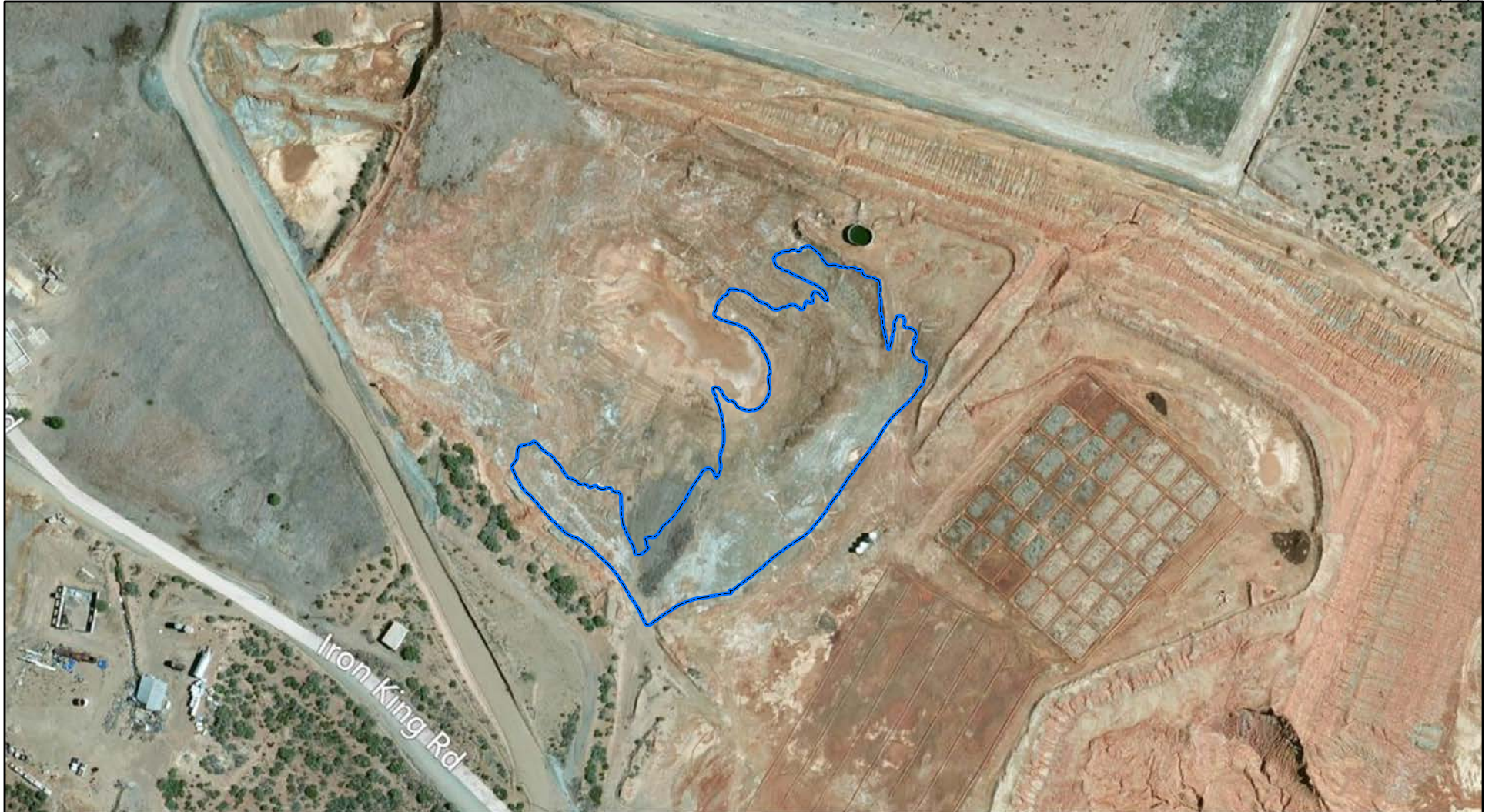
- |  |   |  |
|--|---|--|
| <span style="display:inline-block; width:15px; height:15px; background-color:darkgreen; border:1px solid black;"></span> Visually Assessed; No Current Removal Program Action Recommended  | <span style="display:inline-block; width:15px; height:15px; background-color:red; border:1px solid black;"></span> Additional Removal Assessment Sampling Recommended; Unable to Obtain Access    | <span style="display:inline-block; width:15px; height:15px; border:1px solid black;"></span> Parcels |
| <span style="display:inline-block; width:15px; height:15px; background-color:lightgreen; border:1px solid black;"></span> Previously Assessed and Data Reviewed; No Current Removal Program Action Recommended   | <span style="display:inline-block; width:15px; height:15px; background-color:yellow; border:1px solid black;"></span> Yellow: Potential Candidate for Removal Assessment; Unable to Obtain Access |  |
| <span style="display:inline-block; width:15px; height:15px; background: repeating-linear-gradient(45deg, transparent, transparent 2px, black 2px, black 4px); border:1px solid black;"></span> No Further Removal Action Recommended; Removal Action Performed in 2006 | <span style="display:inline-block; width:15px; height:15px; border:2px solid orange;"></span> Iron King Mine  |  |
| <span style="display:inline-block; width:15px; height:15px; background-color:purple; border:1px solid black;"></span> Removal Conducted  | <span style="display:inline-block; width:15px; height:15px; border:2px solid green;"></span> Humboldt Smelter   |  |

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






**LEGEND**

 Footprint



0 200 400 Feet

A horizontal scale bar with markings at 0, 200, and 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**



**LEGEND**



Removal Area



0 50 100 Feet




**Figure 6**  
**OFS-103 Removal Area**  
**Iron King Mine - Humboldt Smelter Removal**  
**Yavapai County, Arizona**



**LEGEND**


 Removal area

 Humboldt Smelter

**1** = Confirmation Sample Identifier  
(represents sample OFS-111-001)




0 50 100 Feet



**Figure 7**  
**OFS-111 Removal Areas**  
**Iron King Mine - Humboldt Smelter Removal**  
**Yavapai County, Arizona**




**LEGEND**

 Removal area



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**



**LEGEND**



Removal area



= Confirmation Sample Identifier  
(represents sample OFS-132-001)





0 50 100 Feet



**Figure 9**  
**OFS-132 Removal Areas**  
**Iron King Mine - Humboldt Smelter Removal**  
**Yavapai County, Arizona**



**LEGEND**

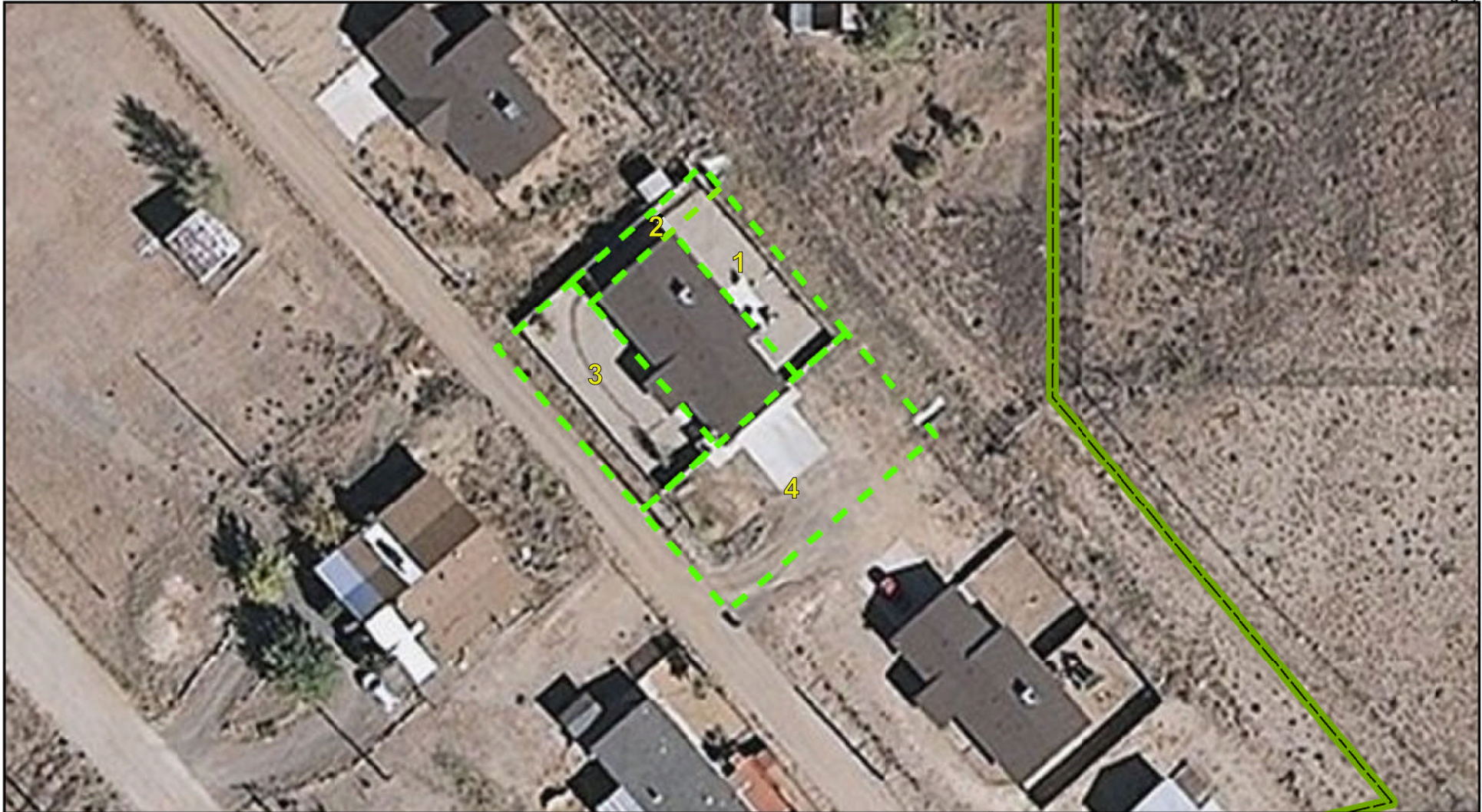
-  Removal area
-  Humboldt Smelter

**1** = Confirmation Sample Identifier  
(represents sample OFS-133-001)




0 50 100 Feet

**Figure 10**  
**OFS-133 and OFS-119 Removal Areas**  
**Iron King Mine - Humboldt Smelter Removal**  
**Yavapai County, Arizona**



