QUALITY ASSURANCE PROJECT PLAN FOR ENVIRONMENTAL DATA COLLECTION ACTIVITIES EAST HELENA FACILITY

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ENVIRONMENTAL DATA COLLECTION ACTIVITIES
EAST HELENA FACILITY

APPROVAL SIGNATURE SHEET

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared at the request of the Montana Trust Group, LLC, as Trustee for the Montana Environmental Custodial Trust (the Custodial Trust) in general accordance with U.S. Environmental Protection Agency (EPA) guidance (EPA, 2001 and 2002a) to direct the planning, implementation, and assessment of environmental data collection activities at the East Helena Facility (the former Asarco East Helena smelter and surrounding properties now owned by the Custodial Trust). The QAPP is intended to be used in conjunction with other East Helena Facility project documents, such as Field Sampling and Analysis Plans (FSAPs), Sampling and Analysis Plans (SAPs), and/or Work Plans (WPs) that have been or will be prepared to address ongoing environmental work at the facility, in order to ensure that all data collected is of the appropriate type, quantity, and quality to achieve the objectives of the individual project, and ultimately to support completion of a Corrective Measures Study for the Facility. This document has been prepared as an update to the Phase I RCRA Facility Investigation (RFI) QAPP (Hydrometrics, 2000).

The QAPP is structured in conformance with EPA (2001), including the following four groups of QA elements:

- Project Management – Section 2.0 of the QAPP;
- Data Generation and Acquisition – Section 3.0 of the QAPP;
- Assessment and Oversight – Section 4.0 of the QAPP; and
- Data Validation and Usability – Section 5.0 of the QAPP.

The overall purpose of the QAPP is to provide in one document a clear and concise presentation of the technical approach (planning), procedures and methodologies (implementation), and data review and evaluation (assessment) tasks used to complete environmental data collection projects for the East Helena Facility, along with a description of how specific quality assurance (QA) and quality control (QC) activities will be applied. The QAPP has been structured to be as flexible and widely applicable as possible; however, this 2010 version of the QAPP for the East Helena Facility is intended to pertain primarily to the following planned data collection efforts:

1. Ongoing long-term groundwater and surface water monitoring, to be conducted in accordance with the 2010 Post-RI/FS Groundwater and Surface Water Field Sampling and Analysis Plan (FSAP) (Hydrometrics, 2010a), including semiannual monitoring of a selected set of project monitoring wells and surface water locations, and quarterly monitoring of wells associated with the Corrective Action Management Units (CAMUs) located south of the facility.
2. Implementation of the Phase II RCRA Facility Investigation (RFI) Site Characterization Work Plan (Hydrometrics, 2010b) and Field Sampling and Analysis Plan (Hydrometrics, 2010c), including surface and subsurface soil sampling, drilling and sampling of additional groundwater monitoring wells, and evaluation of groundwater/surface water interactions.
3. Portions of the Baseline Ecological and Human Health Risk Assessments (RA) data collection programs, although other aspects of the risk assessment program are covered in an RA-specific QAPP (Exponent, 2009a and 2009b).

The QAPP should be reviewed annually (at a minimum) and updated as necessary, to ensure that any revisions pertinent to future data collection activities are incorporated into the document and communicated to project personnel, and also to ensure that any such data collection activities are subject to equivalent planning, implementation, and assessment requirements.

2.0 PROJECT MANAGEMENT

2.1 PROJECT/TASK ORGANIZATION AND RESPONSIBILITY

This section of the East Helena Facility QAPP provides an overview of project organization and responsibilities for implementation of environmental data collection activities at the site. A summary table outlining required elements for QAPPs (stipulated in EPA, 2001) and the corresponding location in this QAPP where these requirements are addressed is in Appendix A. An organization chart illustrating the relationships among the site owner (the Custodial Trust), regulatory oversight agencies, and other data users and/or generators is shown in Figure 2-1.

2.2 PROBLEM DEFINITION/BACKGROUND

The history of the East Helena Facility, including environmental investigations, remedial activities, and regulatory actions conducted to date has been reviewed in detail in a number of existing documents, including the Phase II RFI Site Characterization Work Plan (Hydrometrics, 2010b). The Phase II RFI Work Plan (Section 2.0) also includes an extensive discussion of existing conditions at the Facility.

2.2.1 Problem Background (Site History)

The East Helena Facility is a former custom lead smelter located on approximately 142 acres. The Facility is located primarily on the Prickly Pear Creek alluvial plain, and is bounded to the south by Upper Lake and Lower Lake, to the east and northeast by Prickly Pear Creek, and to the west and southwest by uplands or foothills comprised of tertiary-age sediments. The Facility is bordered on the north by State Highway 12 and the American Chemet Facility (a manufacturer and marketer of metals-based chemicals), with the business district and major residential areas in the City of East Helena located a short distance north of the Facility (see Figure 1-1-1 of the Phase II RFI Work Plan in Appendix B).

FIGURE 2-1. EAST HELENA FACILITY ENVIRONMENTAL DATA COLLECTION PROJECT ORGANIZATION CHART

(K:\project\10022\2010 qapp\fig2-1.ppt)

The following brief operational summary of the East Helena smelter was obtained from the recently published draft MPDES discharge permit for the East Helena Facility wastewater treatment plant (MDEQ, 2010):

> Asarco operated the smelter for over 100 years as a custom, primary lead smelter using pyrometallurgical processes to recover base metals from ores and concentrates. The plant produced lead bullion and by-products such as silver, gold, copper, and sulfuric acid. Ore concentrates were transported by railcars or trucks to the plant and mixed with siliceous flux, limestone flux, iron flux, coke, and recycled by-products dust. This mixture was roasted in the sinter plant to drive off the sulfur content. The resultant sulfur dioxide gas was captured and cooled in the acid plant to produce sulfuric acid, a product shipped off-site for use. The sinter was then sent to the blast furnace for smelting. In the blast furnace, several layers of metals formed. Molten lead sank to the bottom of the furnace and was referred to as lead bullion. The lightest metals, including arsenic and antimony, floated to the top and formed a layer called speiss. Copper and metal sulfides formed a layer called matte. The blast furnace also produced slag, which was stored on-site. The lead bullion would then undergo the drossing process in which the bullion was agitated in kettles and then cooled. A product called dross was produced which was lead oxides, copper, antimony, and other metals that floated to the top of the process. After additional metals recovery, the dross was sent off-site for metals recovery. Lead was also shipped off-site for further processing.

In September 1984, pursuant to Section 105 of CERCLA, EPA added to the National Priorities List the Facility, all of the City of East Helena, nearby residential subdivisions, numerous rural developments such as farms and homes on small acreage plots, and surrounding undeveloped lands (the Site). In November 1989 EPA divided the Site into five operable units (OUs) ((1) Process Ponds and Fluid; (2) Surface Soils and Surface Water; (3) Groundwater; (4) Slag Pile; and (5) Ore Storage Areas) and issued a record of decision for the Process Ponds and Fluids OU (Process Ponds ROD). The remedial action and groundwater monitoring program required by the Process Ponds ROD was set forth in a December 1990 Consent Decree (the Process Ponds CD) between EPA and ASARCO.

In 1997, EPA initiated a transfer of responsibility for ongoing remedial activities at the Facility from its CERCLA program to its Corrective Action program under the Resource Conservation and Recovery Act (RCRA). In May of 1998, ASARCO and EPA entered into a Consent Decree (the 1998 CD) to further the objectives of RCRA and the Clean Water Act

(CWA) (U.S. District Court, 1998). Since then, groundwater sampling and analysis requirements of the Process Ponds CD have been performed pursuant to the 1998 CD and the Surface Soils/Surface Water, Groundwater, Slag Pile and Ore Storage Areas operable units have been addressed under the 1998 CD.

On December 9, 2009, the Montana Environmental Custodial Trust was established as part of the larger Asarco bankruptcy settlement agreement approved by the Bankruptcy Court (SD, Texas) and the US Federal District Court (SD, Texas). A Consent Decree and Settlement Agreement regarding Montana Sites (the Settlement Agreement) was entered into by Asarco, US Department of Justice (DOJ), EPA, the State of Montana (the State) and the Montana Environmental Trust Group, LLC, as Trustee for the Montana Environmental Custodial Trust (the Custodial Trust). The Settlement Agreement describes the role and responsibilities of the Custodial Trust, which include owning, managing, and performing the clean-up and revitalization of Asarco's property in East Helena, Montana under oversight of EPA.

As part of the Settlement Agreement the Custodial Trust agreed to fulfill ASARCO's obligations under the 1998 CD. These obligations include completion of all environmental investigations and related work at ASARCO properties, including addressing groundwater contamination resulting from ASARCO's past practices. This work is to be completed by the Custodial Trust with EPA oversight. Therefore, at the present time, EPA, the US Department of Justice (DOJ), and the Custodial Trust are in the process of finalizing a First Modification to the 1998 CD that will substitute the Custodial Trust for ASARCO. The Custodial Trust has already been substituted for ASARCO in the Process Ponds CD.

As part of the 1998 CD, Asarco prepared a RCRA Current Conditions/Release Assessment (CC/RA) (Hydrometrics, 1999a). The purpose of the RCRA CC/RA was to assess the completeness and quality of the existing data used to define, in whole or in part, the nature and extent of any hazardous waste and hazardous constituent releases, if any, at or migrating from the Facility. Based on its review of the RCRA CC/RA, EPA determined that interim remedial measures were necessary and warranted for portions of the Facility, and a RCRA Interim Measures Work Plan (IMWP) was prepared (Hydrometrics, 1999b).

Concurrent with its approval of the RCRA IMWP, EPA determined that a RCRA Facility Investigation (RFI) was required for the Facility, with the RFI to be conducted in two phases. Objectives of the Phase I RFI included characterization and investigation of portions and aspects of the Facility not addressed as part of the interim measures process, and to provide sufficient data for development of corrective measures alternatives. Phase II of the RFI is intended to address site characterization issues not addressed in the Phase I RFI or other previous investigations. An assessment of the human health and ecological risk(s) created by the Facility is being conducted concurrently with the Phase II RFI (Exponent, 2009a and 2009b). Information obtained through the RFI will be used to prepare a RCRA Corrective Measures Study (CMS) for the East Helena Facility.

Post-RI/FS (long-term) groundwater and surface water monitoring has been conducted at the Facility from 1991 to the present. This monitoring program consists of monitoring groundwater and surface water sample collection semiannually (typically in May and November) within and adjacent to the East Helena Facility. The data generated through this long-term monitoring program is used to evaluate long-term trends in groundwater and surface water quality and to characterize the status and evolution of groundwater contaminant plumes beneath and downgradient of the facility, with an emphasis on arsenic and (more recently) selenium migration.

In addition to the ongoing site characterization and remediation efforts, as part of the 1998 CD with EPA and separate February 2005 and October 2007 consent decrees with the Montana Department of Environmental Quality (MDEQ), Asarco began demolishing structures and disposing of demolition waste in two Corrective Action Management Units (CAMUs) constructed on site. Groundwater detection monitoring activities related to operation of the CAMUs are conducted quarterly at a suite of wells adjacent to the Phase I and Phase II CAMU cells.

A number of current and historic Facility structures and features have been identified as sources or potential sources of metals loading to groundwater including: the former acid plant area, the former speiss-dross plant area, the former ore storage areas, and the former process water circuit. Another prominent feature at the Facility is the slag pile (a by-product of the smelting process). Many of these features have been analyzed, addressed or removed through past site remediation efforts, including the ongoing Facility demolition program. The Phase II RFI Work Plan (Hydrometrics, 2010b) includes a figure showing the locations of former and existing features (see Figure 1-2-1 of the Phase II RFI Work Plan in Appendix B) and a discussion of previous investigations and remedial activities related to these features (Section 1.2.3 and Appendix A of the Work Plan).

2.2.2 Problem Definition

The problem to be addressed at the East Helena Facility may be stated as follows:

> Metals and other constituents have been released to the environment (soil, air, groundwater, and surface water) as a result of historic activities at the Facility. While extensive remedial measures have been implemented in many portions of the Facility as described above and in the Phase II RFI Work Plan, elevated constituent concentrations persist in site soils and groundwater. Surface and subsurface soils contain elevated concentrations of constituents including but not limited to arsenic, cadmium, copper, lead and zinc. Groundwater monitoring on and downgradient of the Facility has revealed two plumes with elevated arsenic and selenium concentrations in groundwater extending north and northwestward from the Facility.

