From:	Getty, Donna J
To:	Dhont, Jeffrey; Natasha Raykhman (nraykhma@ch2m.com); Bussey, Donald
Cc:	richard.m.leuser@lmco.com; david.l.aloysius; scott.c.grossman
Subject:	Most recent version of the Iron King QAPP is attached...
Date:	Thursday, February 27, 2014 7:32:13 AM
Attachments:	SERAS-146-DQAPPA3R1-022814.docx

Please be aware that this DRAFT version has not received internal review.

Donna Getty
Mathematician/Statistician
Lockheed Martin, SERAS Contract
Contractor to the US EPA/ERT
(215)962-9929 (Cell)
(732)321-4200 ext. 4274 (Office)

QUALITY ASSURANCE PROJECT PLAN
Iron King Mine Site
Dewey-Humboldt, Arizona

Amendment 3

Prepared for:
United States Environmental Protection Agency/Environmental Response Team
Edison, New Jersey

By:
Lockheed Martin/Scientific Engineering Response & Analytical Services (SERAS)
Work Assignment Number: SERAS-146

Based on the Intergovernmental Data Quality Task Force Uniform
Federal Policy for Quality Assurance Project Plans
(Final Version 1.1, June 2006)

February 28, 2014

TABLE OF CONTENTS

QAPP Worksheet #1
Title and Approval Page

Site Name/Project Name: Iron King Mine Site
Site Location: Dewey-Humboldt, Arizona (AZ)

Document Title: Quality Assurance Project Plan for Iron King Mine Site

Lead Organization: Environmental Protection Agency/Environmental Response Team (EPA/ERT)

Preparer's Name and Organizational Affiliation: Donna Getty - Lockheed Martin/Scientific Engineering Response Analytical Services (SERAS)

Preparer's Address, Telephone Number, and E-mail Address: 2890 Woodbridge Avenue, Edison, NJ 08837, (732) 321-4274, donna.j.getty@lmco,com

Preparation Date (Day/Month/Year): 02/28/14

Investigative Organization's Project Manager/Date: _____
Signature

Printed Name/Organization: Terrence Johnson/ERT Work Assignment Manager

Investigative Organization's Project QA Officer/Date: _____
Signature

Printed Name/Organization: Stephen Blaze/ERT Quality Coordinator

Lead Organization's Project Manager/Date: _____
Signature

Printed Name/Organization: Dave Aloysius/SERAS Task Leader

Approval Signatures/Date: _____
Signature

Printed Name/Title: Deborah A. Killeen/SERAS QA/QC Officer

Approval Authority: Lockheed Martin/SERAS

Other Approval Signatures/Date: _____
Signature

Printed Name/Title: Dennis A. Miller/SERAS Program Manager

Document Control Numbering System: SERAS-146-DQAPPA3-022814

QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project Name: Iron King Mine Site
Site Location: Dewey-Humboldt, AZ
Site Number/Code: 09MX
Operable Unit: N/A
Contractor Name: Lockheed Martin
Contractor Number: EP-W-09-031
Contract Title: SERAS
Work Assignment Number: SERAS-146

1. Identify regulatory program: Comprehensive Environmental Response, Liability and Compensation Act (CERCLA)
2. Identify approval entity: EPA/ERT
3. The QAPP is (select one): ☐Generic ☒Project Specific
4. List dates of scoping sessions that were held: 08/06/13, and 9/5/13
5. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	Approval Date
SERAS UFP QAPP for Iron King Mine Site Hydrologic Restoration, document #SERAS-146-DQAPP-093011	01/03/12
SERAS UFP QAPP - Amendment 1, Iron King Mine Site Hydrologic Restoration, document #SERAS-146-DQAPP1-110512	11/05/12
SERAS UFP QAPP - Amendment 2, Iron King Mine Site Hydrologic Restoration, document #SERAS-146-DQAPP2-080813	08/18/13

6. List organizational partners (stakeholders) and connection with lead organization:
   EPA Region 9
7. List data users:
   EPA Region 9
8. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusions below:

Worksheet 37: Usability of the data will be determined by EPA Region 9.

QAPP Worksheet #2
QAPP Identifying Information
(continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
Project Management and Objectives		
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2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	3 4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	5 6 7 8
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)	 9 10
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	11 12

QAPP Worksheet #2
QAPP Identifying Information
(continued)

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3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	 23 24 25

QAPP Worksheet #2
QAPP Identifying Information
(continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Required Documents
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QAPP Worksheet #2
QAPP Identifying Information
(continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
Data Review		
5.1 Overview		
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5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		