**LEGEND**


 Removal area

 Humboldt Smelter

**1** = Confirmation Sample Identifier  
(represents sample OFS-148-001)



0 50 100 Feet



**Figure 11**  
**OFS-148 Removal Areas**  
**Iron King Mine - Humboldt Smelter Removal**  
**Yavapai County, Arizona**



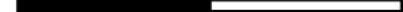


**LEGEND**

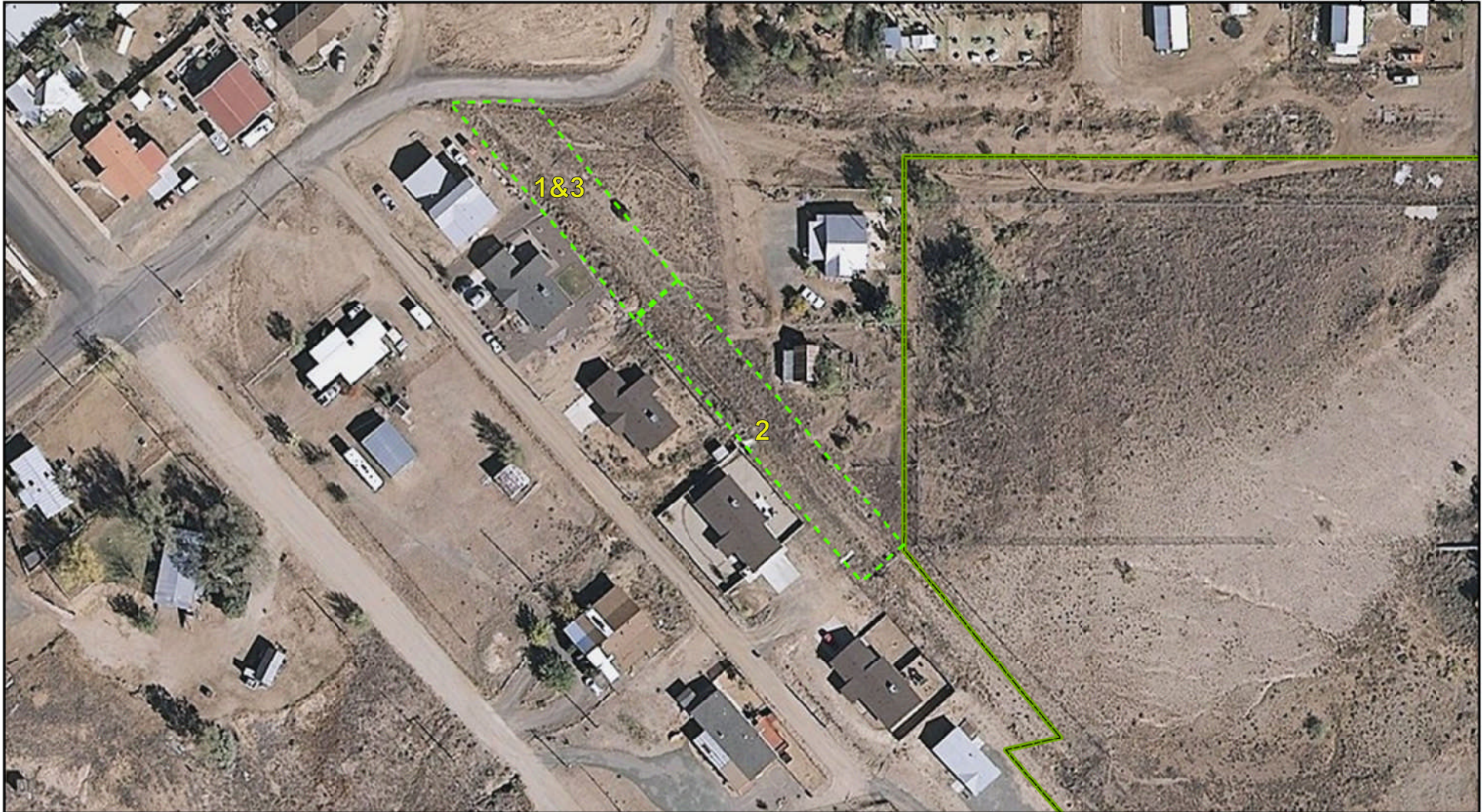
 Removal area



0 50 100 Feet



**Figure 12**  
**OFS-208 and OFS-244 Removal Area**  
**Iron King Mine - Humboldt Smelter Removal**  
**Yavapai County, Arizona**



**LEGEND**



Removal area



Humboldt Smelter

**2** = Confirmation Sample Identifier  
(represents sample OFS-260-002)





0 100 200 Feet

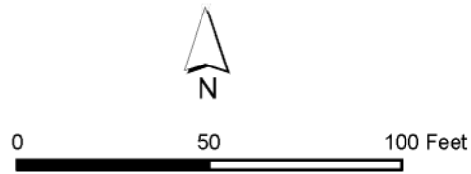


**Figure 13**  
**OFS-260 Removal Areas**  
**Iron King Mine - Humboldt Smelter Removal**  
**Yavapai County, Arizona**

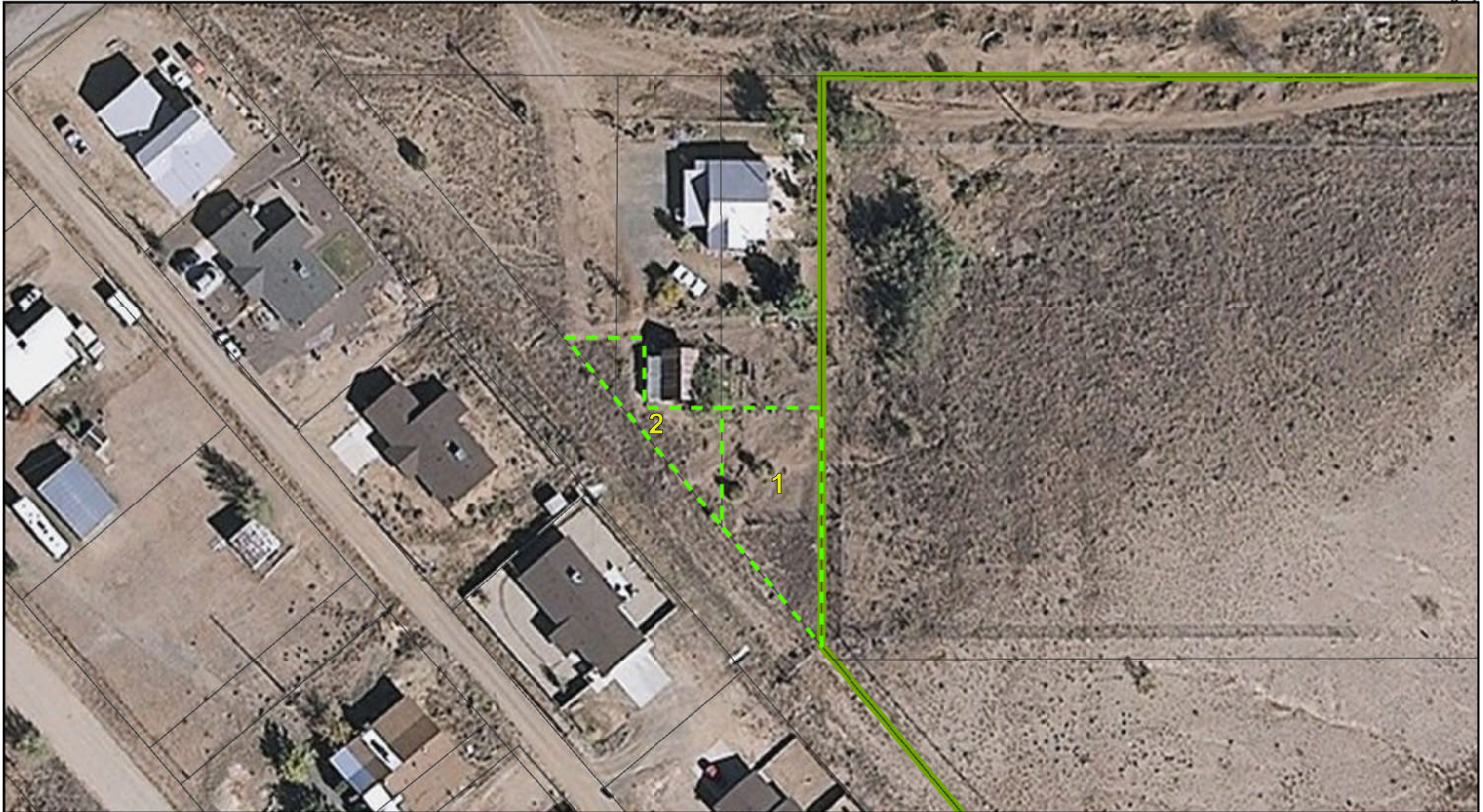


**LEGEND**

-  Removal area
-  Humboldt Smelter
- 2** = Confirmation Sample Identifier  
(represents sample OFS-301-002)