2.3 PROJECT/TASK DESCRIPTION AND SCHEDULE

2.3.1 Phase II RFI

The Phase II RFI Work Plan (Hydrometrics, 2010b) and Field Sampling Plan (Hydrometrics, 2010c) address the site characterization portion of the Phase II RFI. The Phase II RFI represents a continuation of previous site characterization and evaluation programs, most notably the Comprehensive RI/FS, CC/RA, and the Phase I RFI, and relies heavily on data and information obtained through those programs.

Overall objectives of the Phase II site characterization include:

- Filling identified data gaps to complete characterization of the magnitude and extent of contaminated soils on the plant site, accounting for past and ongoing site remediation activities.
- Identifying and delineating source area(s) for the arsenic and selenium groundwater plumes.
- Evaluating the fate and transport of arsenic and selenium in the subsurface, and the current status and predicted future behavior of the groundwater plumes.
- Conducting a preliminary assessment of groundwater containment/treatment alternatives to control groundwater plume migration.
- Providing information and data to support completion of the human health and ecological risk assessment portions of the Phase II RFI, and a subsequent planned RCRA Corrective Measures Study.

Although the site characterization activities detailed in The Phase II RFI Work Plan will support completion of the risk assessment portion of the Phase II RFI, the risk assessments are formally addressed in two separate work plans, including a June 2009 Draft Baseline Ecological Risk Assessment Work Plan and Field Sampling and Analysis Plan (Exponent, 2009a), and a Draft Human Health Risk Assessment Work Plan (Exponent, 2009b).

As outlined in the Phase II RFI Work Plan (Hydrometrics, 2010b), project objectives will be achieved through completion of the following tasks:

1. A detailed review and interpretation of existing information and development of a current conceptual model of the site;
2. Implementation of a focused field sampling program based on the updated conceptual site model and project objectives; and
3. Development of a numerical model of groundwater flow and contaminant transport for the East Helena Facility and surrounding area.

This QAPP for environmental data collection activities at the East Helena Facility addresses the planning, implementation, and assessment of the Phase II RFI focused field sampling program (Task 2 above).

Sampling and monitoring locations selected to achieve the Phase II RFI objectives are shown on the applicable Phase II RFI Work Plan and Field Sampling Plan figures, reproduced in this QAPP in Appendix B and referenced as appropriate. Table 2-1 summarizes in general terms the focused field sampling program stipulated in the Phase II RFI Work Plan, and references the pertinent section of the Work Plan where sampling program details are located.

TABLE 2-1. SUMMARY OF PHASE RFI FOCUSED FIELD SAMPLING PROGRAM

Focused Field Sampling Program Task	General Data Types	Phase II RFI Work Plan Section
Surface/Subsurface Soil Sample Collection	• Total Metals Concentrations (All Soils) • Extraction/Adsorption Testing for Arsenic and Selenium (Subsurface Soils)	3.1
Monitoring Well Drilling and Completion	• Total Metals Concentrations (All Soils) • Extraction/Adsorption Testing for Arsenic and Selenium (Subsurface Soils) • Static Water Levels, Field Parameters, Physical Parameters, Common Ions, Dissolved Metals (Groundwater)	3.2
Evaluation of Groundwater/Surface Water Interactions	• Streamflow (Prickly Pear Creek) and Static Water Level Measurements • Field Parameters	3.3
Evaluation of Arsenic in Southwest Lamping Field	• Streamflow (Wilson Ditch) and Static Water Level Measurements • Field Parameters, Physical Parameters, Common Ions, Total Recoverable Metals (Surface Water)	3.4

2.3.2 Long-Term Groundwater/Surface Water Monitoring

The 2010 Post-RI/FS Groundwater and Surface Water Field Sampling and Analysis Plan (Hydrometrics, 2010a) outlines the regularly scheduled monitoring to be performed as a continuation of the long-term monitoring program initiated in 1991. In addition, the quarterly groundwater detection monitoring requirements for the wells associated with the CAMU have been incorporated into the Post-RI/FS SAP. Objectives of the Post-RI/FS monitoring include:

- Continuing to obtain sufficient groundwater and surface water data to characterize groundwater flow directions, groundwater-surface water interactions, and long-term water quality trends within and adjacent to the Facility.
- Monitoring the ongoing status of the arsenic and selenium groundwater plumes, prior to and following the evaluation, testing, and/or implementation of corrective measures at the Facility.
- Supplementing the information obtained during concurrent data collection efforts (e.g., the Phase II RFI, ecological and human health risk assessments).
- Meeting the groundwater detection monitoring provisions related to operation and maintenance of the CAMU.
- Monitoring for potential impacts to public and private water supply wells.

The following tasks are associated with the 2010 Post-RI/FS Groundwater and Surface Water Monitoring FSAP (Hydrometrics, 2010a):

1. Semiannual measurement of static water levels at a comprehensive set of sitewide monitoring wells;
2. Collection and analysis of groundwater and surface water quality samples on a semiannual basis at a defined set of monitoring locations; and
3. Collection and analysis of groundwater quality samples on a quarterly basis at eleven monitoring wells associated with the CAMU Phase I and Phase II cells.

Groundwater and surface water sampling and monitoring locations selected to achieve the Post-RI/FS monitoring objectives are shown on the applicable Post-RI/FS FSAP figures, reproduced in this QAPP in Appendix C and referenced as appropriate. Table 2-2 summarizes in general terms the parameters, types of analyses, and intended uses of the data sets to be collected under the Post-RI/FS program.

2.3.3 Schedule

The Phase II RFI field work, sampling, and analysis is scheduled to occur during the spring, summer, and fall of 2010, following EPA approval of the Phase II RFI Work Plan, the 2010 FSAPs, and this QAPP. The 2010 Post-RI/FS long-term groundwater and surface water monitoring is scheduled for spring and fall 2010, while remaining CAMU groundwater detection monitoring events for 2010 are scheduled quarterly.

TABLE 2-2. SUMMARY OF POST-RI/FS GROUNDWATER AND SURFACE WATER MONITORING PROGRAM

Post-RI/FS Monitoring Program Task	General Data Types	2010 FSAP Section
Semiannual Groundwater Monitoring	• Static Water Levels, Field Parameters, Physical Parameters, Common Ions, Dissolved Metals	2.1.1
Semiannual Surface Water Monitoring	• Streamflows, Field Parameters, Physical Parameters, Common Ions, Total Recoverable Metals, Dissolved Aluminum	2.1.2
Quarterly CAMU Well Groundwater Monitoring	• Static Water Levels, Field Parameters, Physical Parameters, Common Ions, Dissolved Metals	2.2

2.4 QUALITY OBJECTIVES AND CRITERIA

This QAPP describes procedures for ensuring that chemical data generated from soil, groundwater, and surface water samples collected in conjunction with data collection activities at the East Helena Facility, including activities planned as part of the Phase II RFI Work Plan and the Post-RI/FS Groundwater and Surface Water FSAP, are of known and acceptable quality to support the intended data uses. The QAPP also summarizes procedures for expressing the quality of the results generated through Data Quality Indicators (DQIs). Quantitative DQIs include precision, accuracy and completeness, and qualitative DQIs include representativeness and comparability. DQI targets are presented in Section 5.3 below.

EPA's Requirements for Quality Assurance Project Plans (QA/R-5; EPA, 2001) and Guidance for Quality Assurance Project Plans (QA/G-5; EPA, 2002a) state that a systematic planning process should be used to determine the quality objectives for a project and the performance criteria used to achieve those objectives. The Data Quality Objectives (DQO) process (EPA, 2006a) provides an example of how to apply systematic planning to generate performance and acceptance criteria for collecting new environmental data. Use of the DQO framework is non-mandatory, but recommended by EPA when data are to be used to make decisions (e.g., compliance vs. non-compliance with a standard) or to estimate some property of the environment (e.g., determining the average soil concentration of a contaminant).

The DQO process consists of seven steps (EPA, 2006a):

1. State the Problem;
2. Identify the Goal of the Study;
3. Identify Information Inputs;
4. Define the Boundaries of the Study;
5. Develop the Analytic Approach;
6. Specify Performance or Acceptance Criteria; and
7. Develop the Plan for Obtaining Data.

The application of these DQO steps to the environmental data collection activities proposed at the East Helena Facility are discussed below in Sections 2.4.1 through 2.4.7.

2.4.1 State the Problem

Major environmental remediation has been performed at the Facility during the last 20 years; however, environmental problems persist in specific locations on the plant site and in the groundwater both on and off the plant site. Elevated constituent concentrations continue to exist in groundwater and in shallow aquifer soils. Arsenic and selenium have migrated off-site through groundwater transport at concentrations exceeding relevant water quality standards, posing a possible threat to human health and the environment. The sources and geochemical behavior of the arsenic and selenium groundwater plumes require further refinement to allow evaluation of potential corrective measures.

2.4.2 Identify the Goal of the Study

The objectives of the data collection activities to be performed at the East Helena Facility are outlined above in Section 2.3.1 (for the Phase II RFI) and Section 2.3.2 (for the Post-RI/FS Groundwater and Surface Water Monitoring). All of these objectives have been established to ensure that all data collected will be applicable to the primary critical issue to be addressed at the Facility: the planned evaluation, selection, and eventual implementation of corrective measures. As noted in Section 2.3.2, groundwater monitoring of the wells associated with the CAMU (monitoring wells MW-1 through MW-11) is also being conducted to satisfy regulatory groundwater detection monitoring requirements.

2.4.3 Identify Information Inputs

The purpose of this section is to identify the types and sources of information needed to support the stated study goals.

<u>Phase II RFI</u> – Data gaps have been identified as part of the comprehensive review of site data (including Phase I RFI results) presented in the Phase II RFI Work Plan (Hydrometrics, 2010b). Based on the results of this review, additional data is required to further define groundwater contaminant source areas and to support development of a Corrective Measures Study for the East Helena Facility. This information will be gained through a program of monitoring well installation and groundwater sampling and analysis, surface and subsurface soil sampling and analysis, and surface water sampling and analysis.

Field sampling and analytical details are presented in the FSAP and in subsequent sections of this QAPP. However, it should be noted that the suite of analytical parameters proposed for soil and water analysis has been designed to address data gaps by providing data on constituents not previously characterized at the site, with emphasis on the primary constituents of concern in groundwater (arsenic and selenium). Field and laboratory procedures and methods have been selected to be consistent with prior investigations to the extent practicable, so that data comparability is maximized and the set of suitable data available for inclusion in the Corrective Measures Study will be as extensive as possible. At the same time, analytical methods and reporting limits for individual constituents have been set at levels appropriate for use in the Facility risk assessment.

Post-RI/FS Groundwater and Surface Water Monitoring – Information on long-term water quality trends in groundwater and surface water at the Facility and in downgradient areas, and ongoing characterization of the Facility-derived arsenic and selenium groundwater plumes will be accomplished by collection and analysis of water samples on a semiannual basis (for 2010). In the case of the CAMU wells, detection of potential releases of hazardous constituents from the CAMU cells to groundwater will be achieved through a quarterly program of sampling and analysis. For consistency and completeness, the current laboratory analytical parameter suite for water resources is based on the Phase II RFI constituent list.

2.4.4 Define the Boundaries of the Study

In general, the spatial study boundary will be the Facility property boundary, directly adjacent areas, and other areas where Facility-derived contaminants to be addressed in the Phase II RFI and Post-RI/FS monitoring program currently exist or may come to be located.

The water and soil sampling and analysis outlined for 2010 in the Phase II RFI Work Plan and Post-RI/FS Groundwater and Surface Water monitoring program targets groundwater, surface water, and soil sample units in two general categories:

1. Areas where previous characterization activities have occurred, but additional information is needed to evaluate ongoing trends or to analyze for additional constituents; and
2. Areas where (spatial) data gaps were identified through the review of current site conditions discussed in the Phase II RFI Work Plan (Hydrometrics, 2010b), and additional information is needed to evaluate potential source areas of contaminant loads to groundwater.

2.4.5 Develop the Analytic Approach

In contrast with sampling activities developed to address simple decision or estimation problems such as those presented in DQO guidance (EPA, 2006a), the 2010 environmental data collection activities for the East Helena Facility have been developed based on an assessment of the extensive amount of available information gathered during nearly 30 years of site characterization and remediation. The purpose of the proposed data collection is to characterize areas or constituents that have not previously been adequately characterized during the course of previous investigations, and to more fully define contaminant source areas. Sampling locations and parameters have been selected cooperatively by the Custodial Trust, regulatory personnel, and environmental consultants to target specific sections of the Facility where data gaps currently exist (i.e., the sampling program is based on best professional judgment and best management practices, referred to as a judgmental sampling design). Probability-based (random or systematic) statistical designs for the monitoring well drilling, surface and subsurface soil sampling, and groundwater/surface water interaction assessment programs are therefore not applicable.