QAPP Worksheet #3 – November 2013
Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Terrence Johnson	WAM	ERT	(702) 496-0703	(702) 784-8001	johnson.terrence@epa.gov	SERAS-146-DQAPP3-122313
Mark Sprenger	WAM	ERT	(732) 906-6826	(732) 321-6274	sprenger.mark@epa.gov	SERAS-146-DQAPP3-122313
Don Bussey	WAM	ERT	(702) 784-8016	(702) 784-8001	bussey.don@epa.gov	SERAS-146-DQAPP3-122313
Duane Newell	WAM	ERT	(702) 784-8015	(702) 784-8001	newell.duane@epa.gov	SERAS-146-DQAPP3-122313
Henry Gerard	WAM	ERT	(702) 501-8009	(702) 784-8001	gerard.henry@epa.gov	SERAS-146-DQAPP3-122313
Greg Powell	WAM	ERT	(513) 569-7533	(859) 372-0889	powell.greg@epa.gov	SERAS-146-DQAPP3-122313
Stephen Blaze	Quality Coordinator	ERT	(732) 906-6921	(732) 321-6274	blaze.stephen@epa.gov	SERAS-146-DQAPP3-122313
Jeffrey Dhont	Superfund Project Manager	EPA Region 9	(415) 972-3020	NA	dhont.jeff@epa.gov	SERAS-146-DQAPP3-122313
David Aloysius	Hydrogeologist/TL	SERAS	(732) 494-4058	(732) 494-4021	david.l.aloysius@lmco.com	SERAS-146-DQAPP3-122313
Scott Grossman	Environmental Scientist	SERAS	(732) 321-4230	(732) 494-4021	scott.c.grossman@lmco.com	SERAS-146-DQAPP3-122313
Chris Gussman	Phytoremediation Scientist/ Senior Biologist	SERAS	(732) 321-4237	(732) 494-4021	christopher.d.gussman@lmco.com	SERAS-146-DQAPP3-122313
Jay Patel	ICP/MS, ICP Chemist	SERAS	(732) 494-4052	(732) 494-4021	jay.r.patel@lmco.com	SERAS-146-DQAPP3-122313
Richard Leuser	Deputy Program Manager (DPM)	SERAS	(732) 494-4060	(732) 494-4021	richard.m.leuser@lmco.com	SERAS-146-DQAPP3-122313
Deborah Killeen	QA/QC Officer	SERAS	(732) 321-4225	(732) 494-4021	deborah.a.killeen@lmco.com	SERAS-146-DQAPP3-122313
Dennis Miller	Program Manager	SERAS	(732) 321-4216	(732) 494-4021	dennis.a.miller@lmco.com	SERAS-146-DQAPP3-122313

NA = Not available, ICP/MS – Inductively Coupled Plasma/Mass Spectrometry, ICP = Inductively Coupled Plasma, TL = Task Leader, QA/QC = Quality Assurance/Quality Control

QAPP Worksheet #4
Project Personnel Sign-Off Sheet

Organization: SERAS/ERT/EPA Region 9

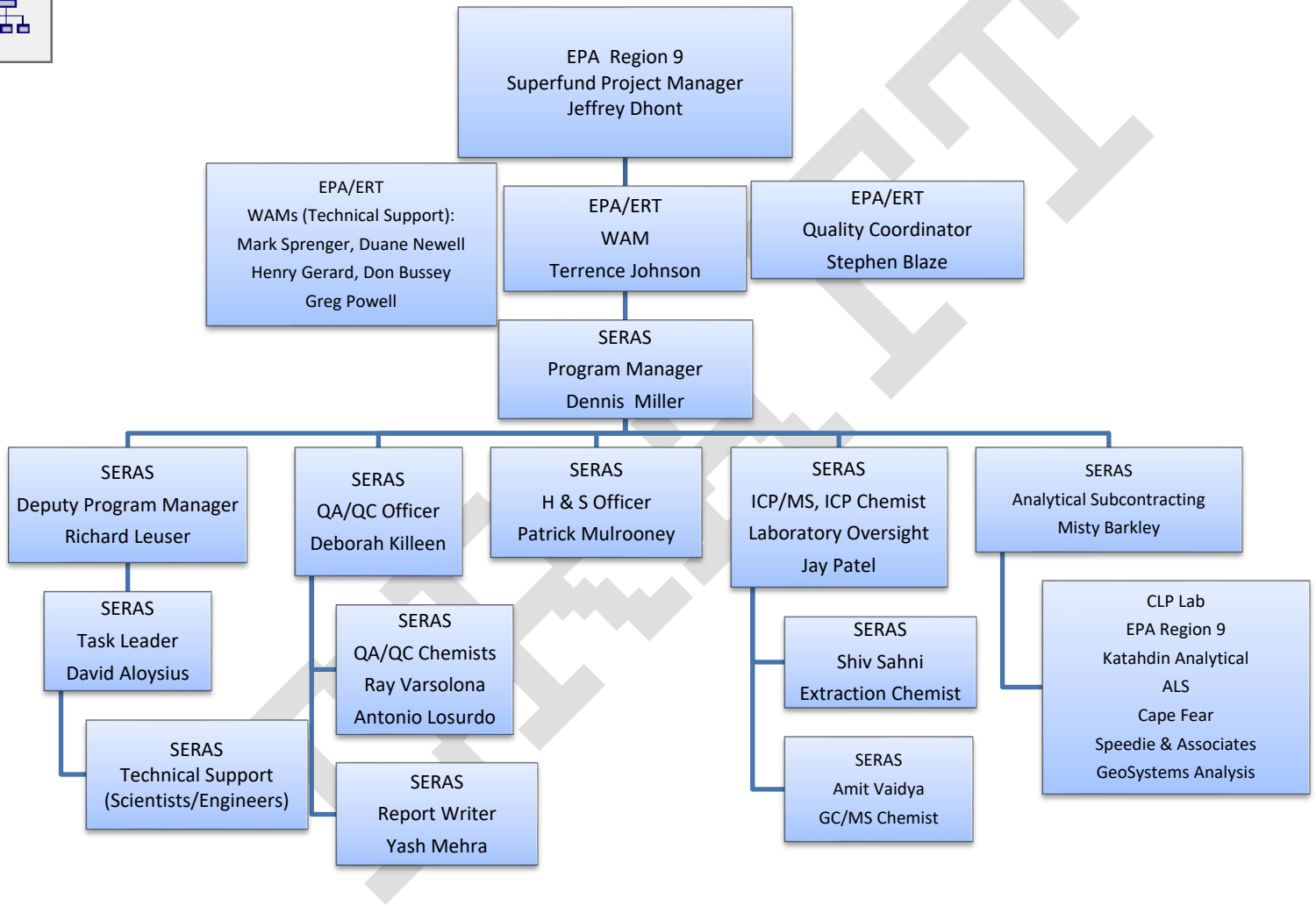
Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Terrence Johnson	ERT WAM	(702) 784-8022		
Jeffrey Dhont	EPA R9 Superfund Project Manager	(415) 972-3020		
Mark Sprenger	ERT WAM	(732) 906-6826		
Don Bussey	ERT WAM	(702) 784-8016		
Duane Newell	ERT WAM	(702) 784-8015		
Henry Gerard	ERT WAM	(702) 501-8009		
Greg Powell	ERT WAM	(513) 569-7533		
David Aloysius	SERAS Hydrogeologist/TL	(732) 494-4058		
Jay Patel	SERAS ICP-MS, ICP Chemist	(732) 494-4052		
Shiv Sahni	SERAS Extraction Chemist	(732) 321-4226		
Amit Vaidya	SERAS GC/MS Chemist	(732) 321-4251		
Scott Grossman	SERAS Environmental Scientist	(732) 321-4230		
Sandra Richards	SERAS Environmental Technician	(732) 494-4265		
Chris French	SERAS Environmental Technician	(732) 494-4040		
Jean Bolduc	SERAS Hydrogeologist	(732) 321-4280		
Chris Gussman	SERAS Phytoremediation Scientist	(732) 321-4237		
Dave Adams	SERAS Environmental Scientist (Air Response)	(732) 494-4008		