**Figure 14**  
**OFS-301 Removal Areas**  
**Iron King Mine - Humboldt Smelter Removal**  
**Yavapai County, Arizona**



**LEGEND**



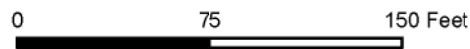
Removal Area



Humboldt Smelter

**1**

= Confirmation Sample Identifier  
(represents sample OFS-306-001)



**Figure 15**  
**OFS-306 Removal Areas**  
**Iron King Mine - Humboldt Smelter Removal**  
**Yavapai County, Arizona**

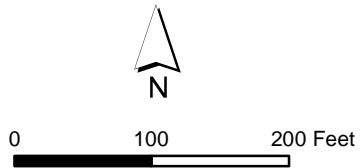
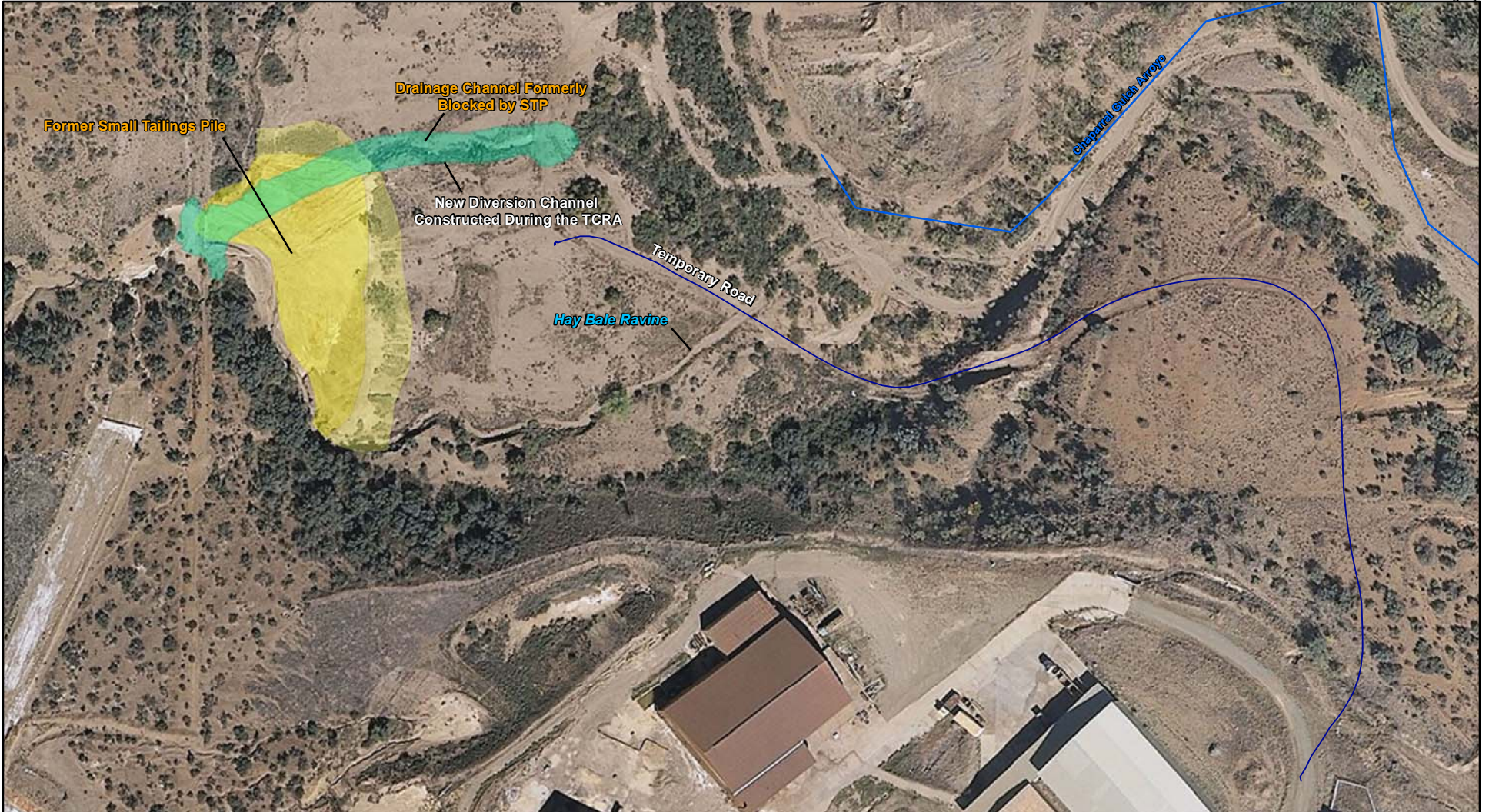
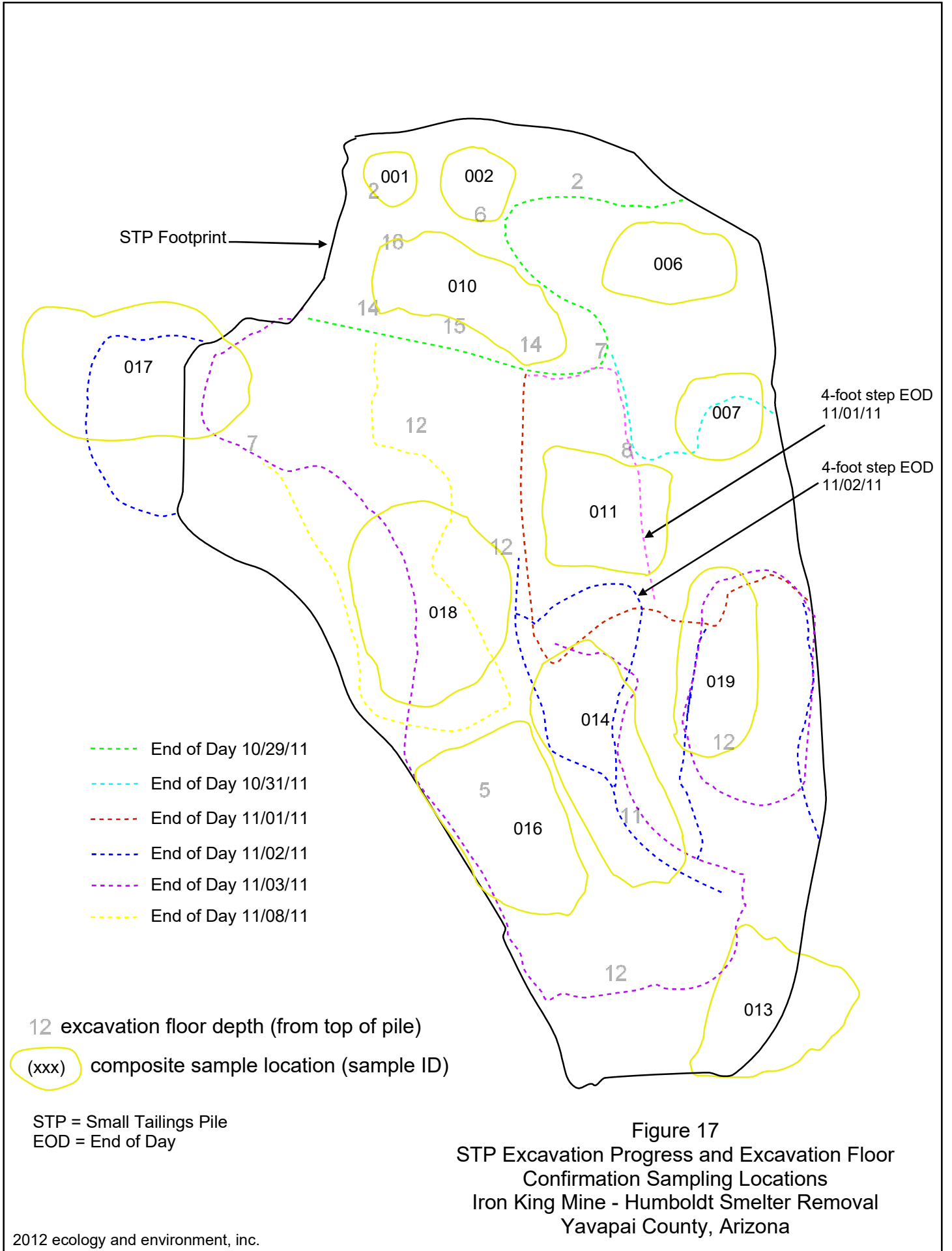