Similarly, the long-term groundwater and surface water sampling program outlined under the Post-RI/FS Field Sampling Plan has been designed based on the current understanding of site and regional hydrogeology, site access, the geometry of existing contaminant plumes, and further delineation of areas where data gaps exist and additional information is required (e.g., downgradient boundary of the selenium plume). The sampling schedule and statistical analysis of groundwater data collected from the CAMU wells (trend testing, comparison with well-specific concentration limits) is detailed in the CAMU Sampling and Monitoring Plan (Hydrometrics, 2007).

Given the intended data uses for the Phase II RFI and Post-RI/FS monitoring efforts and the use of judgmental rather than probability-based sampling designs, no formal statistical decision rules (hypothesis tests) or individual population parameter estimates (means, medians, or percentiles with associated confidence intervals) are specified in this QAPP. Rather, the collected data will generally be examined and interpreted using typical measures of central tendency (e.g., mean, median) and spread (e.g., standard deviation, confidence intervals, percentiles), along with graphical presentations of spatial and temporal concentration trends such as concentration/depth plots, boxplots, and time-concentration plots. Appropriate statistical analyses may also be used to evaluate temporal trends in water quality, such as linear regression analyses or the non-parametric Mann-Kendall trend test. Any statistical analyses of environmental data will be accompanied by supporting information (distribution tests, outliers, methods for accommodating censored values) demonstrating that assumptions underlying the tests are valid. Guidance on the statistical analysis of environmental data (Helsel and Hirsch, 2002; EPA, 2009; EPA, 2006b) may be consulted to determine appropriate metrics.

2.4.6 Specify Performance or Acceptance Criteria

Specification of performance or acceptance criteria are intended to minimize the possibility of making erroneous conclusions, or failing to keep uncertainty in estimates to within acceptable levels. As noted in Section 2.4.5, formulation of a statistical hypothesis test or a specific parameter estimate is not considered applicable to the data collections activities covered under this QAPP, and in fact is not feasible when a non-probability-based sampling scheme is employed. In order to ensure that uncertainty in the collected data is controlled and can be meaningfully evaluated relative to the existing data set, sampling- and measurement-specific data quality indicators (DQIs) have been specified as performance criteria in Section 5.3. These criteria cover the well-known PARCC parameters (data precision, accuracy, representativeness, completeness, and comparability), and are assessed through evaluation of field and laboratory quality control sample results, review of data collection documentation (including the results of any corrective actions), and the results of any field or laboratory audits. The data collected as part of the Phase II RFI and Post-RI/FS monitoring program will be evaluated against the criteria outlined in Section 5.3 during the assessment of data quality and usability. Results or measurements not meeting criteria will be qualified in the project database, so that data users will be aware of potential data quality issues and can make informed decisions about whether particular results should be excluded from the decision-making process.

Decisions regarding potential further actions at the facility will ultimately be addressed in the Corrective Measures Studies, and will be based on a comprehensive consideration of RFI, IM, and RI/FS/Post-RI/FS data, along with the results of the baseline ecological and human health risk assessments to be conducted concurrently with the Phase II RFI. Therefore, data comparability will be a principal concern during the data validation and usability assessment.

2.4.7 Develop the Plan for Obtaining Data

The final step of the DQO process involves specification of the type, number, location, and physical quantity of samples and data, and the QA/QC activities that will be implemented to ensure sampling and measurement errors are managed sufficiently to meet performance/acceptance criteria. As noted above in Section 2.4.5, a judgmental sampling design (direct selection of specific sampling locations) has been specified for data collection efforts covered by this QAPP, with water and soil sampling locations selected to fill identified data gaps; to identify source areas based on the current configuration of groundwater contaminant plumes; and to continue long-term monitoring of plume migration and water quality trends. EPA guidance on sampling design (EPA, 2002b) suggests that judgmental sampling designs are appropriate when "there is reliable historical and physical knowledge about the feature or condition under investigation." Given the extensive amount of data collected during previous Facility investigations and the need to address data gaps, the judgmental sampling design is warranted for data collection activities. Once data gaps are adequately addressed and sources have been adequately characterized, the Corrective Measures Study for the Facility will be initiated.

Details on the type, number, location, and quantity of samples to be collected are presented in the Phase II RFI Work Plan, the Phase II RFI FSAP, the Post-RI/FS FSAP, and in Section 3.0 of this QAPP. Brief summaries of the planned environmental data collection and analysis activities are presented in Tables 2-1 and 2-2 above.

Quality assurance for field data collection activities will be ensured through the use of standard field operating procedures, sample chain-of-custody documentation, and submission of field quality control (QC) samples. Standard Operating Procedures (SOPs) for all field activities including the collection, documentation and shipment of soil and water samples, decontamination of sampling equipment, and all other applicable activities have been included on the compact disc in Appendix C. Quality assurance in laboratory analyses will be ensured through the use of approved methods of analysis and through adherence to a laboratory quality assurance program, which includes regular analysis and reporting of laboratory QC samples. Data review, validation, and verification relative to specific criteria are discussed in Section 5.0 of this QAPP.

As previously noted, a baseline ecological and human health risk assessment will be conducted concurrently with the Phase II RFI focused field sampling program. The conclusions of the risk assessment will be an integral part of decisions concerning any corrective measures proposed in the Corrective Measures Study for the Facility.

2.5 SPECIAL TRAINING/CERTIFICATION

Site-specific general health and safety training requirements (e.g., safety issues concerning arsenic, lead, and cadmium exposure) are addressed in the Custodial Trust's Health & Safety Plan (Nickel, 2010) and the Hydrometrics' Health & Safety Plan (Hydrometrics, 2009). The Facility Health and Safety Officer is responsible for ensuring that project personnel have received the proper health and safety training, and that health and safety requirements are met at all times.

The qualifications of the laboratory selected for analysis of 2010 Phase II RFI and Post-RI/FS groundwater and surface water monitoring samples are discussed in Section 3.4, and a copy of the laboratory quality assurance manual is on the compact disc in Appendix D. Although no specific laboratory certifications are required for this project, the qualifications of the selected laboratory (Energy Laboratories) to conduct analysis of samples under the terms of the Consent Decree have previously been provided for EPA review and approval (Asarco, 1998, 2000). Additionally, the EPA has approved Energy Laboratories for laboratory analysis by the Custodial Trust.

2.6 DOCUMENTS AND RECORDS

All samples collected and sent to the laboratory for analysis will follow standard documentation and chain of custody procedures. Field data reporting shall be recorded in field notebooks and will contain results of all measurements made in the field. Documentation includes:

- Chain of custody forms;
- Field notebooks and forms;
- Shipping records;
- Transmittal records; and
- Corrective action reports.

Additional information on sample handling, documentation, and records is in Section 3.3.

The task of recording laboratory data begins once the samples arrive at the laboratory and continues until the final laboratory report is submitted. The Laboratory QA Manager will review the report summary and case narrative to ensure that the data report meets project requirements. In addition to the record of chain-of-custody, the laboratory shall include:

- Cover letter;
- Case narrative;
- Analytical sample results; and
- Associated quality control results.

The selected laboratory for performing chemical and physical analyses will deliver complete documentation including the results of the tests, the testing method employed, practical quantitation (detection) limits (PQLs), and any relevant method specific quality control information (calibration, laboratory standard sample results, etc.). Although no raw data are required in the laboratory deliverable, raw data will be archived by the laboratory to allow further review of the data if warranted. All sample results will be provided in both paper and electronic formats. The deliverable package will also contain a summary of any deviations from procedures described in this QAPP resulting from corrective actions. All hardcopies of field data, laboratory data packages, and data quality/validation reports will be stored and cataloged by the Custodial Trust or its designee, along with any QA/QC records such as audit reports, training records, and corrective action reports.

3.0 DATA ACQUISITION AND MEASUREMENT

3.1 SAMPLING PROCESS DESIGN

Sampling process design addresses the type and number of samples required, sample locations, sample frequencies, sample matrices, and rationale. Sampling process design is addressed in Tables 3-1 through 3-4 of this QAPP. Sampling designs are presented for surface soils (Table 3-1), subsurface soils (Table 3-2), groundwater (Table 3-3), and surface water sampling (Table 3-4). Sample locations are shown on the following Phase II RFI Work Plan, FSAP, and Post-RI/FS FSAP figures in Appendix B:

- Figure 3-1-1 (Plant Site and Surrounding Area Soil Sample Locations);
- Figure 3-1-2 (Proposed Phase II RFI Soil Boring Locations);
- Figure 3-1-3 (Proposed Groundwater Monitoring Wells);
- Figure 3-3-1 (Groundwater/Surface Water Interaction Monitoring Locations);
- Figure 3-4-1 (Evaluation of Groundwater Chemistry in Vicinity of EH-128 and EH-132);
- Figure 1 (Post-RI/FS Groundwater Monitoring Locations); and
- Figure 2 (Post-RI/FS Surface Water Monitoring Locations).

Note that field variances can arise when the sample network is changed (i.e., more/fewer samples, sampling locations other than those specified in the Work Plan, FSAP, and QAPP, etc.); when sampling procedures and/or field analytical procedures require modification due to unexpected conditions; and/or if EPA requests contingent sampling (i.e., additional sampling decisions subject to results of earlier sampling events). Technical staff and project personnel will be responsible for reporting all field variances, technical or QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the QA Manager or designee. The QA Manager will assess suspected problems, and in consultation with the Project Manager, make a decision based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable variance or nonconformance requiring corrective action, then a

TABLE 3-1. PHASE II RFI SURFACE SOIL SAMPLE COLLECTION AND ANALYSIS MATRIX

(h:\files\MTETG\10022\t10 qapp-sampling design.xls\surface)

TABLE 3-1. PHASE II RFI SURFACE SOIL SAMPLE COLLECTION AND ANALYSIS MATRIX (CONTINUED)

TABLE 3-2. PHASE II RFI SUBSURFACE SOIL SAMPLE AND ANALYSIS AND COLLECTION MATRIX

(h:\files\MTETG\10022\t10 qapp-sampling design.xls\subsurface)

TABLE 3-2. PHASE II RFI SUBSURFACE SOIL SAMPLE AND ANALYSIS AND COLLECTION MATRIX (CONTINUED)

TABLE 3-3. GROUNDWATER SAMPLE COLLECTION AND ANALYSIS MATRIX

(h:\files\MTETG\10022\t10 qapp-sampling design.xls\groundwater)

TABLE 3-4. SURFACE WATER SAMPLE COLLECTION AND ANALYSIS MATRIX

(h:\files\MTETG\10022\t10 qapp-sampling design.xls\surface water) report will be initiated by the manager. Field variance and nonconformance procedures are outlined in HF-SOP-30 (Appendix C).

3.2 SAMPLING METHODS REQUIREMENTS

All field sampling will be conducted in general accordance with the SOPs collected in Appendix C. The SOPs applicable to 2010 data collection activities at the Facility are denoted in Table C-1 in Appendix C. Sampling methods and procedures for each of the planned sample types (surface and subsurface soils, groundwater, and surface water) are presented below in Sections 3.2.1 through 3.2.4. A summary of applicable SOPs and sample container and preservation requirements for soil and water matrices is in Table 3-5.

TABLE 3-5. SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Matrix	Parameters	Collection Methods[(1)]	Sample Containers	Preservative[(2)]
Soil Samples	Total Metals Extraction/Adsorption Testing	HS-SOP-6 HS-SOP-57 HS-SOP-72	Ziploc –type bags (double-bagged) or glass jars	None
Water Samples (Groundwater and Surface Water)	Field Parameters	HF-SOP-20 HF-SOP-22 HF-SOP-79 HF-SOP-84	None	None
	Common Constituents	HF-SOP-11	1000 ml HDPE	Cool to 4°C
	Trace Constituents (dissolved for groundwater, total recoverable for surface water ***except aluminum***)	HF-SOP-11 HF-SOP-73	500 ml HDPE	Filter dissolved samples (0.45 µm) HNO_3 to pH <2 Cool to 4°C

NOTES: (1) Hydrometrics' Standard Operating Procedures (see Appendix C).
(2) All chemical preservatives will be added in the field.