QAPP Worksheet #4
Project Personnel Sign-Off Sheet

Organization: SERAS/ERT/EPA Region 9

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Joe Brandine	SERAS Industrial Hygienist (Air Response)	(732) 321-4220		
Martin Ebel	SERAS Geophysicist	(732) 321-4241		
David Edgerton	SERAS Groundwater Modeler	(732) 494-4057		
Buck Gabriel	SERAS Hydrogeologist	(315) 558-3824		
Rick Leuser	SERAS DPM	(732) 494-4060		
Rich Magan	SERAS Environmental Scientist	(732) 321-4234		
Jon McBurney	SERAS Project Engineer	(732) 321-4244		
Pete Roesner	SERAS Environmental Scientist	(702) 784-8030		
Stewart Sandberg	SERAS Sr. Geophysicist	(207) 233-9948		
Colleen Steffensen	SERAS Environmental Scientist	(732) 321-4211		
Rafael Volker	SERAS Air Response Scientist	(732) 321-4278		
Amanda Wagner	SERAS Environmental Scientist	(702) 784-8043		
Josephine Yosephan	SERAS Environmental Scientist	(732) 321-4284		
Gail Heath	University of Arizona-Mining Expert	(208) 521-4776		

QAPP Worksheet #5
Project Organizational Chart



QAPP Worksheet #6
Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Approval of initial QAPP and any amendments	ERT WAM ERT Quality Coordinator SERAS Program Manager SERAS QA/QC Officer SERAS TL	Terrence Johnson Steve Blaze Dennis Miller Deborah Killeen David Aloysius	702-496-0703 732-906-6921 732-321-4216 732-321-4245 732-494-4058	SERAS internal peer review, followed by ERT approval, implementation of changes effective only with approved QAPP or QAPP Change Form
Nonconformance and Corrective Action	SERAS TL ERT WAM SERAS QA/QC Officer SERAS ICP-MS/ICP Chemist SERAS Extraction Chemist SERAS GC/MS Chemist	David Aloysius Terrence Johnson Deborah Killeen Jay Patel Shiv Sahni Amit Vaidya	732-494-4058 702-496-0703 732-321-4245 732-494-4052 732-494-9312 732-321-4251	Use of the Work Assignment Field Change Form for field issues. Use of nonconformance memos to document laboratory deficiencies.
Posting of Deliverables to ERT-Information Management System (IMS) website	SERAS TL SERAS QA/QC Officer SERAS Deputy Program Manager SERAS Administrative Support	David Aloysius Deborah Killeen Richard Leuser Eileen Ciambotti	732-494-4058 732-321-4245 732-494-4060 732-321-4255	As per work assignments, posting of deliverables to ERT-IMS website constitutes delivery to the WAM.
Work Assignment	SERAS Program Manager	Dennis Miller	732-321-4216	Describes scope of work to SERAS personnel from the ERT WAM.
Health and Safety On-Site Meeting	SERAS TL, Site Health and Safety Officer	David Aloysius Scott Grossman	732-494-4058 732-321-4230	Explains site hazards, personal protective equipment, local hospital