Figure 16  
New Diversion Channel and  
Location of Temporary Road  
Iron King Mine - Humboldt Smelter Removal  
Dewey-Humboldt, Yavapai County, AZ



**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
<b>Complete Removal</b>	OFS 111	402-06-102L	2925 South Sweet Pea Lane	PO Box 485 Humboldt, AZ 86329	0.27
	OFS 118	402-06-102K	2905 South Sweet Pea Lane	PO Box 508 Humboldt, AZ 86329	0.27
	OFS 132	402-06-102P	2875 South Third Street	PO Box 122 Humboldt, AZ 86329	0.25
	OFS 260	800-27-005T	Unsurfaced right-of-way behind Sweet Pea Lane	Municipal property	0.5 (approx.)
	OFS 148	402-06-102M	2945 Sweet Pea Lane	1575 Purple Sage Road Chino Valley, AZ 86323	0.27
	OFS 133 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
<b>Hot-Spot Removal</b>		402-07-007C	13080 East Main Street	PO Box 552 Humboldt, AZ 86329	0.48
	OFS-103	402-07-002B	13030 East Main Street	PO Box 488 Humboldt, AZ 86329	0.46
	OFS 208 OFS-244 (one hot spot between two parcels)	402-09-016D	2565 Hill Street	PO Box 32 Humboldt, AZ 86329	0.21
		402-09-016H	2575 Hill Street	PO Box 548 Humboldt, AZ 86329	0.21
	OFS-002 (hot spot is the STP)	402-08-034A	12470 East Yavapai Road	PO Box 721 Dewey, AZ 86327	0.6
	OFS-301	402-06-102N	2965 Sweet Pea Lane	PO Box 905 Humboldt, AZ 86329	0.28
	OFS-306	402-06-026	13087 E. Main Street	PO Box 699	0.19
402-06-027B		13089 E. Main Street	Humboldt, AZ 86329	0.32	

2012 ecology and environment, inc.



Table 2  
Air Monitoring and Sampling Results  
Iron King Mine - Humboldt Smelter Removal  
(mg/m<sup>3</sup>)

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<sup>3</sup> - 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<sup>3</sup>)

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 between 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<sup>3</sup> - 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<sup>3</sup>)

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<sup>3</sup>

2012 ecology and environment, inc.

Notes:

As - Arsenic

Pb - Lead

mg/m<sup>3</sup> - 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	<b>350</b>	8.7	390	<0.50	120
	BA-1-2	<b>210</b>	<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		<b>43</b>	<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	<b>5000</b>	<b>5100</b>
	OFS-002-006 (excavation floor)	11/1/2011	<b>42</b>	<b>42</b>
	OFS-002-007 (excavation floor)	11/1/2011	<b>110</b>	<b>71</b>
	OFS-002-008 ("berm soil")	11/1/2011	<b>86</b>	<b>85</b>
	OFS-002-009 (tailings wall)	11/1/2011	<b>1300</b>	<b>2000</b>
	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	<b>190</b>	<b>31</b>
	OFS-002-013 (excavation floor)	11/3/2011	<b>43</b>	<b>25</b>
	OFS-002-014 (excavation floor)	11/9/2011	<b>67 J</b>	<b>65 J</b>
	OFS-002-016 (excavation floor)	11/9/2011	<b>50 J</b>	<b>32 J</b>
	OFS-002-017 (excavation floor)	11/10/2011	<b>200 J</b>	<b>160</b>
OFS-002-018 (excavation floor)	11/10/2011	22 J	9.1	
OFS-002-019 (excavation floor)	11/10/2011	<b>56 J</b>	<b>47</b>	
OFS-103 13030 East Main Street	OFS-103 001 (2 foot)	9/27/2011	<b>62</b>	<b>180</b>
OFS-111 2925 Sweet Pea Lane	OFS-111-001 (2 foot) below shed	9/15/2011	<b>170</b>	<b>460</b>
	OFS-111-002 (1 foot)	9/19/2011	<b>84</b>	<b>460</b>
	OFS-111-003 (1 foot)		<b>160</b>	<b>620</b>
	OFS-111-004 (1 foot)		<b>180</b>	<b>880</b>
	OFS-111-005 (1 foot)		<b>190</b>	<b>820</b>
	OFS-111-006 (2 foot) (same location as -004)	9/26/2011	<b>120</b>	<b>390</b>
	OFS-111-007 (2 foot) (same location as -002)		<b>140</b>	<b>290</b>
	OFS-111-008 (2 foot) (same location as -003)		<b>180</b>	<b>570</b>
OFS-111-009 (2 foot) (same location as -005)	<b>160</b>		<b>610</b>	
OFS-118 2905 Sweet Pea Lane	OFS-118-001 (2 foot)	10/6/2011	<b>95</b>	<b>310</b>
	OFS-118-002 (2 foot)	10/7/2011	<b>85</b>	<b>400</b>
	OFS-118-003 (2 foot)		<b>250</b>	<b>820 J</b>
	OFS-118-004 (2 foot)		<b>98</b>	<b>620 J</b>
OFS-132 2875 South Third Street	OFS-132-001 (1 foot)		9/17/2011	<b>100</b>
	OFS-132-002 (1 foot)	20		52
	OFS-132-003 (1 foot)	<b>130</b>		<b>480</b>
	OFS-132-004 (1 foot)	<b>200</b>		<b>1400</b>
	OFS-132-005 (2 foot) (same location as -004)	10/3/2011	<b>93</b>	<b>320</b>
	OFS-132-006 (2 foot) (same location as -002)		14	23
	OFS-132-007 (2 foot) (same location as -001)		<b>52</b>	<b>400</b>
	OFS-132-008 (2 foot) ((same location as -003)		<b>150</b>	<b>660</b>
OFS-133 and OFS-119 13070 Main Street	OFS-133-001 (2 foot)	10/11/2011	<b>320</b>	<b>1000 J</b>
	OFS-133-002 (2 foot) <sup>1</sup>	10/13/2011	<b>71</b>	<b>220 J</b>
	OFS-133-003 (2 foot)	10/12/2011	<b>240</b>	<b>720 J</b>
	OFS-133-004 (2 foot)	10/24/2011	<b>90</b>	<b>280</b>
OFS-148 2945 Sweet Pea Lane	OFS-148-001 (1 foot)	9/15/2011	<b>180</b>	<b>760</b>
	OFS-148-002 (1 foot)		<b>200</b>	<b>850</b>
	OFS-148-003 (1 foot)		29	67
	OFS-148-004 (1 foot)	9/16/2011	<b>120</b>	<b>470</b>
	OFS-148-006 (2 foot) (same location as -003)	9/21/2011	<b>69 J</b>	<b>450 J</b>
	OFS-148-007 (2 foot) (same location as -002)		<b>120 J</b>	<b>470 J</b>
	OFS-148-008 (2 foot) (same location as -001)		<b>290 J</b>	<b>1500 J</b>
	OFS-148-009 (2 foot) (same location as -004)		<b>93 J</b>	<b>380 J</b>
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	<b>220</b>	<b>870</b>
	OFS-260-002 (composite, 2 foot)	10/5/2011	<b>200</b>	<b>700</b>
	OFS-260-003 (partial pothole composite, 2 foot)		<b>75</b>	<b>330</b>
OFS-301 2965 Sweet Pea Lane	OFS-301-001 (2 foot) outside of fence	9/26/2011	<b>110</b>	<b>770</b>
	OFS-301-002 (2 foot)	9/27/2011	<b>69</b>	<b>230</b>
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)		<b>54</b>	<b>81</b>
	OFS-306-003 (2 foot) (same location as -001)	9/26/2011	29	59
	OFS-306-004 (2 foot) (same location as -002)		<b>52</b>	<b>180</b>

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.

<sup>1</sup> - 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	TTLIC	Site-Specific Action Level	Sample Result
Antimony	500	none	40 J
Arsenic	500	38	<b>5,000</b>
Barium	10,000	5,300	26
Beryllium	75	none	<0.50
Cadmium	100	38	<b>120</b>
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	<b>17</b>
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	<b>48,000</b>
Total Cyanide	NA	none	1.9

Notes:

CAM-17 - California Assessment Manual 17 metals

J - Estimated concentration

NA - Not applicable

TTLIC - California Title 22 Total Threshold Limit Concentration

Results in **bold** exceed site-specific action levels

2012 ecology and environment, inc.

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



November 2012 Modifications

- Rock-lined spillway
- Swale
- Compacted soil berm
- French drain

Approximate property boundary

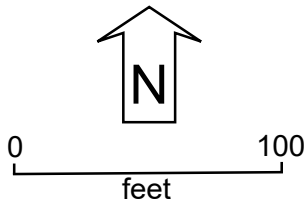


Figure 1  
U.S. EPA Modifications to Properties On  
or Near Sweet Pea Lane  
Dewy-Humboldt, Arizona

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	
Sample ID	Date Collected	Result (mg/kg)	
		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.			
2013 ecology and environment, inc.			