3.2.1 Surface Soil Sampling

At each surface soil sampling location, a 5-foot deep test pit will be excavated using a backhoe. Soil samples will be collected from the appropriate intervals (0-6 inch, 6-30 inch, and 30-60 inch) as four-spot composites. For the two shallower intervals (0-6 and 6-30 inch), one subsample will be collected from each wall of the test pit. For the 30-60 inch depth interval, the backhoe will place excavated soils in a separate pile at the surface, and four subsamples will be collected from random locations within the pile. Subsamples of soil from the target depth interval will be collected with hand tools, combined in a clean plastic mixing bowl, thoroughly homogenized, and placed in a Ziploc-type bag for storage. Sample bags will be labeled with a unique sample number, along with the date and time of collection and the depth interval sampled. Each sample will then be double-bagged (i.e., labeled bags will be placed in a second Ziploc-type bag for additional protection against sample loss).

Reused sampling equipment (shovels, trowels, mixing bowls) will be decontaminated between surface soil sampling intervals and locations using the following sequence:

- Brushing loose soil from the equipment;
- Scrubbing equipment with tap water and a non-phosphate detergent;
- Rinsing equipment with a small amount of tap water; and
- Rinsing with deionized or distilled water.

The effectiveness of the decontamination will be evaluated through collection and analysis of equipment rinsate blanks, as described in Section 3.5.1.1.

Field notebooks will be used to record pertinent sampling information, including lithologic descriptions of each soil sample (color, texture, moisture content).

Bagged soil samples will be placed in coolers for storage and transport to the laboratory. Chain-of-custody procedures will be followed throughout the project by utilizing standard chain-of-custody forms to transfer samples from the field to the laboratory. Each cooler of transferred samples will be accompanied by a cover letter, analytical parameter list with project required detection limits (PRDLs), and chain-of-custody documentation for recording the transfer of samples from the possession of field personnel to the possession of the laboratory. All Phase II RFI surface soil sample locations will be photographed, and location coordinates will be recorded using a resource-grade GPS unit. Sample handling and custody requirements are also addressed below in Section 3.3.

Excavation equipment (e.g., backhoe) will be decontaminated between sampling locations using the pressure washing equipment available at the Facility. Wash water from the pressure wash bay reports to the Facility water treatment system.

3.2.2 Subsurface Soil Sampling

Soil boreholes (for both monitoring wells and soil-sample only borings) will be drilled using an air rotary drilling system, and subsurface soil samples will be collected using a split-spoon sampler to document the subsurface lithology, and to provide samples for laboratory analysis. Soil samples will be collected every five feet from ground surface to borehole total depth. Samples from additional intervals will be collected as warranted to correspond to significant changes in lithology or visual evidence of soils contamination. All soil borings will be advanced into the top of the silt/clay layer to aid in more detailed mapping of the shallow/intermediate aquifer base. Drilling activities will be supervised by a geologist or other qualified scientist familiar with the East Helena Facility and the project objectives. Drill cuttings and split spoon samples will be logged to provide a continuous record of subsurface lithology at each boring location. All drill cuttings other than those collected for laboratory analysis will be containerized and characterized to determine proper disposal procedures (i.e., placement in the Facility CAMU or off-site disposal).

Soil samples collected from split spoons will be double-bagged in labeled Ziploc-type bags immediately after retrieval. Because subsurface soil samples will potentially be subjected to extraction and/or adsorption tests, in addition to total metals characterization, efforts will be made to maintain the geochemical integrity of subsurface soil samples, principally to avoid oxidation of reduced sediments under surface conditions. Field personnel will exclude air from the sample containers (bags) to the extent feasible, will seal bags tightly, reinforcing closures with tape as necessary, and will store bagged samples on ice or under refrigeration and in the dark.

Sample bags will be labeled with a unique sample number, along with the date and time of collection and the depth interval sampled. Sampling documentation, storage, and handling requirements for subsurface soil samples will be the same as those outlined for surface soil samples in Section 3.2.1 above. All Phase II RFI subsurface soil sample locations will be photographed, and location coordinates will be recorded using a resource-grade GPS unit.

Drilling equipment (augers, split spoons, etc.) will be decontaminated between borehole locations using the pressure washing equipment available at the Facility. Wash water from the pressure wash bay reports to the Facility water treatment system.

3.2.3 Groundwater Sampling

The collection of groundwater samples from site monitoring wells will generally consist of three steps:

1. Measurement of static water level;
2. Well purging and monitoring for field parameter stabilization; and
3. Water quality sample collection.

3.2.3.1 Static Water Level Measurement

Prior to collection of samples or removal/introduction of any equipment into the well, the static water level will be measured at each well using an electric water level probe to determine the depth of groundwater below a specified measuring point (typically the top of the PVC well casing). Water level measurements will be combined with surveyed measuring point elevations to compute groundwater elevations at each monitoring point. Typically, a complete set of static water level measurements at all wells designated for static water level monitoring will be collected prior to initiating water quality sampling. This procedure allows static water levels to be measured over a shorter time period (one or two days) than would be possible if measurements were collected concurrently with sampling activities at each well.

3.2.3.2 Water Quality Sample Collection

In general, groundwater sampling will proceed in order from “clean” sites (with lower concentrations of constituents of concern), to “dirty” sites based on previous data collected at the site. Field personnel will determine the appropriate sampling order before conducting sampling in cooperation with the field team leader and the project manager.

Dedicated tubing installed in each monitoring well and a 12-volt submersible pump will be used to purge and sample monitoring wells. Purging will consist of removing three to five well volumes while routinely monitoring field parameters (pH, dissolved oxygen, temperature, specific conductance) at least twice during removal of each well volume. Field parameters will be measured using a flow-through device to minimize potential effects from atmospheric exposure. Field meters will be calibrated daily according to factory instructions, with calibration results recorded on calibration forms. All purge water will be containerized and routed to the Facility water treatment system.

Samples for laboratory analysis will be collected only after one of the following purge conditions is met:

- A minimum of three well volumes have been removed and successive field parameter measurements agree to within the stability criteria given below; or
- At least five well volumes have been removed although field parameter stabilization criteria are not yet met; or
- The well has been pumped dry and allowed to recover sufficiently such that adequate sample volumes for rinsing equipment and collecting samples can be removed.

Criteria for field parameter stabilization are as follows:

Parameter (Units)	Stability Criteria
pH (standard units)	± 0.1 s.u.
Water temperature (°C)	± 0.2 °C
Specific conductance (µmhos/cm)	± 5% (SC ≤ 100 µmhos/cm) ± 3% (SC > 100 µmhos/cm)
Dissolved oxygen (mg/L)	± 0.3 mg/L

NOTE: Stability criteria obtained from USGS *National Field Manual for the Collection of Water Quality Data: Chapter A4, Collection of Water Samples* (September 1999).

Following well purging, final field parameter measurements will be collected and recorded, and groundwater quality samples will be obtained. Sample bottles will be filled directly from a sampling port, prior to the pumped water passing through the flow-through cell. Samples for trace constituents will be filtered through a 0.45µm filter prior to preservation, to allow analysis for the dissolved fraction.

Sample containers will be rinsed three times with sample water prior to sample collection, then preserved as appropriate for the intended analysis (e.g., nitric acid preservation to pH <2 for metals analysis), and stored on ice in coolers at approximately 4°C during transport.

Groundwater sampling equipment reused between monitoring locations (sampling pump and short piece of discharge line used to connect to the dedicated well tubing) will be thoroughly decontaminated between uses. Equipment decontamination will consist of the following steps:

- Rinse with about five gallons of soapy water (Alconox or other non-phosphate detergent);
- Rinse with about five gallons of clean tap water; and
- Final rinse with about three gallons of distilled or deionized water.

The effectiveness of the decontamination procedure will be evaluated through the periodic collection of equipment rinsate and deionized water blanks, as outlined in Section 3.5.1.2.

3.2.4 Surface Water Sampling

3.2.4.1 Flow Measurement

Surface water flow measurements will be collected using one of two methods, depending on the channel geometry and stream discharge rate:

- Marsh-McBirney current meter and wading rod (velocity-area method); and
- Portable flume.

If measurement conditions are unsafe due to high flows, the field sampling team will estimate the flow.

The Marsh-McBirney current meter is used to measure streamflow at larger, wadeable stream sites. Measurement of streamflow is performed in accordance with the area-velocity method developed by the USGS (USGS, 1977). In general, the entire stream width is divided into subsections and the stream velocity measured at the midpoint of each subsection and at a depth equivalent to six-tenths of the total subsection depth. The velocity in each subsection is then multiplied by the cross-sectional area to obtain the flow volume through each subsection. The subsection flows are then summed to obtain the total streamflow rate. Streamflow measurements are typically collected in a stream reach as straight and free of obstructions as possible, to minimize potential measurement error introduced by converging or turbulent flow paths.

Streamflow measurements on smaller streams may be obtained using a portable flume such as a 90° v-notch cutthroat or portable Parshall flume. To measure streamflow, the flume is placed and leveled in the streambed, and the full streamflow directed through the flume throat. Water depth or head measurements are then collected at specified locations in the converging and (if applicable) diverging sections of the flume. The head measurements are used to verify proper functioning of the flume and to calculate streamflow based on the water depth.

3.2.4.2 <u>Field Parameters and Water Quality Sampling</u>

Field parameters measured at surface water quality monitoring sites will include the following:

- pH;
- Specific conductance (SC);
- Dissolved oxygen (DO); and
- Water temperature.

Field meters will be calibrated daily according to factory instructions, with calibration results recorded in the field notebook and on calibration forms. Field parameter measurements will be obtained directly in the stream if possible; however, high velocity areas should be avoided to limit possible pH measurement errors due to streaming potentials. Alternatively, a clean container may be filled with sample water for parameter measurement. Results are recorded in the field notebook and on standard sample forms. Field meters are checked periodically throughout the day for drift by measuring standard solutions (pH buffers, SC solutions), and are recalibrated as necessary.

Water quality samples will be collected from each surface water monitoring site by passing an uncapped sample container across the area of flow. When wading, samples are collected near the centroid of flow upstream of the sampler; during unsafe wading conditions, samples are collected from the stream bank. Sample containers will be rinsed three times with sample water prior to sample collection. Samples will be preserved as appropriate for the intended analysis (e.g., nitric acid preservation to pH <2 for metals analysis), and stored on ice in coolers at approximately 4±2°C for transport. Note that all trace constituents will be analyzed for total recoverable concentrations (unfiltered samples) with the exception of aluminum, which is analyzed as dissolved. Therefore, a separate sample for aluminum will be field filtered through a 0.45 µm filter prior to preservation.

All samples will be stored in coolers or refrigerated from the time of collection until delivery to the analytical laboratory. All water quality sampling information, including sample sites, sample numbers, date and time of sample collection, field parameter measurements, flow measurements, and other notes and observations, will be documented in waterproof ink in a dedicated project field notebook.

3.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

The SOPs for sample labeling, documentation and shipping procedures are in Appendix C. All samples collected and sent to the laboratory for analysis will follow standard documentation, packing, and chain-of-custody procedures. Samples will be stored in iced coolers or refrigerated following collection, then hand-delivered to the laboratory in iced coolers.

Sample custody (responsibility for the integrity of samples and prevention of tampering) will be the responsibility of the samplers until samples are shipped. Sample coolers will be sealed with custody seals prior to shipping and the laboratory will record the condition of the seals upon arrival to ensure that the containers have not been opened during transport. Upon arrival at the laboratory, sample custody shifts to laboratory personnel, who are responsible for tracking individual samples through login, analysis, and reporting. At the time of sample login, the laboratory will assign a unique laboratory sample number, which can be cross-referenced to the field sample number and used to track analytical results.

Documents generated during sample collection will consist of:

1. Sample collection field notes and forms;
2. Chain-of-Custody forms; and
3. Shipping receipts in the event that samples are sent to a laboratory via independent courier.

Sampling activities will be recorded in a project-specific field notebook, and the appropriate sample collection form will be completed. Each sample will be identified on adhesive labels attached to sample bottles, or on the inner bag of double-bagged soil samples. All labels will be completed using waterproof ink. Field notebooks used to record pertinent sampling information will include, at a minimum, the following:

- Project name;
- Date and time;
- Sample location;
- Sample number;
- Sample depth (if applicable);

- Media type;
- Field meter calibration information;
- Sampling personnel present;
- Analyses requested;
- Sample preservation;
- Field observations (soil descriptions and field parameter measurements);
- Weather observations; and
- Other relevant project-specific site or sample information.