QAPP Worksheet #7
Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
David Aloysius	Hydrogeologist/TL	SERAS	Project Supervision/Field Investigation, Field Sampling, Field Health and Safety, Reporting	M.A. Geology and 25 years environmental experience/Lockheed Martin Employee Files
Jay Patel	ICP/MS, ICP Chemist	SERAS	Field Portable X-ray Fluorescence (FP XRF) Operation	Minimum B.S. Degree with 14 yrs. related experience/ Lockheed Martin Employee Files
Shiv Sahni	Extraction Chemist	SERAS	FP XRF Operation	Minimum B.S. Degree with 3 yrs. related experience/ Lockheed Martin Employee Files
Amit Vaidya	GC/MS Chemist	SERAS	FP XRF Operation	Minimum B.S. Degree with 8 yrs. related experience/ Lockheed Martin Employee Files
Scott Grossman	Environmental Scientist	SERAS	Residential Field Investigation & Sampling	B.S. Biology, M.S. and 8 years environmental experience/Lockheed Martin Employee Files
Sandra Richards	Environmental Technician	SERAS	Field Investigation, Field Sampling, Sample Management	Environmental sampling experience/ Lockheed Martin Employee Files
Chris French	Environmental Technician	SERAS	Field Investigation, Field Sampling	Environmental sampling experience/ Lockheed Martin Employee Files
Jean Bolduc	Hydrogeologist	SERAS	Field Investigation, Field Sampling	Minimum B.S. Degree with 8 yrs. related experience/ Lockheed Martin Employee Files
Chris Gussman	Phytoremediation Scientist	SERAS	Field Investigation, Field Sampling	B.S. Biology, M.S. and 10 years environmental experieince/ Lockheed Martin Employee Files
Donna Getty	Statistician	SERAS	QAPP Development	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Nesya Belyarchik	ACAD	SERAS	Map Making	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files

QAPP Worksheet #7
Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Mingling Li	GIS Information Specialist	SERAS	GIS/Map Making	Minimum B.S. degree plus 3 years of related experience/Lockheed Martin Employee Files
Deborah Killeen	QA/QC Officer	SERAS	Quality Assurance	Minimum B.S. degree plus 14 years of related experience/Lockheed Martin Employee Files
Yash Mehra	Report Writer	SERAS	Final Analytical Report and EDD	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Ray Varsolona/ Antonio Losurdo	QA/QC Chemist	SERAS	Validation of Subcontract Laboratory Analytical Results	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Dave Adams	Environmental Scientist (Air Response)	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Joe Brandine	Industrial Hygienist (Air Response)	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree plus 3 years of related experience/Lockheed Martin Employee Files
Martin Ebel	Geophysicist	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree plus 14 years of related experience/Lockheed Martin Employee Files
David Edgerton	Groundwater Modeler	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree plus 14 years of related experience/Lockheed Martin Employee Files
Buck Gabriel	Hydrogeologist	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree plus 14 years of related experience/Lockheed Martin Employee Files
Rick Leuser	DPM	SERAS	Personnel & Activity Oversight	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Rich Magan	Environmental Scientist	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree /Lockheed Martin Employee Files

QAPP Worksheet #7
Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Jon McBurney	Project Engineer	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree plus 14 years of related experience/Lockheed Martin Employee Files
Pete Roesner	Environmental Scientist	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree plus 3 years of related experience/Lockheed Martin Employee Files
Stewart Sandberg	Sr. Geophysicist	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree plus 14 years of related experience/Lockheed Martin Employee Files
Colleen Steffensen	Environmental Scientist	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree plus 3 years of related experience/Lockheed Martin Employee Files
Rafael Volker	Air Response Scientist	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree plus 3 years of related experience/Lockheed Martin Employee Files
Amanda Wagner	Environmental Scientist	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree plus 3 years of related experience/Lockheed Martin Employee Files
Josephine Yosephan	Environmental Scientist	SERAS	Field Investigation, Field Sampling	Minimum B.S. degree /Lockheed Martin Employee Files
Gail Heath	Geophysicist	University of Arizona/SERAS	Field Investigation, Mining Expertise	Minimum B.S. degree plus related experience/Lockheed Martin Employee Files
Terrence Johnson	Work Assignment Manager (WAM)	EPA/ERT	Technical Direction	Project Management & Coordination Expert/EPA Files
Jeffrey Dhont	Superfund Project Manager	EPA Region 9	Project Oversight	Project Management & Coordination Expert/EPA files
Mark Sprenger	WAM	ERT	Technical Direction of Biological Assessment and Survey	EPA job-related qualifications/EPA Files