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<sup>3</sup>), 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<sup>3</sup>. 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 <sup>3</sup> )	
		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 <sup>3</sup> = milligrams per cubic meter ND - not detected above laboratory detection limit. Based on an ND value for total micrograms on filter.			
2013 ecology and environment, inc.			

## 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,

A handwritten signature in black ink, appearing to read "M. Schwennesen", with a long horizontal flourish extending to the right.

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.

**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 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.





**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 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.



**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 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.

**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 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**



Ecology and Environment - Lakewood 3700 Industry Ave, Suite 102 Lakewood, CA 90712 Mindy Song	Work Order: PVK1217	Received: 11/16/12 Reported: 11/26/12 16:20
	Project: Iron King Mine - Humboldt Smelter Removal	
	Project Number: 002693.2155.01RF06	

## ANALYTICAL REPORT

Analyte	Result	Qual	Date Analyzed	Analyst	Rpt Limit ug, Total	Method
<b>Metals using ICP-AES by NIOSH 7300 (Modified)</b>						
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

*AM* 11/4/2013

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

4625 East Colton 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 (TKMHSR-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 (TKMHSR-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

*The results pertain only to the samples tested in the laboratory. This report shall not be reproduced, except in full, without written permission from TestAmerica.*

PVK1212 **7 of 167**  
<page 2 of 3>


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<sub>2</sub>) 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:

$$\text{MDL} = t(n-1,99) * \Phi_s$$

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 Number	Sample Location	Lead (mg/kg)		Arsenic (mg/kg)	
		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	<b>355</b>	50	143	35.5
30W-018-1	30W-018	105	50	35 U	35
30W-019-1	30W-019	<b>523</b>	50	137	52.3
30W-020-1	30W-020	<b>540</b>	50	<b>210</b>	54.0
30W-021-1	30W-021	<b>1,165</b>	50	<b>245</b>	117
30W-022-1	30W-022	173	50	51	35
30W-023-1	30W-023	210	50	78	35
30W-024-1	30W-024	<b>617</b>	50	<b>231</b>	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	<b>312</b>	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	<b>333</b>	50	43	35
36W-009-1	36W-009	<b>738</b>	50	<b>208</b>	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	<b>313</b>	50	111	35
36W-014-1	36W-014	<b>853</b>	50	<b>218</b>	85.3
36W-015-1	36W-015	<b>1,180</b>	50	<b>259</b>	118
36W-016-1	36W-016	138	50	35 U	35
36W-017-1	36W-017	<b>1,505</b>	50	<b>396</b>	151
36W-018-1	36W-018	<b>820</b>	50	<b>475</b>	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 Number	Sample Location	Lead (mg/kg)		Arsenic (mg/kg)	
		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 Number	Sample Location	Lead (mg/kg)		Arsenic (mg/kg)	
		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	<b>410</b>	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 Number	Sample Location	Lead (mg/kg)		Arsenic (mg/kg)	
		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	<b>369</b>	50	<b>440</b>	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	<b>399</b>	50	<b>392</b>	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	<b>484</b>	50	<b>442</b>	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 Number	Sample Location	Lead (mg/kg)		Arsenic (mg/kg)	
		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	<b>311</b>	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 Number	Sample Location	Lead (mg/kg)		Arsenic (mg/kg)	
		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 Number	Sample Location	Lead (mg/kg)		Arsenic (mg/kg)	
		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 <sup>2</sup> 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.

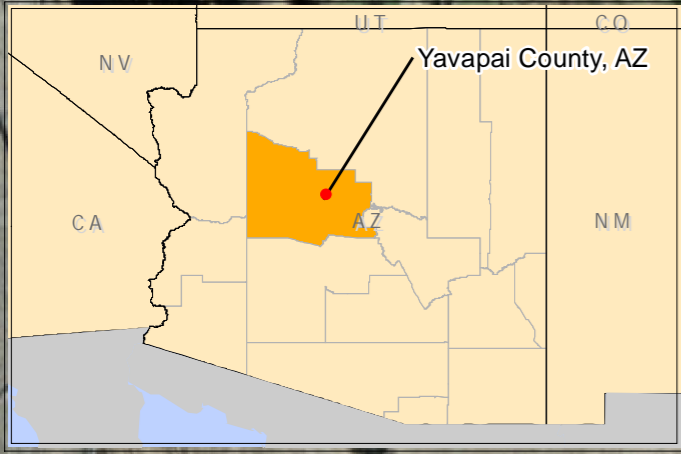
ND = Analyte was not detected above the Detection Limit

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**



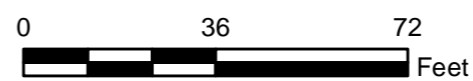
Base map created using 2010 orthoimagery, sample location from 2013 GPS survey and sample result data from 2013.

Map Creation Date: 01 September 2013

Coordinate system: Arizona State Plane Central  
 FIPS: 0202  
 Datum: NAD83  
 Units: Feet

Legend

- Sampling Location
- Tailing Piles
- Property Boundary



U.S. EPA Environmental Response Team  
 Scientific Engineering Response and Analytical Services  
 EP-W-09-031  
 W.A.# 0-146

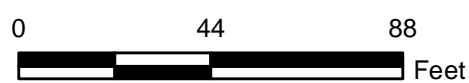
Figure 1  
 Sample Location Map  
 Iron King Mine Site  
 Dewey-Humboldt, Arizona



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



U.S. EPA Environmental Response Team  
 Scientific Engineering Response and Analytical Services  
 EP-W-09-031  
 W.A.# 0-146

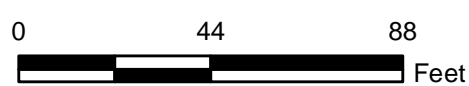
Figure 2  
 Lead Concentration  
 Iron King Mine Site  
 Dewey-Humboldt, Arizona



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



Data: g:\arcviewprojects\SERAS01\00-146  
 MXD file: g:\arcinfo\projects\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)	Arsenic (mg/kg)
		Concentration	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)	Arsenic (mg/kg)
		Concentration	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)	Arsenic (mg/kg)
		Concentration	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)	Arsenic (mg/kg)
		Concentration	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)	Arsenic (mg/kg)
		Concentration	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)	Arsenic (mg/kg)
		Concentration	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)	Arsenic (mg/kg)
		Concentration	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

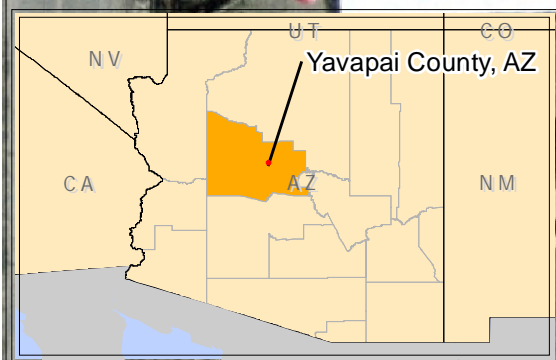
Sample Number	Depth	Lead (mg/kg)	Arsenic (mg/kg)
		Concentration	Concentration
36W-026-1	0 to 2 inches	1,135	366
36W-026-2	10 to 14 inches	50 U	35 U
36W-026-3	22 to 26 inches	50 U	35 U
36W-026-4	34 to 38 inches	50 U	35 U

Sample Number	Depth	Lead (mg/kg)	Arsenic (mg/kg)
		Concentration	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

Old Black Canyon Hwy

Wells St

Jones St



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:\arcinfo\projects\SERAS01\SER00146\_IronKingMineSite\ARS\_WJ\146\_ASR\_WJ\_Subsurface\_Concentration\_Map\_f4

**Legend**

<b>Lead Concentration (mg/kg)</b>	<b>Arsenic Concentration (mg/kg)</b>
<span style="color: green;">●</span> < 300	<span style="color: lightgreen;">●</span> < 150
<span style="color: red;">●</span> >= 300	<span style="color: darkred;">●</span> >= 150



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

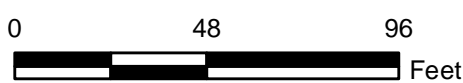


Base map created using 2010 orthoimagery, sample location from 2013 GPS survey and sample result data from 2013.