Entries will be made in permanent ink, with corrections crossed out with a single line, dated and initialed. Field books will be signed and dated at the bottom of each page by personnel making entries on that page.

Individual samples (including QC samples) will be assigned unique sample numbers according to the following sample numbering scheme:

AAA[A]-YYMM-XXX

where AAA[A] is a three- or four-character code denoting the project, YYMM is a four-digit code denoting the year and month (e.g., 1007 for July 2010), and XXX is a three-digit code that is incremented sequentially for each successive sample.

3.4 ANALYTICAL METHODS REQUIREMENTS

Laboratory analysis will be conducted by Energy Laboratories' Helena, Montana branch. Energy Laboratories is certified by EPA Region 8 and the State of Montana under the Safe Drinking Water Act. Energy Laboratories' Quality Assurance Manual is included on the compact disc in Appendix D. Field parameters will be analyzed by field personnel using the procedures outlined in Appendix C. All laboratory analyses will be conducted in accordance with EPA-approved and/or industry standard analytical methods.

3.4.1 Total Constituents in Soils

Total concentrations of metals, metalloids, and nonmetals will be analyzed in soil samples using acid digestion followed by a suitable analytical technique (usually ICP or ICP-MS). Required parameters, analytical methods, and project-required detection limits for surface and subsurface soil samples collected as part of the Phase II RFI are shown in Table 3-6. All soil samples will also be analyzed for pH.

3.4.2 Extraction/Adsorption Testing of Arsenic and Selenium

A number of tests will be conducted specifically for providing information to support fate and transport modeling of arsenic and selenium in groundwater at the East Helena Facility. Modeling objectives and data needs are outlined in the Phase II RFI Work Plan. The types of tests to be conducted on selected soil samples will include the following:

- Synthetic Precipitation Leaching Procedure (SPLP) metals;
- Sequential extractions;
- Batch adsorption tests; and
- Batch leaching tests.

A summary of the proposed testing program to support geochemical and groundwater modeling is in Section 3.1.3.2 of the Phase II RFI Work Plan (Hydrometrics, 2010b). The SPLP samples will be prepared in accordance with EPA Method 1312. Sequential extraction, batch adsorption and batch leaching tests will involve measurement of parameter concentrations in water after equilibration of soils with leaching or extractant solutions at given solid/solution ratios. Sequential extraction methods are given in HL-SOP-42 (Appendix C). Adsorption and leach test methods will follow EPA's *Batch-Type Procedures for Estimating Soil Adsorption of Chemicals* (Roy et al., 1991).

Solutions generated from extraction/adsorption testing will be analyzed for arsenic and selenium concentrations using the methods and project-required detection limits shown in Table 3-6. Solution pH will also be measured on all samples.

TABLE 3-6. ANALYTICAL METHODS AND DETECTION LIMITS FOR SOIL SAMPLES

Total Metals Analysis

Parameter	Analytical Method(1)	Surface Soil Sample PRDL(2) (mg/kg)	Subsurface Soil Sample PRDL (mg/kg)
Aluminum (Al)	SW 3050/6010B/6020	100	5
Antimony (Sb)	SW 3050/6010B/6020	0.1	5
Arsenic (As)	SW 3050/6010B/6020	0.1	5
Barium (Ba)	SW 3050/6010B/6020	100	5
Beryllium (Be)	SW 3050/6010B/6020	10	5
Cadmium (Cd)	SW 3050/6010B/6020	0.1	1
Chromium (Cr)	SW 3050/6010B/6020	5	5
Cobalt (Co)	SW 3050/6010B/6020	1	5
Copper (Cu)	SW 3050/6010B/6020	5	5
Gold (Au)	SW 3050/6010B/6020	5	5
Iron (Fe)	SW 3050/6010B/6020	100	5
Lead (Pb)	SW 3050/6010B/6020	1	5
Manganese (Mn)	SW 3050/6010B/6020	10	5
Mercury (Hg)	SW 7471/6010B/6020	0.05	1
Nickel (Ni)	SW 3050/6010B/6020	5	5
Selenium (Se)	SW 3050/6010B/6020	0.5	5
Silver (Ag)	SW 3050/6010B/6020	2	5
Tellurium (Te)	SW 3050/6010B/6020	1	1
Thallium (Tl)	SW 3050/6010B/6020	0.1	1
Vanadium (V)	SW 3050/6010B/6020	1	5
Zinc (Zn)	SW 3050/6010B/6020	5	5
pH	SW 9045C	0.1 s.u.	0.1 s.u.

Extraction/Adsorption/Leach Testing Analysis

Parameter	Analytical Method(1)	Extractant/Leach Solution PRDL (mg/L)
Arsenic (As)	SW 6010B/6020	0.005
Selenium (Se)	SW 6010B/6020	0.005
pH	EPA 150.1	0.1 s.u.

(1) Laboratory analytical methods are from EPA's *Test Methods for Analysis of Solid Waste (SW-846)* (EPA, 2007) or *Methods for Chemical Analysis of Water and Wastes* (EPA, 1983). Equivalent procedures may be used as long as detection limits are achieved.

(2) PRDL = Project-Required Detection Limit

3.4.3 Groundwater Analyses

Required parameters, analytical methods, and project-required detection limits for groundwater quality samples collected at the East Helena Facility are shown in Table 3-7. Groundwater samples will be analyzed for physical parameters, common constituents, and a comprehensive suite of trace constituents. The PRDLs for individual parameters have been set at concentrations normally achievable by routine analytical testing in the absence of unusual matrix interference (laboratory's practical quantitation limit). These limits will support project objectives for both risk assessment and comparison with regulatory standards. It must be recognized that the PRDL is a detection limit goal, which may not be achieved in all samples due to sample matrix interference or other problems. If a PRDL is not met by the laboratory, the data will be reviewed to determine if any actions (e.g., sample reanalysis or selection of an alternative analytical method) are required.

3.4.4 Surface Water Analyses

Required parameters, analytical methods, and project-required detection limits for surface water quality samples collected at the East Helena Facility are shown in Table 3-8. Similar to groundwater, samples will be analyzed for physical parameters, common constituents, and a comprehensive suite of trace constituents. The PRDLs for individual parameters have been set at concentrations normally achievable by routine analytical testing in the absence of unusual matrix interference (laboratory's practical quantitation limit). These limits will support project objectives for both risk assessment and comparison with regulatory standards; therefore, PRDLs for a number of parameters are different in surface water compared with groundwater. It must be recognized that the PRDL is a detection limit goal, which may not be achieved in all samples due to sample matrix interference or other problems. If a PRDL is not met by the laboratory, the data will be reviewed to determine if any actions (e.g., sample reanalysis or selection of an alternative analytical method) are required.

TABLE 3-7. ANALYTICAL METHODS AND DETECTION LIMITS FOR GROUNDWATER SAMPLES

Parameter	Analytical Method(1)	Project-Required Detection Limit (mg/L)
Physical Parameters		
pH	150.2/SM 4500H-B	0.1 s.u.
Specific Conductance	120.1/SM 2510B	1 µmhos/cm
TDS	SM 2540C	10
TSS	SM 2540D	10
Common Ions		
Alkalinity	SM 2320B	1
Bicarbonate	SM 2320B	1
Sulfate	300.0	1
Chloride	300.0/SM 4500CL-B	1
Calcium	215.1/200.7	5
Magnesium	242.1/200.7	5
Sodium	273.1/200.7	5
Potassium	258.1/200.7	5
Trace Constituents (Dissolved)(2)		
Aluminum (Al)	200.7/200.8	0.1
Antimony (Sb)	200.7/200.8	0.003
Arsenic (As)	200.8/SM 3114B	0.002
Barium (Ba)	200.7/200.8	0.1
Beryllium (Be)	200.7/200.8	0.001
Cadmium (Cd)	200.7/200.8	0.001
Chromium (Cr)	200.7/200.8	0.001
Cobalt (Co)	200.7/200.8	0.001
Copper (Cu)	200.7/200.8	0.001
Gold (Au)	200.7/200.8	0.01
Iron (Fe)	200.7/200.8	0.02
Lead (Pb)	200.7/200.8	0.005
Manganese (Mn)	200.7/200.8	0.01
Mercury (Hg)	245.2/245.1/200.8/SM 3112B	0.001
Nickel (Ni)	200.7/200.8	0.01
Selenium (Se)	200.7/200.8/SM 3114B	0.001
Silver (Ag)	200.7/200.8	0.005
Tellurium (Te)	200.7/200.8	0.1
Thallium (Tl)	200.7/200.8	0.001
Vanadium (V)	200.7/200.8	0.01
Zinc (Zn)	200.7/200.8	0.01
Field Parameters		
Static Water Level	HF-SOP-10	0.01 ft
Water Temperature	HF-SOP-20	0.1 °C
Dissolved Oxygen (DO)	HF-SOP-22	0.1 mg/L
pH	HF-SOP-20	0.1 s.u.
Specific Conductance (SC)	HF-SOP-79	1 µmhos/cm

(1) Analytical methods are from the current version of *Standard Methods (SM) for the Examination of Water and Wastewater* (available online at http://www.standardmethods.org/, or EPA's *Methods for Chemical Analysis of Water and Waste* (EPA, 1983).

(2) Samples to be analyzed for dissolved constituents will be field-filtered through a 0.45 µm filter.

TABLE 3-8. ANALYTICAL METHODS AND DETECTION LIMITS FOR SURFACE WATER SAMPLES

Parameter	Analytical Method(1)	Project-Required Detection Limit (mg/L)
Physical Parameters		
pH	150.2/SM 4500H-B	0.1 s.u.
Specific Conductance	120.1/SM 2510B	1 µmhos/cm
TDS	SM 2540C	10
TSS	SM 2540D	10
Common Ions		
Alkalinity	SM 2320B	1
Bicarbonate	SM 2320B	1
Sulfate	300.0	1
Chloride	300.0/SM 4500CL-B	1
Calcium	215.1/200.7	5
Magnesium	242.1/200.7	5
Sodium	273.1/200.7	5
Potassium	258.1/200.7	5
Trace Constituents (Total Recoverable except Aluminum [Dissolved])(2)		
Aluminum (Al)(2)	200.7/200.8	0.05
Antimony (Sb)	200.7/200.8	0.003
Arsenic (As)	200.8/SM 3114B	0.0005
Barium (Ba)	200.7/200.8	0.1
Beryllium (Be)	200.7/200.8	0.001
Cadmium (Cd)	200.7/200.8	0.0001
Chromium (Cr)	200.7/200.8	0.001
Cobalt (Co)	200.7/200.8	0.0005
Copper (Cu)	200.7/200.8	0.001
Gold	200.7/200.8	0.01
Iron (Fe)	200.7/200.8	0.02
Lead (Pb)	200.7/200.8	0.0005
Manganese (Mn)	200.7/200.8	0.01
Mercury (Hg)	245.2/245.1/200.8/SM 3112B	0.00001
Nickel (Ni)	200.7/200.8	0.01
Selenium (Se)	200.7/200.8/SM 3114B	0.001
Silver (Ag)	200.7/200.8	0.0005
Tellurium	200.7/200.8	0.1
Thallium (Tl)	200.7/200.8	0.0002
Vanadium (V)	200.7/200.8	0.1
Zinc (Zn)	200.7/200.8	0.01
Field Parameters		
Stream Flow	HF-SOP-37/-44/-46	NA
Water Temperature	HF-SOP-20	0.1 °C
Dissolved Oxygen (DO)	HF-SOP-22	0.1 mg/L
pH	HF-SOP-20	0.1 s.u.
Specific Conductance (SC)	HF-SOP-79	1 µmhos/cm

(1) Analytical methods are from the current version of *Standard Methods (SM) for the Examination of Water and Wastewater* (available online at http://www.standardmethods.org/, or EPA's *Methods for Chemical Analysis of Water and Waste* (EPA, 1983).

(2) Samples to be analyzed for dissolved constituents (aluminum) will be field-filtered through a 0.45 µm filter.

3.5 QUALITY CONTROL REQUIREMENTS

3.5.1 Field Quality Control Sample Collection

Field quality control samples will be used to provide quality assurance for field sampling and subsequent laboratory analysis of metals concentrations. This section describes the types of field quality control samples to be collected, and the frequency at which each type of field quality control sample will be collected.