QAPP Worksheet #7
Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Stephen Blaze	Quality Coordinator	ERT	Quality Assurance Oversight	EPA job-related qualifications/EPA Files
Don Bussey	WAM	ERT	Drilling Oversight	EPA job-related qualifications/EPA Files
Duane Newell	WAM	ERT	Oversight of Residential Sampling	EPA job-related qualifications/EPA Files
Henry Gerard	WAM	ERT	Technical Direction and Oversight	EPA job-related qualifications/EPA Files
Greg Powell	WAM	ERT	Oversight of Geophysical Work	EPA job-related qualifications/EPA Files

QAPP Worksheet #8
Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Project Oversight	Health & Safety Training	SERAS	Mar 2013	David Aloysius	Hydrogeologist/TL/SERAS	SERAS H&S Files
XRF Analysis - Niton	Data Integrity Training	SERAS	Jan 2014	Jay Patel	ICP/MS, ICP Chemist/SERAS	SERAS Quality Files
XRF Analysis - Niton	Demonstration of Capability	SERAS	Oct 2013	Jay Patel	ICP/MS, ICP Chemist/SERAS	SERAS Quality Files
On-site XRF Analysis	Health & Safety Training	SERAS	Jan 2013	Jay Patel	ICP/MS, ICP Chemist/SERAS	SERAS Quality Files
XRF Analysis - Niton	Data Integrity Training	SERAS	Jan 2014	Shiv Sahni	Extraction Chemist/SERAS	SERAS Quality Files
XRF Analysis - Niton	Demonstration of Capability	SERAS	Aug 2013	Shiv Sahni	Extraction Chemist/SERAS	SERAS Quality Files
On-site XRF Analysis	Health & Safety Training	SERAS	Dec 2013	Shiv Sahni	Extraction Chemist/SERAS	SERAS Quality Files
XRF Analysis - Niton	Data Integrity Training	SERAS	Jan 2014	Amit Vaidya	GC/MS Chemist/SERAS	SERAS Quality Files
XRF Analysis - Niton	Demonstration of Capability	SERAS	Dec 2013	Amit Vaidya	GC/MS Chemist/SERAS	SERAS Quality Files
On-site XRF Analysis	Health & Safety Training	SERAS	Aug 2013	Amit Vaidya	GC/MS Chemist/SERAS	SERAS Quality Files
QA Oversight	Changes to Environmental Laboratory Accreditation	Advanced Systems	May 2009	Deborah Killeen	QA/QC Officer/SERAS	SERAS Quality Files
QA Oversight	Lead Auditor Training	IT Corp	Sept 1991	Deborah Killeen	QA/QC Officer/SERAS	SERAS Quality Files

QAPP Worksheet #8
Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
QA Oversight	Data Review & Validation	Laboratory Data Consultants	Jan 2007	Deborah Killeen	QA/QC Officer/SERAS	SERAS Quality Files
QA Oversight	Uniform Federal Policy for Quality Assurance Project Plans	Advanced Systems	Jan 2006	Deborah Killeen	QA/QC Officer/SERAS	SERAS Quality Files
Field Operations	Health & Safety Training	SERAS	Nov 2013	Scott Grossman	Environmental Scientist/SERAS	SERAS H&S Files
Field Operations/ Scribe	Health & Safety Training	SERAS	Apr 2013	Sandra Richards	Environmental Technician/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	Nov 2013	Chris French	Environmental Technician/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	Sept 2013	Jean Bolduc	Hydrogeologist/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	Nov 2013	Chris Gussman	Phytoremediation Scientist/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	Jan 2013	Dave Adams	Environmental Scientist (Air Response)/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	Feb 2013	Joe Brandine	Industrial Hygienist (Air Response)/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	Oct 2013	Martin Ebel	Geophysicist/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	Apr 2013	David Edgerton	Groundwater Modeler/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	Nov 2012	Buck Gabriel	Hydrogeologist/ SERAS	SERAS H&S Files

QAPP Worksheet #8
Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Personnel/ Project Oversight	Health & Safety Training	SERAS	Jan 2013	Rick Leuser	DPM/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	Dec 2013	Rich Magan	Environmental Scientist/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	Dec 2013	Jon McBurney	Project Engineer/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	Mar 2013	Pete Roesner	Environmental Scientist/ SERAS	SERAS H&S Files
Field Operations/ Geophysics	Health & Safety Training	SERAS	Dec 2013	Stewart Sandberg	Geophysicist/SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	Feb 2014	Colleen Steffensen	Environmental Scientist/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	May 2013	Rafael Volker	Air Response Scientist/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	June 2013	Amanda Wagner	Environmental Scientist/ SERAS	SERAS H&S Files
Field Operations	Health & Safety Training	SERAS	March 2013	Josephine Yosephan	Environmental Scientist/ SERAS	SERAS H&S Files
Field Operations/ Geophysics	Health & Safety Training	*	*	Gail Heath	Geophysicist/SERAS	*

*In progress – to be completed prior to site mobilization

QAPP Worksheet #9
Project Scoping Session Participants Sheet

Project Name: Iron King Mine Site Hydrologic Restoration **Previous Field Work Dates:** 8/6/13 **Projected Field Work Dates:** November 2013 through 2014 **Project Manager:** David Aloysius	**Site Name:** Iron King Mine Site **Site Location:** Dewey-Humboldt, AZ

Dates of Sessions8/6/13, 9/15/13
Scoping Session Purpose: Discuss project-related tasks

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
8/6/13 - Accelerated Lead Sampling Event					
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Terrence Johnson	WAM	ERT	702-496-0703	johnson.terrence@epamail.epa.gov	Technical Direction
9/5/13 – Extended Study to Fill in Data Gaps (November 2013 through Spring 2014)					
David Aloysius	Hydrogeologist	SERAS	732-494-4058	david.l.aloysius@lmco.com	Task Leader
Terrence Johnson	WAM	ERT	702-496-0703	johnson.terrence@epamail.epa.gov	Technical Direction
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8/6/13: Discussion on scope of work for the accelerated lead sampling event.