Map Creation Date: 02 September 2013

Coordinate system: Arizona State Plane Central  
 FIPS: 0202  
 Datum: NAD83  
 Units: Feet

Data: g:\arcviewprojects\SERAS01\00-146  
 MXD file: g:\arcinfo\projects\SERAS01\SER00146\_IronKingMineSite\ARS\_WJ\146\_ARS\_WJ\_Removal\_Area\_f5



RL = Reporting Limit  
 mg/kg = micrograms per kilogram  
 sqft = Square feet

**Legend**

Lead Concentration (mg/kg)	Arsenic Concentration (mg/kg)	Removal Area
● < 300	● < 150	□ Removal to 1 foot BGS
● >= 300	● >= 150	□ Removal to 3 feet BGS

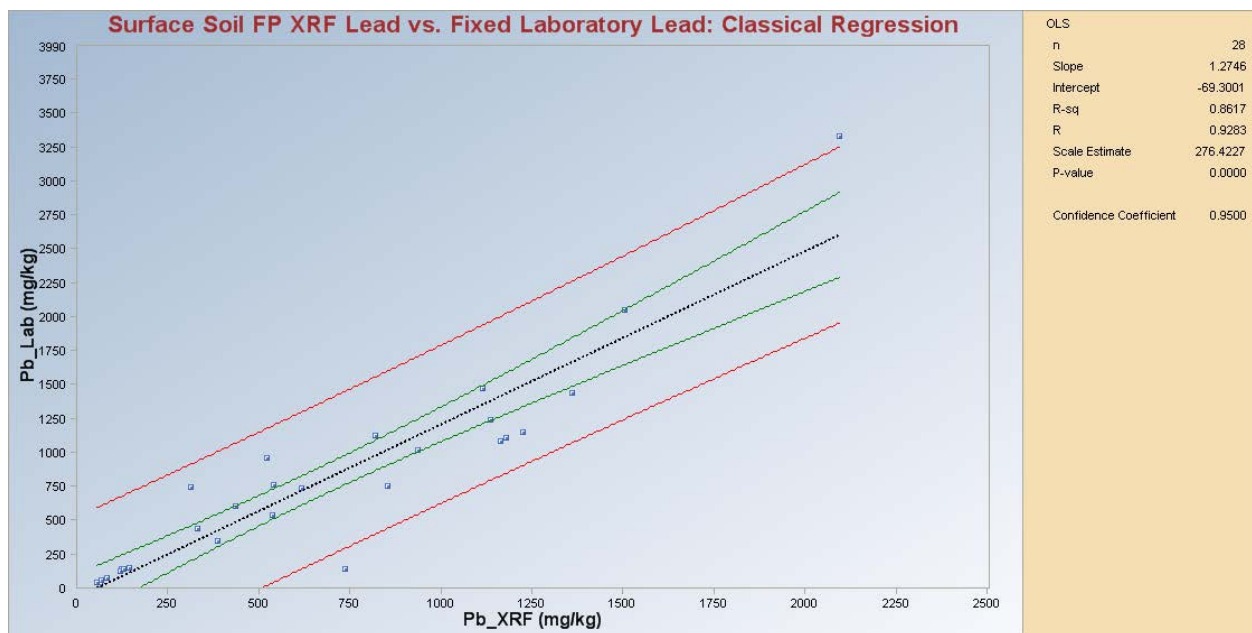
U.S. EPA Environmental Response Team  
 Scientific Engineering Response and Analytical Services  
 EP-W-09-031  
 W.A.# 0-146

Figure 5  
 Removal Area  
 Iron King Mine Site  
 Dewey-Humboldt, Arizona

**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.

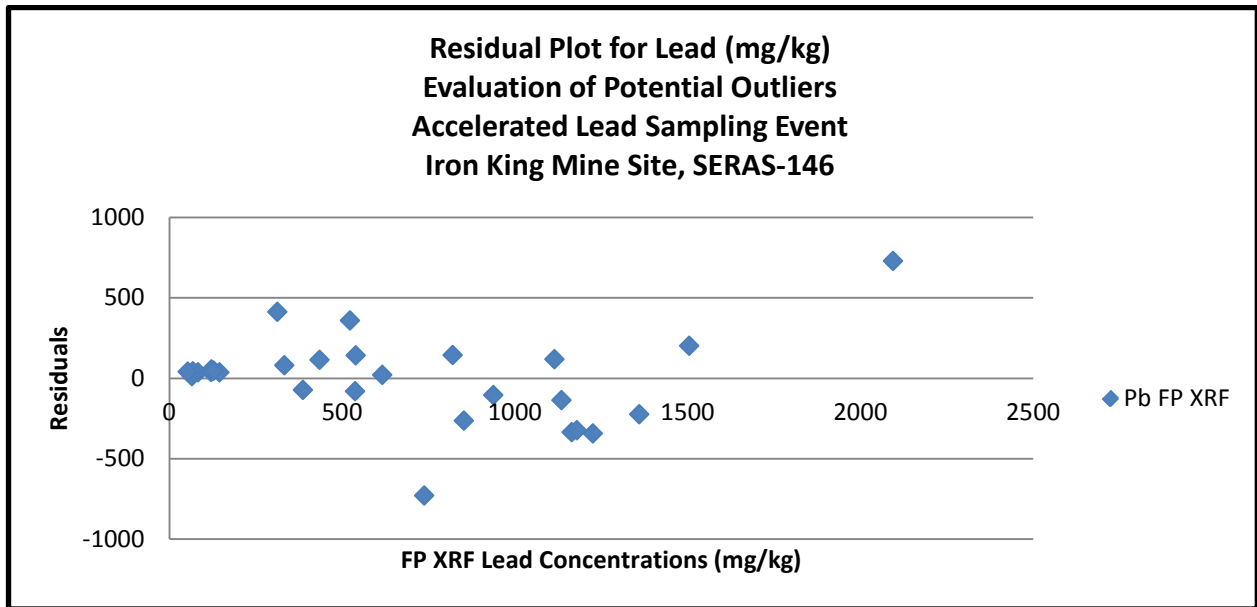


Detailed statistical output can be found in Table A. The regression analysis was performed with the confidence level set at 95% percent. The resulting OLS equation was:

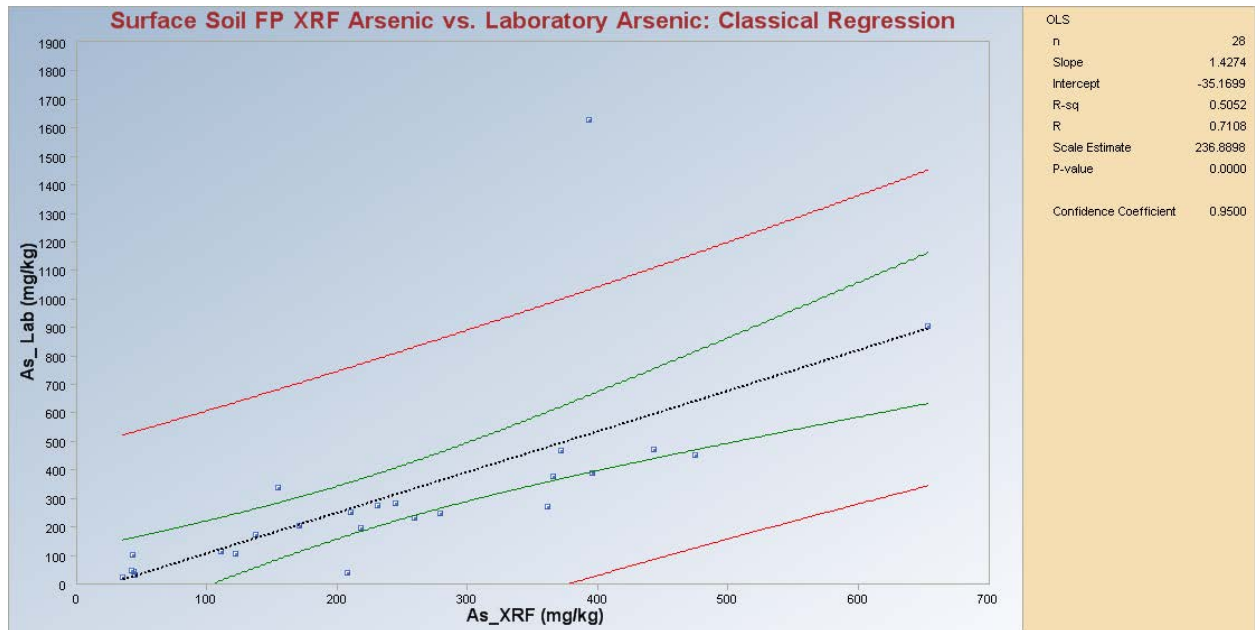
$$\text{Laboratory Lead} = 1.2746 (\text{FP XRF Lead}) - 69.3001$$

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.