3.5.1.1 Field Quality Control for Soil Samples

Field Duplicates

Field duplicate samples are replicate samples from a single sampling location submitted to a laboratory for the same set of analyses. For the purposes of this project, field duplicates for soils will be collected by mixing a soil sample thoroughly in a mixing bowl, then splitting the sample into two sample containers. Duplicates will be sent to the same laboratory, but will be identified with different sample numbers. Field duplicates will be collected at a minimum frequency of one per twenty field samples (5 percent).

Control limits for soil sample duplicates will be agreement of duplicate sample results to within a relative percent difference (RPD) of 35% for when both sample concentrations (original and duplicate) are greater than five times the PRDL, and plus or minus two times the PRDL when either of the sample concentrations is less than five times the PRDL. The calculation for RPD is:

$$\text{RPD} = \text{abs}[(S-D)/(S+D)] \times 200$$

Where:

RPD = Relative Percent Difference;
abs = absolute value;
S = Original Sample Value;
D = Duplicate Sample Value.

Field Blanks (Rinsate Blanks)

Rinsate (equipment) blanks will consist of deionized water that has been used to rinse decontaminated soil sampling equipment (trowels, mixing bowls). Rinsate blanks will be collected at a frequency of one per day.

Target control limits for all types of field blanks are no contaminants present above laboratory's PQLs.

3.5.1.2 Field Quality Control for Groundwater and Surface Water Samples

Field Duplicates

Field duplicate samples will be obtained at an approximate frequency of one per twenty water samples (1/20) or one per day, which ever is greater. Water duplicates will be collected by filling two samples containers consecutively from the same sampling location. Control limits for water duplicate samples will be the agreement of sample results within a RPD of 20% when both sample concentrations (original and duplicate) are greater than five times the PRDL and plus or minus the PRDL when either of the sample concentrations is less than five times the PRDL.

Field Blanks (Rinsate and D.I. Blanks)

Rinsate blanks will consist of aqueous (deionized water) rinsate blanks collected using decontaminated sample collection equipment. D.I. blanks will consist of deionized water placed into sample containers. Both rinsate and D.I. blanks will be collected at a frequency of one per twenty water samples (1/20) or one per day, whichever is greater.

Target control limits for all types of field blanks are no contaminants present above laboratory's PQLs.

3.5.2 Laboratory Quality Control Samples

Laboratory quality assurance and quality control will be maintained through adherence to the laboratory's internal quality assurance protocol during analysis. Laboratory QC sample frequency and control limit guidelines are specified in the QA Manual in Appendix D.

Laboratory analysis for both water and soil matrix samples will include prescribed QC procedures and samples according to the published analytical method and internal laboratory QC procedures. For the purposes of this project, the following laboratory QC sample results will be reported (by the laboratory) and reviewed during the data validation process:

- Laboratory preparation blanks;
- Matrix spike duplicates;
- Laboratory duplicates; and
- Laboratory control standards.

Target control limits for these laboratory control samples are described in Section 5.0.

3.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Field Instrument Maintenance

The field instruments to be used for this project will include thermometers, pH meters, dissolved oxygen meters, water level meters, and conductivity meters. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated daily before use. Calibration checks will be documented on the calibration log sheets. The maintenance schedule and trouble-shooting procedures for field instruments are indicated in SOPs. Critical spare parts such as tape, pH probes, and batteries will be kept on-site to reduce downtime. Backup instruments and equipment will be available on-site or within 1-day shipment to avoid delays in the field schedule. Table 3-9 summarizes the preventative maintenance schedule for field equipment.

TABLE 3-9. PREVENTATIVE MAINTENANCE FOR FIELD INSTRUMENTS

Instruments	Maintenance Procedures/Schedule	Spare Parts In Stock
pH/Redox Meter	1. Calibrate beginning of each day, and as necessary during use. 2. Check calibration periodically throughout day. 3. Store in appropriate storage solution. 4. Replace electrodes as needed. 5. Replace batteries if necessary.	1. pH buffers 2. Batteries 3. Spare electrodes
Conductivity Meter	1. Calibrate beginning of each day, and as necessary during use. 2. Replace batteries as necessary.	1. Batteries
Dissolved Oxygen Meter	1. Calibrate daily and as necessary during use. 2. Check membranes for bubbles daily. 3. Replace membranes as specified by manufacturer. 4. Replace batteries if necessary.	1. Batteries 2. Membranes 3. Solution

Laboratory Instrument Maintenance

As part of their QA/QC Programs, routine preventative maintenance programs are conducted by the Energy Laboratories to minimize the occurrence of instrument failure and other system malfunctions. Each laboratory performs routine scheduled maintenance, or coordinates with the vendor for the repair of all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument service logbook for each instrument. Emergency repair or scheduled manufacturer's maintenance is provided under a repair and maintenance contract with factory representatives.

3.7 INSTRUMENT CALIBRATION AND FREQUENCY

3.7.1 Field Instrument Calibration

The field instruments will be calibrated as described in field SOPs (provided for in this QAPP and Appendix C). Field instruments will include a pH/temperature meter, dissolved oxygen meter, and specific conductance meter. As a rule, instruments will be calibrated daily prior to use and will be checked periodically with standards to assess instrument drift.

The pH-meter will be calibrated using a 2- or 3-point calibration with reference standards (pH 4, 7, and/or 10 buffers) bracketing the expected field sample values. Conductivity meters are calibrated with a single reference solution, and dissolved oxygen meters are calibrated to the specific elevation of the sample site. All the calibration procedures performed will be documented on the field calibration form and will include the date/time of calibration, name of person performing the calibration, reference standard used, temperature at which readings were taken and the readings. Multiple readings on one sample or standard, as well as readings on replicate samples, will likewise be documented. For specific instructions on the calibration frequency, the acceptance criteria and the conditions that will require more frequent recalibration, refer to the specific SOPs for each field analysis (Appendix C).

3.7.2 Laboratory Instrument Calibration

Appendix D details each analysis performed in the laboratory and describes the calibration procedures, their frequency, acceptance criteria and the conditions that will require recalibration.

The laboratory maintains a sample logbook for each instrument which will contain the following information: instrument identification, serial number, date of calibration, analyst, calibration solutions run and the samples associated with these calibrations.

Calibration of laboratory equipment will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities. These records will be filed at the location where the work is performed and will be subject to QA audit. For all instruments, the laboratory will maintain a factory-trained repair staff with in-house spare parts or will maintain service contracts with vendors.

3.8 INSPECTION / ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

The inspection, acceptance and inventory requirements of supplies and consumables will be the responsibility of the field team leader and the QA Manager. The supplies required for this type of sampling are readily available and are easily obtained from local merchants or environmental sampling vendors. Typically, an abundance of supplies will be purchased prior to initiation of field activities. These materials, once obtained, will be inspected and inventoried. As the field activities proceed, it will be the responsibility of the field leader to keep track of the amount of supplies and consumables used. If the quantity of a particular supply or consumable is running low, then it is the responsibility of the field leader to obtain the amount needed.

3.9 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

No formal review of existing data is proposed as part of this QAPP. The CC/RA (Hydrometrics, 1999a) reviewed data usability of existing site data at the time, and found that all data were usable for CC/RA purposes. The usability of existing data for Phase II RFI and eventually for CMS purposes will be determined by referring to the conclusions regarding individual databases in the CC/RA, and by a review of subsequent data quality assessments for information collected after the CC/RA was published. Given the consistency in field and laboratory methods over time for data collection activities at the East Helena Facility, including routine analysis of field and laboratory QC samples, it is anticipated that all historical data should be usable. Critical data sets (e.g., those used for risk assessment purposes) may require a separate, more rigorous evaluation.

3.10 DATA MANAGEMENT

Data records will primarily be maintained, reviewed, and updated as necessary in electronic format (databases). Verification of data at entry is performed as the first step in the validation process. Once the data are entered manually or electronically, database results are compared with laboratory hard copy results to ensure that the data results are accurate.

Procedures for recording and archiving field and laboratory data are further detailed in the field SOPs (Appendix C) and Laboratory QA manuals (Appendix D).

3.10.1 Data Reduction

Field Data Reduction

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory setting. All field measurements will be recorded in field notebooks as they are collected. If errors are made, results will be legibly crossed out, initialed and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry.

Laboratory Data Reduction Procedures

Laboratory data reduction procedures will follow protocol described in the laboratory's QA manuals (see Appendix D). Samples will be assigned a unique laboratory sample number when they are received at the laboratory, which will then be used to cross-reference the field sample number and to track analytical results for the sample. All raw analytical data will be recorded in numerically identified laboratory notebooks. Data are recorded in these notebooks along with other pertinent information, such as the field sample identification number and the sample tag number. Other details will also be recorded in the laboratory notebooks, such as the analytical method used, name of analyst, the date of analysis, matrix sampled, reagent concentrations, instrument settings, and the raw data. Each page of these notebooks shall be signed and dated by the analyst. Periodic documented review of these notebooks by the Laboratory QA Manager takes place prior to final data reporting.

Quality control data (e.g., laboratory duplicates, matrix spikes, duplicates and standards) will be compared to the method acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the Laboratory QA Manager for review. If approved, data are logged into the project database format. Unacceptable data shall be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data exceeding acceptance limits, and any other anomalous conditions encountered during sample analysis. After the Laboratory QA Manager approves these data, they are considered ready for third party data validation.

3.10.2 Data Validation

Validation or data quality review is a systematic process for determining the compliance of the analytical data with the applicable method requirements and project specifications. Data will be assessed in general accordance with EPA's data verification and validation guidance procedures (EPA, 2002c). The evaluation will determine if the data are the correct type, quantity and quality to support the project objectives and the subsequent CMS for the facility. In the event that the data collected do not meet the intended uses, limitations on the use of data may be specified, or additional data may need to be collected. Additional details on the data review and validation process are outlined below in Section 5.0.

4.0 ASSESSMENT/OVERSIGHT

4.1 ASSESSMENT AND RESPONSE ACTIONS

4.1.1 Corrective Action

Any deviations from the Phase II RFI Work Plan, the Phase II RFI or Post RI/FS FSAPs, or this QAPP, which are necessary in order to generate data to meet the intended data uses, are considered corrective actions. Corrective actions may include:

- Changes in sample collection methods;
- Collection of additional samples;
- Sample reanalysis; and
- Modification of analytical procedures or selection of new procedures.

The procedure for assessing and implementing corrective actions is given in HF-SOP-30, Decision Process for Field Variances and Nonconformances (Appendix C). In general, the procedure provides for (1) identification of deficiencies or nonconformances; (2) notification of project managers and suggested resolution; (3) follow-up (may include field visit or audit); and (4) formal notification and modification of Work Plan/FSP/QAPP documents as necessary. It should be emphasized that implementation of corrective actions must be a flexible process, given wide range of potential types of variances or nonconformances that may be encountered.

Corrective actions must be approved by the project manager or QA Manager prior to implementation and must be fully documented as described in HF-SOP-30. A summary of corrective actions (if applicable) will be included in the data quality report.

4.1.2 Performance and System Audits

<u>System Audits</u>

System audits are qualitative evaluations of data quality systems (field procedures and equipment, laboratory procedures and facilities, data management systems, etc.) conducted for the purpose of determining compliance with the organizational and procedural requirements presented in this QAPP. For the Phase II RFI and Post-RI/FS monitoring projects, EPA oversight of work plan/FSP implementation will serve as the system audit. The results of previous audits and/or studies conducted by Energy Laboratories will be provided upon request.

Performance Audits

Performance audits are quantitative determinations of the performance of the measurement system (i.e., including errors associated with field sample handling procedures and laboratory analytical processes). Energy Laboratories routinely participates in State of Montana and Federal laboratory performance audits. Performance evaluation (PE) standards may be submitted at the discretion and request of regulatory personnel as an independent check on the overall accuracy of laboratory analysis.

4.2 REPORTS TO MANAGEMENT

Reports to management will include:

- Data validation report(s);
- Results of any field or laboratory performance audits;
- Corrective action reports; and
- Phase II RFI final data summary report.

Data validation reports will be prepared by the Data Management and Validation Coordinator in accordance with Section 5.0 of this QAPP, and will be distributed to the Project Manager and QA manager. Typically, separate data validation reports are prepared for different sampling events and/or sample matrices. For example, review and validation of soil sample results would be reported separately from review and validation of water samples, and different water sampling events would also be reported separately.

Results of any performance audits conducted during field or laboratory activities will be documented by the QA Manager and distributed to the Field Team Leader and Project Manager. Results of any previous State and/or Federal laboratory audits will be available upon request for management review.