- Surface soil (0 to 6 inches) sampling on 7 properties; approximately 70 surface locations using a hand trowel; additional samples at depth (using a hand auger) based on XRF reading.
- Locations will be based on where sampling has been previously conducted; do not want to replicate locations but final determination will be made in the field by the WAM and RPM.
- Samples will be screened for lead and arsenic using FP XRF. Samples will be collected in a baggie. Two XRF readings per sample. Reading on one-side then flip bag over and take an additional reading.
- Action level is 150 mg/kg for both lead and arsenic. This benchmark was determined by the EPA Region 9 RPM.

- Surface samples which have XRF readings >150 mg/kg will trigger additional sampling up to 3 feet (ft) below ground (bg).
- Surface samples will be collected first across all the properties to facilitate the XRF work. If reading exceeds 150 mg/kg, after all surface samples have been collected return to that location and collect samples at 6"-12", 12"-18", 18"-24", and 24"- 36".
- XRF work on the subsurface samples will be based on time constraints.
- RPM received access to all but 1 of the properties; RPM hopes to have access to all of the properties by the time sampling activities begin.
- SERAS will travel on Monday, August 12, 2013 with sampling 2-3 days of work beginning on Tuesday.
- Jay Patel can analyze (FP XRF) approximately 70 samples a day.
- RPM will be on-site at 10:30 on Tuesday, August 13, 2013.
- Do sampling teams need to use respirators? Consult Pat Mulrooney. Half or full face?
- 100% of samples will be shipped by SERAS to a location which will be determined by the WAM and RPM.
- Region 9 will determine which samples will be run for confirmatory analysis.
- Region 9 Lab is currently backed-up with work but metals have a 6 month holding time so they may be able to hold the samples until their workload allows for analysis.
- No XRF duplicates will be collected because each sample will be analyzed twice by the XRF.
- No rinsate blanks; decon between "holes".
- Focus of efforts is on obtaining a volume estimate for removal.

Action Items:

- Terrence will speak with the RPM to find out who is going to submit the Analytical Request Form (ARF) for the confirmatory samples. He will also establish whether the samples will be shipped to the Region 9 Laboratory.

Updated 8/6/2013: SERAS will submit the ARF and choose the confirmatory samples at a rate of 10%. Samples will be shipped to a Contract Laboratory Program (CLP) Laboratory.

Updated 8/7/2013: Toxicity Characteristic Leaching Procedure (TCLP) metals are added to the list of analyses. Resource Conservation and Recovery Act list of 8 metals (RCRA-8). Same samples going for confirmatory analysis will also go for TCLP. Confirmatory analysis will be for metals full target analyte list (TAL), not just As and Pb.

EPA Region 9 can handle TCLP sample analysis.

9/5/13:

- QAPP will be written to encompass all the sampling and analysis events extending into 2014.
- All data and analyses need to be delivered to EPA Region 9 by April 31, 2014.
- Per the WAM surface is defined as 0-2 inches.
- Analytical data will be validated. Analytical work performed by the EPA Region 9 Laboratory will be validated by Region 9. Subcontracted analytical work will be validated by SERAS (Hexavalent Chromium [Cr(VI)]).
- SERAS will submit the Analytical Request Form (ARF) to the Region 9 Laboratory for standard turn-around time (TAT): 30 days for preliminary results, 45 days for final results.
- Water samples being sent for dissolved metals analysis will be filtered in the field.
- Sampling locations have been pre-selected by EPA Region 9 and their contractor.

- Mobilization is planned for November 13, 2013 beginning with soil borings in the Main Tailings Pile (MTP). Two drilling rigs will be subcontracted.
- Reporting limits for dioxin analyses need to be in the range of parts per trillion (ppt).
- Field duplicates will be collected at a rate of 5%.
- Matrix spike/matrix spike duplicates (MS/MSDs) at a rate of 5%.
- Five request for proposals (RFPs) are required for this project (drilling, wells, borehole geophysics, professional surveying, and dust control).
- Pre-bid walk-through of the site will be required for some of the RFPs.
- EPA will obtain property access but will need a SERAS person to log the information. The TL will put together a list of priorities for access to properties. Access to Chaparral Gulch is needed first. He will need to locate the monitoring wells and determine if they are located on private property.
- The TL will submit a Draft Sampling and Analysis Summary Plan (DSAP) to the Region on 9/6/13 when he meets with the RPM. The WAM will be present for this meeting.
- A preliminary project schedule was discussed and will be presented to the Region separate from the DSAP.
- Personnel needs were identified for each phase of the project.