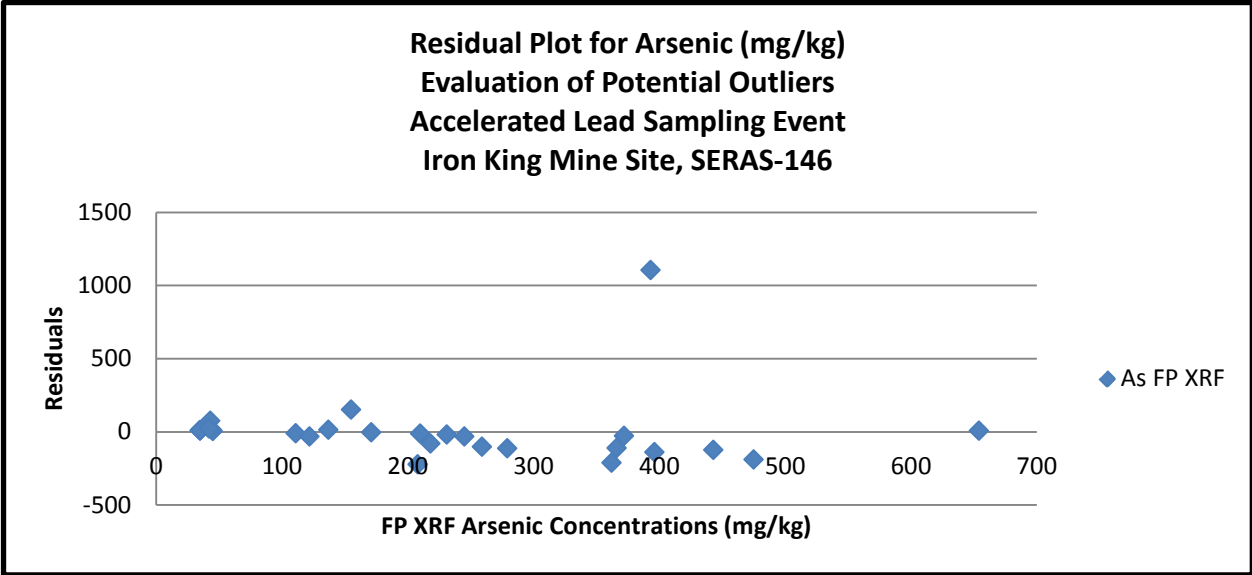




**Arsenic.** XRF As measurements ranged from not detected, at a reporting limit of 35 mg/kg, to 654 mg/kg. Corresponding laboratory analytical results ranged from 21.3 mg/kg to 1630 mg/kg. A regression analysis was conducted with the confidence level set at 95%. The computed  $R^2$  was 0.505.



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:

$$\text{Laboratory As} = 1.1419 (\text{XRF arsenic}) - 15.5025$$

Detailed statistical output can be found in Table C.

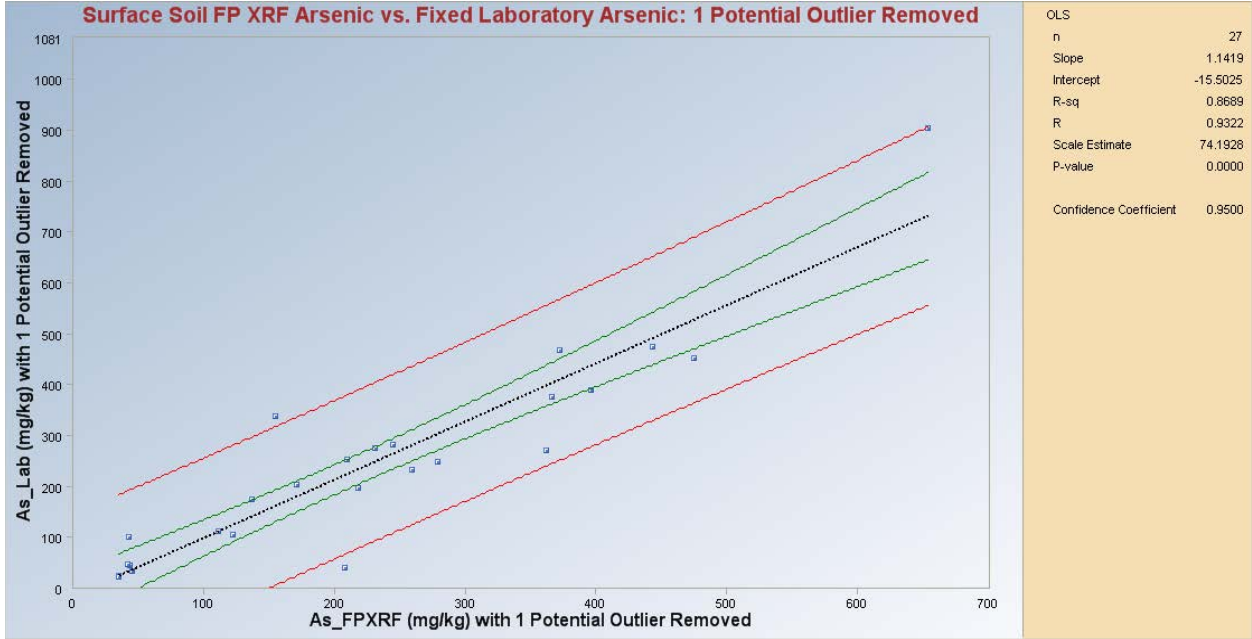


Table A. ProUCL Statistical Output for Classical Regression on Lead Results  
 FP XRF Lead Measurements (mg/kg) versus EPA Region 9 Confirmation Results (mg/kg)  
 Accelerated Residential Lead Sampling Event  
 Iron King Mine Site

**FP XRF Lead (mg/kg) vs. Fixed Laboratory Arsenic (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 Regression Diagnostics True  
 Display Regression 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**

Parameter	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
<b>Regression</b>	12380538	1	12380538	162	0
<b>Error</b>	1986647	26	76410		
<b>Total</b>	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 Resregion Diagnostics True  
 Display Resregion Tables True  
 Title For Y vs X Plots Classical Regression  
 Confidence Level for Regression 0.95  
 Line  
 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

Obs	Y Vector	Regression Table		
		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 Regression**

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\_Arsenic\_Resident.wst  
 Full Precision OFF  
 Display Limits True  
 Confidence Level for Intervals 0.95  
 Display Regression Diagnostics True  
 Display Regression 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	Estimate	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 Claressenicsical 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

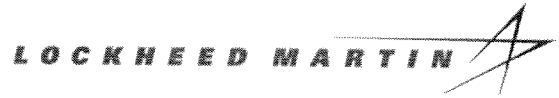
Obs	Y Vector	Regression Table		
		Yhat	Residuals	Res/Scale
1	174	140.9	33.06	0.446
2	252	224.3	27.7	0.373
3	276	248.3	27.72	0.374
4	24.6	24.47	0.135	0.00182
5	23.5	24.47	-0.965	-0.013
6	25.4	24.47	0.935	0.0126
7	23.1	24.47	-1.365	-0.0184
8	204	179.8	24.23	0.327
9	283	264.3	18.73	0.252
10	474	490.4	-16.37	-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 Claressenicsal 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

<b>Summary Table for Prediction and Confidence Limits</b>										
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



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

<u>Chain of Custody No.</u>	<u># of samples</u>	<u>Matrix</u>	<u>Analyses</u>
NA	204	Soil	Pb & As by XRF ( <b>on-site</b> 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  
 XRF used: NITON XLI792YW  
 XRF S/N: 8262  
 XRF Operator: Jay Patel

SERAS WA#: SER00146

Matrix type: Soil  
 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  
 XRF used: NITON XLT792YW  
 XRF S/N: 8262  
 XRF Operator: Jay Patel

SERAS WA#: SER00146

Matrix type: Soil  
 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  
 XRF used: NITON XLT792YW  
 XRF S/N: 8262  
 XRF Operator: Jay Patel

SERAS WA#: SER00146

Matrix type: Soil

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  
 XRF used: NITON XLT792YW  
 XRF S/N: 8262  
 XRF Operator: Jay Patel

SERAS WA#: SER00146

Matrix type: Soil

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  
 XRF used: NITON XLt792YW  
 XRF S/N: 8262  
 XRF Operator: Jay Patel

SERAS WA#: SER00146

Matrix type: Soil  
 Conc. Units: mg/Kg

Date Analyzed	SAMPLE ID	Location	Lead		Arsenic		
			Conc.	RL	Conc.	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  
 XRF used: NITON Xlt792YW  
 XRF S/N: 8262  
 XRF Operator: Jay Patel

SERAS WA#: SER00146

Matrix type: Soil

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  
 XRF used: NITON XLt792YW  
 XRF S/N: 8262  
 XRF Operator: Jay Patel

SERAS WA#: SER00146

Matrix type: Soil

Conc. Units: mg/Kg

Date Analyzed	SAMPLE ID	Location	Lead		Arsenic		
			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  
 XRF used: NITON XLT792YW  
 XRF S/N: 8262  
 XRF Operator: Jay Patel

SERAS WA#: SER00146

Matrix type: Soil

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  
 XRF used: NITON XLT792YW  
 XRF S/N: 8262  
 XRF Operator: Jay Patel

SERAS WA#: SER00146

Matrix type: Soil

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

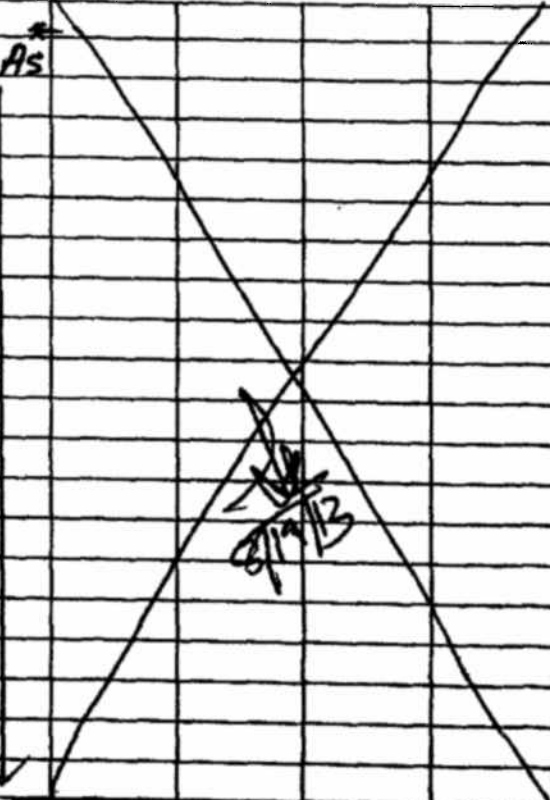
No: **06617**  
 Sheet 01 of 01 (Do not copy)  
 (for addnl. samples use new form)