As previously stated, corrective actions must be approved by the Project Manager or QA Manager prior to implementation. All corrective actions will be documented by the QA Manager in a corrective action report, and submitted to the Project Manager. A summary of corrective actions taken will be included in the final data summary report.

A final Phase II RFI data summary report will be prepared after the conclusion of all Phase II RFI-related sampling and analysis, to summarize the overall quality of the data in terms of meeting the project objectives. This report will consist of a complete project database (with results qualified as necessary based on the validation criteria in Section 5.0), a summary of the data quality review conducted for each media type, an assessment of the overall completeness objectives for each analyte and matrix, and a summary of relevant corrective action measures that were implemented.

Monthly progress reports, required by Section XI of the Consent Decree, will include a narrative summary of sampling and testing conducted in the previous month, as well as any data packages that have been generated, validated, and reviewed in accordance with approved Work Plans, FSAPs, and QAPPs.

5.0 DATA VALIDATION AND USABILITY

5.1 DATA REVIEW, VALIDATION, AND VERIFICATION

Overall completeness and adherence to project objectives is assessed through validation and verification. Verification includes confirmation of adherence to sample design, collection, handling, custody, shipping, transmittal, and documentation procedures. Validation includes the confirmation of adherence to specific analytical procedure criteria and protocols, and the assessment of data quality in terms of usability. Verification and validation methods are discussed in Section 5.2.

Electronic data deliverables (EDDs) from the laboratory, will be transferred into the East Helena Facility project database by the Data Management and Validation Coordinator. All data entries will be compared to hardcopy or Adobe® portable document formatted (pdf) laboratory reports, to ensure the project database remains free of transcription errors.

The need for additional corrective action (see Section 4.1.1) may be identified during data validation or data verification. Potential types of corrective action resulting from data verification may include the collection of additional samples or a summary of deficiencies. Potential types of corrective action resulting from data that are considered unusable (as determined by data validation) may include resampling by the field team or reanalysis of samples by the laboratory. When the Data Management and Validation Coordinator identifies a potential corrective action situation, the QA Manager and Project Manager will be responsible for approving the implementation of corrective action, including any resampling, during data assessment. Corrective actions will be documented by the QA Manager.

5.2 VERIFICATION AND VALIDATION METHODS

All data deliverables containing analytical data and quality control information will be reviewed for overall completeness of the data package. Completeness checks will be administered on all data to determine whether deliverables specified in the project planning documents (including this QAPP) are present. At a minimum, deliverables will include field notes and/or forms, transmittal information, sample chain-of-custody forms, analytical results, methods and PQLs, and laboratory QC summaries. The reviewer will determine whether all required items are present and request copies of missing deliverables.

The number and type of samples collected will be compared with project specifications to ensure conformance with the sampling process design. Review of sample collection and handling procedures will include verification of the following:

- Completeness of submittal packages;
- Completeness of field documentation, including chain-of-custody documentation;
- Field equipment calibration and maintenance and/or quality of field measurements; and
- Adherence to proper sample collection procedures.

All data will be reviewed for completeness of deliverables, and adherence to the sampling and analytical protocols prescribed in this QAPP.

Data validation will include a detailed review of all analytical results, including:

- Reporting limits (RLs) and PQLs vs. PRDLs;
- Holding times;
- Analytical methods;
- Field QC sample results; and
- Laboratory QC sample results.

Table 5-1 summarizes the inorganic sample quality control review criteria to be used for data collected at the Facility. It is important to note that the following table is only a condensed guideline and that additional criteria (as specified by EPA functional guidelines) and professional judgment must be used to determine if the data should be qualified or rejected. The criteria in the following table are consistent with EPA functional guidelines for inorganic data review (EPA, 2004).

TABLE 5-1. VALIDATION CRITERIA FOR ANALYTICAL DATA

TASK	FREQUENCY REQUIREMENT	CONTROL LIMIT	FLAGGING REQUIREMENTS
Field Blanks (Rinsate and D.I.)	1 per 20 samples or 1 per day for water samples (whichever is greater); 1 per day for soil sampling rinsate blanks	<PRDL	Flag associated sample results with UJ for values < 5 times the blank level.
Field Duplicates	1 per 20 samples or 1 per day (whichever is greater) for water samples; 1 per 20 samples for soil samples	RPD +/-20% for aqueous (+/- 35% for soil) sample values >5 times PRDL. Duplicate value within +/- PRDL (2 times PRDL for soil) for values < 5 times PRDL.	Flag associated sample results with J for values > PRDL, and UJ for values < PRDL.
Holding Time	All sample analysis	Within specified holding time for analyte (and analyses)	Professional judgment is used for flagging purposes. However, in general, flag associated sample results > PRDL that exceeded the holding time by one fold with J; and UJ for results < PRDL. Flag associated samples results that exceeded the holding time by two fold with R.
Laboratory Blanks (Prep or Method)	1 per 20 samples or 1 per digestion batch	<PRDL	Flag associated sample results with UJ for values < 5 times the blank level.
Laboratory Duplicates	1 per 20 samples or 1 per batch	RPD +/-20% for water and +/- 35% for soil sample values >5 times PRDL. Duplicate value within +/- PRDL (2 times PRDL for soil) for values < 5 times PRDL.	Flag associated sample results with J for values > PRDL, and UJ for values < PRDL.
Laboratory Control Standard (LCS)	1 per 20 samples or 1 per batch	Recovery 80% to 120% or within 95% confidence limits of the known value.	For recovery rates 50% to 79% (or < the confidence limit), flag associated sample results with J- for values > PRDL, and UJ for values < PRDL. For recovery rates > 120% (or > the confidence limit), flag associated sample results with J+ for values > PRDL. For recovery rates < 50%, flag associated sample results with J- for values > PRDL, and R (rejected) for values < PRDL.
Matrix Spikes	1 per 20 samples or 1 per batch	Recovery 75% - 125% for samples values (original sample) < 4 times the spike value added to matrix spike sample	Professional judgment is used for flagging purposes. However, in general, for recovery rates 30% to 74% (or < the confidence limit), flag associated sample results with J- for values > PRDL, and UJ for values < PRDL. For recovery rates > 125% (or > the confidence limit), flag associated sample results with J+ for values > PRDL. For recovery rates < 30%, flag associated sample results with J- for values > PRDL, and R (rejected) for values < PRDL.

Notes: Duplicate RPD calculation is described in Section 3.5.1.1. LCS and matrix spike recovery calculation are described in Section 5.3.2.

Data qualifiers will be assigned to data exceeding quality control criteria. A summary of the data qualifier codes is provided in Table 5-2.

TABLE 5-2. DATA VALIDATION CODES AND DEFINITIONS

CODE	DEFINITION
A	Anomalous data. (Not an EPA code.)
J	The associated numerical value is an estimated quantity because quality control criteria were not met. A bias was not determined.
J-	The associated numerical value is estimated with a low bias because quality control criteria were not met.
J+	The associated numerical value is estimated with a high bias because quality control criteria were not met.
UJ	The true value may be less than the reported value because quality control criteria were not met. This qualifier is usually associated with either non-detected values or detected values that are linked to blank contaminates.
R	Quality control indicates that the data are unusable (compound may or may not be present).

5.3 RECONCILIATION WITH USER REQUIREMENTS

To ensure that the data generated are of sufficient quality to support the intended data uses, the following sampling and analysis DQIs for the PARCC parameters (precision, accuracy, representativeness, completeness and comparability) are specified. Assessment of these non-direct measurements will guide the evaluation of overall data quality.

5.3.1 Precision Objective

Precision is defined as a measure of reproducibility of replicate measurements, and is inversely related to the variability among the results obtained (e.g., highly variable results have low precision). Precision is assessed by field and laboratory duplicate (includes matrix spike and

LCS duplicates) result comparisons. Field duplicates measure field and laboratory precision whereas, laboratory duplicates measure only laboratory precision.

The precision objective goal for soil sample duplicates will be agreement of duplicate sample results to within a RPD of 35% for when both sample concentrations (original and duplicate) are greater than five times the PRDL, and plus or minus two times the PRDL when either of the sample concentrations is less than five times the PRDL.

The precision objective goal for aqueous sample duplicates will be agreement of duplicate sample results to within a RPD of 20% for when both sample concentrations (original and duplicate) are greater than five times the PRDL, and one times the PRDL when either of the sample concentrations is less than five times the PRDL.

5.3.2 Accuracy Objective

Accuracy is the agreement between a measured value and a 'true' value. Accuracy is assessed by laboratory matrix spike samples and LCSs.

The accuracy objective goal for matrix spike and matrix spike duplicate samples will be a recovery of 75% to 125%. The accuracy objective goal LCSs will be a recovery of 80% to 120% or within the 95% confidence limit of the known value. If method-specific control limits for particular laboratory techniques differ from these, comparisons will be made with the method-specific control limits. Recoveries for matrix spike and LCS results will be calculated using the following formulas:

Matrix Spike Recovery

$$\text{MS R\%} = [(\text{SSR}-\text{SR})/\text{SA}] \times 100$$

Where:

MS R% = Matrix spike recovery percentage;

SSR = Matrix spike sample result;

SR = Original sample result;

SA = Concentration of the spike added to the matrix spike sample.

LCS Recovery

LCS R% = (SR/Known Value) x 100

Where:

LCS R% = LCS Recovery Percentage

SR = LCS sample result

Known Value = LCS's Known Value

5.3.3 Representativeness Objective

Representativeness is the extent to which discrete measurements and testing accurately describe the environmental system. Representative data are achieved through careful selection of sampling locations and frequencies, and proper sampling and analytical procedures, as provided for in the project planning documents (including this QAPP).

5.3.4 Completeness Objective

Completeness is achieved when the number of valid measurements is sufficient to satisfactorily address project objectives. Completeness is calculated as the number of valid measurements divided by the total number of planned measurements, expressed as a percentage. The completeness goal for this project is 90%.

A valid measurement is one in which the sample was properly collected and considered representative of the material sampled, and which was not rejected during the data quality review process. Results qualified during the data quality review process as estimated will be considered valid measurements, unless extenuating circumstances or professional judgment indicate otherwise.

5.3.5 Comparability Objective

Comparability is the degree to which two or more data sets from the same site are generated using consistent procedures. Inherent compositional differences aside, discrete data sets may differ as a result of non-random (biased) sampling, variability in sampling technique, and variations in methods of analysis. To ensure comparability of data collected under this plan, the following actions will be implemented:

1. Soil and water sampling programs are based to a large extent on previously implemented sampling programs (e.g., the Post-RI/FS groundwater and surface water sampling, and Phase I RFI surface and subsurface soil sampling and testing programs) to maximize data comparability;
2. Standard Operating Procedures (SOPs) will be employed for sampling and analytical activities, as appropriate;
3. Field personnel will be thoroughly trained in sampling techniques;
4. Data results will be reported in standard units;
5. Data qualifiers will consistent for all project data;
6. All sampling sites will be accurately delineated and recorded (HF-SOP-2); and
7. Analyses will be performed using EPA-accepted methods, as available and appropriate.