Action Items:

- The WAM and TL will talk to the RPM/OSC about sending samples back to the SERAS laboratory for XRF analysis if the results won't drive the step-out assessment or on-site work.
- Schedule of field work needs to be submitted and approved by Region 9.
- WAM will discuss with the RPM how many metals will be analyzed for using the Synthetic Precipitation Leaching Procedure (SPLP) analyses? RCRA 8? Total Analyte List (TAL) metals (23)?
    - On 9/9/13 SERAS was told SPLP metals analysis will be for the Resource Conservation and Recovery Act list of 8 metals (RCRA-8) plus zinc (Zn), copper (Cu), aluminum (Al), iron (Fe) and manganese (Mn).
- TL will put together a Projected Work Assignment (PWA) for M. Barkley so she can begin the subcontracting process.
- Investigate whether temperature will affect the copolymer application for dust control.

Additional decisions made during the on-set of sampling:

- In addition to Pb and As analysis by FP XRF: Zn, Cu, Fe, Mn, and Cr will also be measured by the FP XRF at the request of Region 9 EPA.
- 20% of XRF samples collected in the dross material will be sent for confirmation analysis

QAPP Worksheet #10
Problem Definition

The problem to be addressed by the project:
The Iron King Mine (IKM) Site is located in the Town of Dewey-Humboldt, AZ. The site, which occupies approximately 153 acres, was periodically operated from 1906 to 1969 for extraction of gold, silver, copper, lead and zinc. The Iron King Mine is bordered by Chaparral Gulch to the north, Galena Gulch to the south, State Highway 69 to the east, and undeveloped land to the west.

There are two tailings piles at the site: the Large Tailings Pile (LTP) and the Small Tailings Pile (STP). The LTP, located just west of Highway 69, covers over 55 acres, is over 100 feet (ft) in height and contains over six million cubic yards of mine tailings. The STP is located approximately 600 ft north of the LTP and was found to contain approximately 21,500 cubic yards of tailings (based on field delineation and excavation in November 2011). Chaparral Gulch borders the STP along the northern and eastern sides and is impacted by both runoff and sediment transport from the pile. This pile was an accumulation of tailings materials that resulted from surface water-related sediment transport over many decades, which began as early as 1940.

The EPA Region 9 Removal Program proposed to excavate and move materials from the STP, and subsequently consolidate the materials immediately adjacent to the LTP, within a temporary storage pile (TSP). Based on the physical characteristics of the site and the general nature of the proposed work, EPA Region 9 requested assistance from the ERT to provide technical support for area restoration of the STP and adjoining areas. This request included a combination of hydrologic, open channel, and slope stabilization designs for minimizing runoff, erosion, and sediment transport. In addition, interim measures were also required for stabilization of the tailings within the TSP and minimizing surface erosion.

In the summer of 2011, the EPA Region 9 Removal Program removed surface mine tailings from a number of residential properties in the vicinity of the site. As part of the post-removal restoration effort, riprap spillways (or rock chutes) were installed to direct storm water runoff away from backyard areas (along S. Sweet Pea Lane, off of Third Street). These spillways failed during the 2012 rainy season resulting in severe soil erosion. On August 31, 2012, SERAS staff visited the site and met with the WAM to perform a site walkover. During the site visit, a number of hydrologic restoration efforts were discussed and defined.

<u>August 2013 – Accelerated Lead Sampling Event</u>
In June 2013, EPA Region 9 requested assistance from the ERT in conducting a site investigation to address data gaps in order to complete the Site Feasibility Study. In July and August 2013, while ERT was preparing to conduct the investigation to fill the data gaps, additional and immediate assistance was requested to support a removal action assessment of arsenic (As) and lead (Pb) concentrations found on seven residential properties located on Wells Street and Jones Street in downtown Humboldt.

The problem to be addressed by the project (con't):
The focus of this time-critical As/Pb sampling event will be to determine the volume and range of contamination on the seven residential properties to facilitate a cost analysis for removal of any contaminated material found to be present on the properties. The full distribution of the residential As/Pb contamination is currently unknown. Region 9 requested soil sampling and field portable x-ray fluorescence (FP XRF) screening support for Pb and As in surface soil (0 to 6 inches) and at depths up to 3 ft below ground surface (bgs). Ten percent (%) of the samples collected and analyzed by XRF will be shipped by SERAS to a CLP laboratory for TAL metals confirmation analysis. The same samples will be analyzed for TCLP metals at the EPA R9 Laboratory.