WO# R308007

**Sample Identification**

**Analyses Requested**

REAC#	Sample No	Sampling Location	Matrix	Date Collected	# of Bottles	Container/Preservative	Analyses Requested
01	557-002-1	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	605-001-1				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		



**Matrix:**

- A- Air
- AT- Animal Tissue
- DL- Drum Liquids
- DS- Drum Solids
- GW- Groundwater
- O- Oil
- PR- Product
- PT- Plant Tissue
- PW- Possible 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 #:**

Item/Reason	Relinquished by	Date	Received by	Date	Time	Item/Reason	Relinquished by	Date	Received by	Date	Time
PU/Storage	[Signature]	8/20/13	[Signature]	8/19/13	11:00	All Analysis	[Signature]	8/19/13	[Signature]	8/19/13	11:30



REAC, Edison, NJ  
 (732) 321-4200  
 EPA Contract 68-C99-223

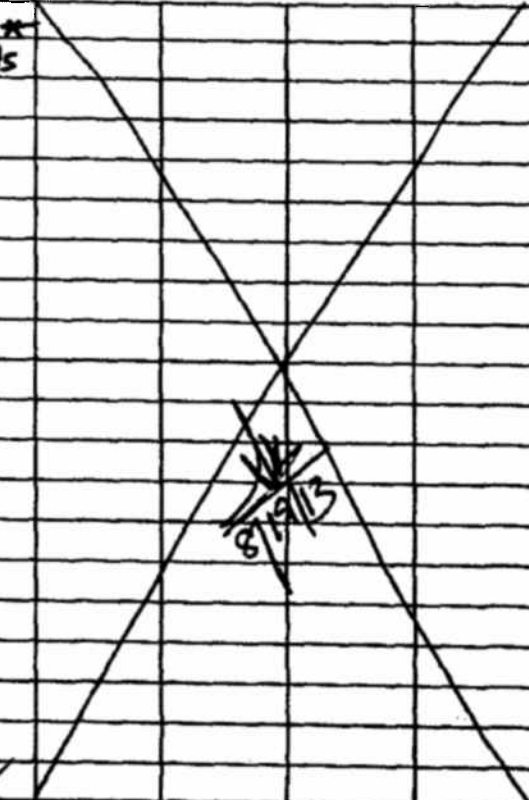
**CHAIN OF CUSTODY RECORD**  
 Project Name: Iron King Mine Site  
 Project Number: 0-146  
 LM Contact: S. Grahman Phone: 732-321-4200

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	Analyses Requested
20	80J-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		



Matrix:

- A- Air
- AT- Animal Tissue
- DL- Drums Liquids
- DS- Drums 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 #:**

Item/Reason	Relinquished by	Date	Received by	Date	Time	Item/Reason	Relinquished by	Date	Received by	Date	Time
ALL Storage	[Signature]	8/20/13	[Signature]	8/19/13	11:30	All Analysis	[Signature]	8/19/13	[Signature]	8/19/13	11:30

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. Goodman 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#	Sample No	Sampling Location	Matrix	Date Collected	# of Bottles	Container/Preservative	*Analyses Requested
39	70J-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						
52	-003-1						
53	-004-1						
54	-005-1						
55	-006-1						
56	-007-1						
57	-008-1						

8/19/13

Matrix:

- A- Air
- AT- Animal Tissue
- DL- Drain Liquids
- DS- Drain 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 #:

Item/Reason	Relinquished by	Date	Received by	Date	Time	Item/Reason	Relinquished by	Date	Received by	Date	Time
ACU/S/Spec	JG	8/20/13	[Signature]	8/19/13	11:00	All Analysis	[Signature]	8/19/13	[Signature]	8/19/13	11:30

REAC, Edison, NJ  
 (732) 321-4200  
 EPA Contract 68-C99-223

**CHAIN OF CUSTODY RECORD**

Project Name: Iron King Mine Site  
 Project Number: 6-146  
 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						
60	-012-1						
61	-014-1						
62	-015-1						
63	-017-1						
64	-018-1						
65	-019-1						
66	-021-1						
67	-022-1						
68	-024-1						
69	-025-1						
70	-026-1						
71	-027-1						
72	-028-1						
73	-029-1						
74	-030-1						
75	-031-1						
76	-032-1						

*[Handwritten signature]*  
 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-ICLP 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

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

REACT	Sample No	Sampling Location	Matrix	Date Collected	# of Bottles	Container/Preservative	Analyses Requested
77	853-037-1	N/A	S	8/14/13	1	Plastic Bags	Pb, As
<del>8/14/13</del>							
<del>8/19/13</del>							

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 #:**

Item/Reason	Relinquished by	Date	Received by	Date	Time	Item/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

**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	

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
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
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	





**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 Region 9 Laboratory

1337 S. 46th Street, Building 201, Richmond, CA 94804  
Phone:(510) 412-2300 Fax:(510) 412-2302

<b>Project Manager:</b> Zi Zi Searles	<b>California Site Cleanup Section 1</b>	<b>SDG:</b> 13231B
<b>Project Number:</b> R13SA1	<b>75 Hawthorne Street</b>	<b>Reported:</b> 09/09/13 16:31
<b>Project:</b> Iron King Mine Wells/Jones Street 2013 Sampling	<b>San Francisco CA, 94105</b>	

## 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  
Region 9 Laboratory**

1337 S. 46th Street, Building 201, Richmond, CA 94804  
Phone:(510) 412-2300 Fax:(510) 412-2302

<b>Project Manager:</b> Zi Zi Searles	<b>California Site Cleanup Section 1</b>	<b>SDG:</b> 13231B
<b>Project Number:</b> R13SA1	<b>75 Hawthorne Street</b>	<b>Reported:</b> 09/09/13 16:31
<b>Project:</b> Iron King Mine Wells/Jones Street 2013 Sampling	<b>San Francisco CA, 94105</b>	

**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**

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**

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**

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 Region 9 Laboratory

1337 S. 46th Street, Building 201, Richmond, CA 94804  
Phone: (510) 412-2300 Fax: (510) 412-2302

<b>Project Manager:</b> Zi Zi Searles <b>Project Number:</b> R13SA1 <b>Project:</b> Iron King Mine Wells/Jones Street 2013 Sampling	<b>California Site Cleanup Section 1</b> <b>75 Hawthorne Street</b> <b>San Francisco CA, 94105</b>	<b>SDG:</b> 13231B <b>Reported:</b> 09/09/13 16:31
--	--	---

## 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	0.00020		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	0.00200	0.000284	107	70-130		20
---------	---------	--	--------	------	---------	----------	-----	--------	--	----

#### Matrix Spike Dup (B13H129-MSD1)

Source: 1308026-01

Mercury	0.00249		0.0003	mg/L	0.00200	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



**United States Environmental Protection Agency  
Region 9 Laboratory**

1337 S. 46th Street, Building 201, Richmond, CA 94804  
Phone:(510) 412-2300 Fax:(510) 412-2302

<b>Project Manager:</b> Zi Zi Searles	<b>California Site Cleanup Section 1</b>	<b>SDG:</b> 13231B
<b>Project Number:</b> R13SA1	<b>75 Hawthorne Street</b>	<b>Reported:</b> 09/09/13 16:31
<b>Project:</b> Iron King Mine Wells/Jones Street 2013 Sampling	<b>San Francisco CA, 94105</b>	

**Quality Control**

Analyte	Result	Qualifiers / Comments	Quantitation Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
---------	--------	-----------------------	--------------------	-------	-------------	---------------	------	-------------	-----	-----------

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**

<b>Duplicate (B13H133-DUP1)</b>		<b>Source: 1308026-01</b>								
Lead	ND	U	0.3	"		ND				20
Selenium	ND	U	0.2	"		ND				20
Silver	ND	U	0.1	"		ND				20
<b>Matrix Spike (B13H133-MS1)</b>		<b>Source: 1308026-01</b>								
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
<b>Matrix Spike Dup (B13H133-MSD1)</b>		<b>Source: 1308026-01</b>								
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



United States Environmental Protection Agency  
**Region 9 Laboratory**

1337 S. 46th Street, Building 201, Richmond, CA 94804  
Phone:(510) 412-2300 Fax:(510) 412-2302

**Project Manager:** Zi Zi Searles

**Project Number:** R13SA1

**Project:** Iron King Mine Wells/Jones Street 2013  
Sampling

**California Site Cleanup Section 1**

**75 Hawthorne Street  
San Francisco CA, 94105**

**SDG:** 13231B

**Reported:** 09/09/13 16:31

**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.