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APPENDIX A

CROSSWALK TABLE -- EPA REQUIREMENTS FOR QUALITY ASSURANCE PROJECT PLANS (QA/R-5) AND EAST HELENA FACILITY QAPP FOR ENVIRONMENTAL DATA COLLECTION ACTIVITIES

CROSSWALK TABLE

QA/R-5 Elements	East Helena Facility QAPP Location
Group A: Project Management Elements	
A1 Title and Approval Sheet	Page ii
A2 Table of Contents	Page iv
A3 Distribution List	Page iii
A4 Project/Task Organization	Section 2.1; Figure 2-1
A5 Problem Definition/Background	Section 2.2
A6 Project/Task Description	Section 2.3
A7 Quality Objectives and Criteria	Section 2.4
A8 Special Training/Certification	Section 2.5
A9 Documents and Records	Section 2.6
Group B: Data Generation and Acquisition Elements	
B1 Sampling Process Design	Section 3.1; Tables 3-1 through 3-4; Appendix B
B2 Sampling Methods	Section 3.2; Appendix C
B3 Sample Handling and Custody	Section 3.3; Table 3-5; Appendix C
B4 Analytical Methods Requirements	Section 3.4; Appendix D; Tables 3-6 through 3-8
B5 Quality Control Requirements	Section 3.5; Appendix D
B6 Instrument/Equipment Testing, Inspection, and Maintenance	Section 3.6; Appendix C; Appendix D
B7 Instrument/Equipment Calibration and Frequency	Section 3.7; Appendix C; Appendix D
B8 Inspection/Acceptance of Supplies and Consumables	Section 3.8
B9 Non-direct Measurements	Section 3.9
B10 Data Management	Section 3.10
Group C: Assessment and Oversight Elements	
C1 Assessments and Response Actions	Section 4.1; Appendix C
C2 Reports to Management	Section 4.2
Group D: Data Validation and Usability Elements	
D1 Data Review, Verification, and Validation	Section 5.1
D2 Verification and Validation Methods	Section 5.2; Tables 5-1 and 5-2
D3 Reconciliation with User Requirements	Section 5.3

APPENDIX B

PHASE II RFI WORK PLAN/FIELD SAMPLING PLAN FIGURES

Phase II RFI Work Plan /Field Sampling Plan Figures for Appendix B – QAPP

Phase II RFI Work Plan (location: h:\files\MTETG\10022\QAPP PDF Documents\figures)

Figure 1-1-1. Asarco East Helena Facility Site Location Map (dwg. No. 105408h016.dwg)

Figure 1-2-1. Primary Source Areas and Soil Stockpiles Identified in CC/RA (dwg. No. 105408h005.dwg)

Figure 3-1-1. Plant Site and Surrounding Area Surface Soil Sample Locations (dwg. No. 105408h047.dwg)

Figure 3-1-2. Proposed Phase II RFI Soil Borings (K:\project\10022\GIS\Figure 3-1-2 Phase II Soil Borings.mxd)

Figure 3-1-3. Proposed Phase II Groundwater Monitoring Wells (dwg. No. 105408h048.dwg)

Figure 3-3-1. Monitoring Locations for Groundwater/Surface Water Interactions Study (dwg. No. 105408h026.dwg)

Figure 3-4-1. Evaluation of Groundwater Chemistry in Vicinity of EH-128 and EH-132 (dwg. No. 105408h029.dwg)

Post-RIFS SAP

Figure 2-1. Post-RI/FS Long Term Monitoring Well Sites (dwg. No. 1002201h001.dwg)
Figure 2-2. Surface Water Monitoring Sites (dwg. No. 1002201h002.dwg)

APPENDIX C

HYDROMETRICS' STANDARD OPERATING PROCEDURES (SOPs)

SOP #	Title
HF-SOP-3	Preservation and Storage of Inorganic Water Samples
HF-SOP-9	Logging Of Monitoring Wells Geological Conditions, Construction and Development
HF-SOP-10	Water Level Measurement with an Electric Probe
HF-SOP-11	Sampling Monitoring Wells for Inorganic Parameters
HF-SOP-19	Obtaining Water Quality Samples from Streams
HF-SOP-20	Field Measurement of pH using a pH Meter
HF-SOP-22	Field Measurement of Dissolved Oxygen
HF-SOP-30	Decision Process for Field Variances and Nonconformances
HF-SOP-37	Streamflow Measurement Using a Marsh-McBirney Water Current Meter
HF-SOP-44	Flow Measurements Using a Portable 90° V-Notch Cutthroat Flume
HF-SOP-46	Streamflow Measurement Using a Portable 3-inch Parshall Flume (Montana Flume)
HF-SOP-73	Filtration of Water Samples
HF-SOP-79	Field Measurement of Specific Conductivity
HF-SOP-84	Field Measurement of Temperature
HL-SOP-42	Sequential Extraction of Metals from Soils
HSOP-2	Determination, Identification, and Description of Field Sampling Sites
HSOP-4	Chain-of-Custody Procedures, Packing and Shipping Samples
HSOP-7	Decontamination of Sampling Equipment
HSOP-13	Equipment Rinsate Blank Collection
HSOP-29	Labeling and Documentation of Samples
HSOP-31	Field Notebooks
HS-SOP-6	Procedure for Collecting Surface Soil Samples
HS-SOP-57	Soil Sampling Procedure for Test Pits
HS-SOP-72	Split Spoon Sampling

TABLE C-1. STANDARD OPERATING PROCEDURES
FOR ENVIRONMENTAL DATA COLLECTION ACTIVITIES
EAST HELENA FACILITY

GENERAL SAMPLING PROCEDURES

SOP #	TITLE	EAST HELENA QAPP
HF-SOP-3	Preservation and Storage of Inorganic Water Samples	X
HF-SOP-30	Decision Process for Field Variances and Nonconformances	X
HF-SOP-32	Preservation and Storage of Organic Water Samples	
HF-SOP-58	Management and Validation of Field and Laboratory Data	
HF-SOP-66	Collection, Preservation, and Storage of Water Samples Using USGS Clean Analytical Techniques	
HF-SOP-67	Decontamination of Sampling Equipment Using USGS Clean Analytical Techniques	
HF-SOP-73	Filtration of Water Samples	X
HSOP-2	Determination, Identification, and Description of Field Sampling Sites	X
HSOP-4	Chain-of-Custody Procedures, Packing and Shipping Samples	X
HSOP-7	Decontamination of Sampling Equipment	X
HSOP-13	Equipment Rinsate Blank Collection	X
HSOP-29	Labeling and Documentation of Samples	X
HSOP-31	Field Notebooks	X

GROUNDWATER SAMPLING PROCEDURES

SOP #	TITLE	EAST HELENA QAPP
HF-SOP-6	Obtaining Groundwater Samples With a Bladder Pump	
HF-SOP-10	Water Level Measurement With An Electric Probe	X
HF-SOP-11	Sampling Monitoring Wells For Inorganic Parameters	X
HF-SOP-18	Measurement of Light Non-Aqueous Phase Liquids (LNAPL) Using an Oil/Water Interface Probe	
HF-SOP-38	Sampling Monitoring Wells For Organic Parameters	
HF-SOP-71	Fluid Sampling With Peristaltic Pump	
HF-SOP-102	Sampling of Municipal Wells	
HF-SOP-105	Low Flow Sampling of Monitoring Wells for Inorganic Parameters	

SURFACE WATER SAMPLING PROCEDURES

SOP #	TITLE	EAST HELENA QAPP
HF-SOP-12	Sampling Suspended Sediment	
HF-SOP-19	Obtaining Water Quality Samples From Streams	X
HF-SOP-59	Single Stage Sediment Samples	
HM-SOP-62	Use of the USGS Churn Splitter	

SEDIMENT SAMPLING PROCEDURES

SOP #	TITLE	EAST HELENA QAPP
HF-SOP-13	Sampling Stream Bottom Sediment With a Piston Core Sampler	
HF-SOP-52	Measuring Bedload	
HF-SOP-69	Sampling Lake Bottom Sediment	

SOIL SAMPLING PROCEDURES

SOP #	TITLE	EAST HELENA QAPP
HSOP-33	Soil Sample Collection Using a Hand Auger	
HS-SOP-6	Procedure For Collecting Surface Soil Samples	X
HS-SOP-10	Procedure for Collecting Soil Samples for VPH Analysis Using the En Core© Soil Sampler	
HS-SOP-12	Procedure for Sampling Sod	
HS-SOP-14	Replacement Soil Sampling	
HS-SOP-18	Use of Pressure-Vacuum Lysimeter to Sample Soil Moisture	
HS-SOP-34	Procedure for Collecting Direct-Push Soil Samples	
HS-SOP-36	Organic Vapor Analyzer Operating Procedure	
HS-SOP-39	Soil Moisture Measurement With a Soil Probe	
HS-SOP-45	Headspace Gas Analytical Screening Procedure for Soils	
HS-SOP-48	Nuclear Density Gauges	
HS-SOP-57	Soil Sampling Procedure For Test Pits	X
HS-SOP-58	Double Ring Infiltration Test	
HS-SOP-63	Replacement Stockpile Sampling	
HS-SOP-65	Installation of Soil Moisture Tubes For Use With The Neutron Hydro-Probe	
HS-SOP-72	Split Spoon Sampling	X
HS-SOP-86	Replacement Soil/Compost Stockpile Sampling	

FIELD PARAMETER TESTING

SOP #	TITLE	EAST HELENA QAPP
HF-SOP-20	Field Measurement of pH Using a pH Meter	X
HF-SOP-22	Field Measurement of Dissolved Oxygen	X
HF-SOP-23	Field Measurement of Redox Potential (Eh)	
HF-SOP-42	Field Measurement of pH Using Beckman Model pHI Series pH Meter	
HF-SOP-48	Measurement of Water Quality Parameters Using a Horiba U-10 Water Quality Checker	
HF-SOP-49	Use of a Flow Cell For Collecting Field Parameters	
HF-SOP-53	Field or Laboratory Measurement of Turbidity	
HF-SOP-79	Field Measurement of Specific Conductivity	X
HF-SOP-84	Field Measurement of Temperature	X
HF-SOP-87	Field Measurement of Iron (II) and Iron (III) in Water Samples	
HL-SOP-41	Determination of Iron (II) and Iron (III) in Groundwater Samples	

STAGE AND FLOW MEASUREMENT

SOP #	TITLE	EAST HELENA QAPP
HF-SOP-14	Maintenance and Operation of Stevens Type F Recorders	
HF-SOP-15	Measurement of Stream or Pond Stage	
HF-SOP-16	Streamflow Measurement Using a Price Type AA or Pygmy Current Meter	
HF-SOP-17	Streamflow Measurement Using a Parshall Flume	
HF-SOP-24	Streamflow Measurement Using Crest-Stage Gage	
HF-SOP-25	Streamflow Measurement Using a Weir	
HF-SOP-26	Streamflow Measurement Using a Flume	
HF-SOP-27	Flow Estimation Method for Springs and Culverts	
HF-SOP-37	Streamflow Measurement Using a Marsh-McBirney Water Current Meter	X
HF-SOP-44	Flow Measurements Using a Portable 90° V-Notch Cutthroat Flume	X
HF-SOP-46	Streamflow Measurement Using a Portable 3-Inch Parshall Flume (Montana Flume)	X
HF-SOP-50	Synoptic Runs on Streams	
HF-SOP-80	Water Level Monitoring With The Stevens Multilogger 9200	
HF-SOP-81	Operation of The Stevens Type A/F Multilogger	

AQUIFER TESTING

SOP #	TITLE	EAST HELENA QAPP
HF-SOP-8	Aquifer Testing - Pump Method	
HF-SOP-9	Logging of Monitoring Well Geological Conditions, Construction and Development	X
HF-SOP-99	Operation of Pneumatic Slug Tester	
HF-SOP-100	Aquifer Test Methods - Slug Technique	
HF-SOP-101	Aquifer Test Methods - Bailer Technique	
HF-SOP-103	Water Level Monitoring with the In-Situ Hermit © 1000 Data Logger	
HF-SOP-104	Water Level Monitoring with the In-Situ Troll © SP4000-232 Data Logger	

WATER ANALYSIS

SOP #	TITLE	EAST HELENA QAPP
HL-SOP-2	Laboratory Measurement of pH	
HL-SOP-18	Hydrometer Analysis	
HL-SOP-42	Sequential Extraction of Metals from Soils	X

SOIL ANALYSIS

SOP #	TITLE	EAST HELENA QAPP
HL-SOP-19	Sieve Analysis	
HL-SOP-20	Preparing a Saturated Soil Paste	
HL-SOP-21	Preparing a Saturation Extract	
HL-SOP-23	pH Reading of Saturated Soil Paste	
HL-SOP-24	Determination of Percent Organic Carbon In Soil	
HL-SOP-26	Determination of Soil Water Holding Capacity	
HL-SOP-35	Laboratory Analysis of Demolition Debris for Arsenic, Cadmium and Lead	
HL-SOP-53	Spectrace 5000 EDXRF Routine Soil Analysis	
HS-SOP-27	Determination of Soil Saturation Percentage	
HS-SOP-52	Pre-Analytical Soil Handling and Preparation	
HS-SOP-83	Pre-Analytical Soil Handling and Preparation for Silt	

MISCELLANEOUS PROCEDURES

SOP #	TITLE	EAST HELENA QAPP
HF-SOP-86	House Dust Sampling Using a High Volume Vacuum	
HM-SOP-10	Plant Matter Sample Collection	
HM-SOP-30	Wet Wipe Sample Collection	
HM-SOP-31	Scraping Sample Collection From Demolition Debris	
HM-SOP-32	Drill Core Sample Collection	
HM-SOP-37	Chip Sample Collection	
HM-SOP-55	Operation of a Class A Evaporation Station	

PUT HSOPs ON A CD INSTEAD OF COPYING

APPENDIX D

ENERGY LABORATORIES' QUALITY ASSURANCE MANUAL