2013-2014 Extended Study: The overall objective of this study is to fill in data gaps which were identified in the *Draft Data Gap Analysis Report (April 2013)* prepared for EPA Region 9 by their contractors. The ERT has requested support from SERAS in implementing an extensive and multi-phased field investigation which will fill in the identified data gaps. Details of this investigation can be found in the attached *Supplemental Field Investigation Work Plan*. Specific objectives are listed below:

Iron King Mine Main Tailings Pile (MTP)

- Determine stability of pile, buffering capacity, acid rock drainage (ARD) potential, loading and moisture
- Refine bioaccessibility values used in risk assessment
- Determine durability, chemical properties and degradation characteristics of waste rock materials for evaluation of use as cover
- Assess seasonal groundwater fluctuations within the pile
- Determine local off-site sources of materials that could be used for: erosion protection, low permeability cover soil, drainage material and engineered fill

Iron King Mine Property (IKM; excluding tailings pile and including Galena Gulch [GAL])

- Conduct an extent of contamination study on lands within the IKM property operating area yet outside the MTP
- Fill in data gaps from previous studies by collecting more samples, going to greater depths, in a side gulch that drains to the small tailings pile
- Investigate levels of contamination in Galena Gulch at the back of the mine to confirm only waste rock is present at this location
- Determine volume of tailings on lower bench
- ~~Refine bioaccessibility values used in risk assessment~~
- Refine volume estimates of tailings in Galena Gulch to aid in selecting a remedy

Undeveloped Areas (UND)

- Characterize the extent and distribution of lead and arsenic in shallow soil within areas that have not been previously sampled.
- Estimate the extent of aerial deposition of dust generated from the MTP

Smelter Plateau Soil (PS)/Dross(ASH)/Slag (SL)

- Determine depth and volume of dross material
- Enhance knowledge of the chemical properties of the dross material
- Establish nature and extent of contamination on the plateau and determine the nature of soils in the area where a future containment cell for dross might be built

The problem to be addressed by the project (cont'd):

- Collect geotechnical testing data to be used in the FS as part of the conceptual design of the containment cell
- Establish stability of the slag given the presence of crevasses
- Confirm differences in slag chemical characteristics identified in the RI between the main and satellite slag piles

Smelter Tailings Swale (STS)

- Determine total depth and volume of tailings material in tailings swale
- Assess AMD potential
- Assess potential to move and consolidate tailings in this area for the FS
- Collect geotechnical testing data to be used in the FS as part of the conceptual design of an in-place closure of tailings
- Conduct a surface geophysical investigation to determine the thickness of the tailings and the topography of the underlying materials

Chaparral Gulch Floodplain (CHF)

- Determine depth and volume of tailings material in the floodplain
- Evaluate AMD potential and metals content
- Evaluate moisture content and occurrence of perched water
- Evaluate chemical properties and layering within the alluvium
- Collect geotechnical testing data to be used in the FS for constructability/foundation of potential conveyance channel and to determine erosive nature of tailings
- ~~Refine bioaccessibility values used in risk assessment~~

Dam and Area Behind Dam (DAM)

- Determine the batter (slope angle) of upstream surface of the concrete dam
- Determine total depth and volume of material and metals
- Assess loading on the dam, dam stability, water levels and weight of materials
- Evaluate AMD potential behind the dam
- Assess dam width, dam stability, and the suitability for long term retainment of materials

The problem to be addressed by the project (con't):

Upper Chaparral Gulch (CH; near 3rd Street)

- Determine depth and volume of contaminated soils and tailings material
- Assess layering with alluvium
- Collect geotechnical testing data to be used in the FS for constructability/foundation of potential conveyance channel and to determine erosive nature of tailings

Chaparral Gulch (CH; between 3rd Street and Smelter)

- Determine depth and volume of contaminated soils and tailings material
- Assess layering with alluvium
- Collect geotechnical testing data to be used in the FS for constructability/foundation of potential conveyance channel and to determine erosive nature of tailings

Residential Properties: Area Screening (Soil)

- Conduct initial soil screening of homes (specifically for Pb and As) near the periphery of potential site impacts to determine if full risk characterization is required.

Residential Properties: Full Risk Characterization (Soil)

- Determine properties that need to be cleaned-up based on criteria to be determined by Region 9

Site-wide Groundwater: Installation of New Wells

- Further evaluate both groundwater flow conditions and contaminant distributions

Groundwater Sampling: New & Existing Wells

- Develop detailed knowledge of groundwater chemistry for assessing chemical signatures of groundwater and understanding reactions that are occurring along flow paths

Biological Survey & Bioassessment Sampling

- Assess riparian corridors and upland areas within the site boundaries that would provide suitable habitat for wildlife
- Estimate bioaccessibility for ecological risk assessment

Other Tasks:

- Obtain aerial imagery and 2 –foot contour data for the site and surrounding areas (Yavapai County GIS Department) to be used for estimation of mine waste volumes, identification of parcels to obtain access agreements for sampling and for removal activities, and site for site restoration activities.

The problem to be addressed by the project (con't):

- Provide support with and maintaining property access requests
- Retain a subcontractor to apply a copolymer liquid over the entire area (approximately 15 acres) for site dust control
- Conduct hydrologic monitoring and surface water sampling to assess the impact of site sources on surface water quality in the Chaparral Gulch and Agua Fria River.
- Assess stability of smelter smoke stack

The environmental questions being asked:

- Can future erosion rates (soil loss) be minimized (i.e., for specific areas of concern)?
- Can uncontrolled surface water runoff, sediment yield, and sediment transport be minimized?
- What is the extent and depth of Pb, As, zinc (Zn), copper (Cu), iron (Fe), manganese (Mn) and chromium (Cr) concentrations exceeding the site-specific benchmarks in matrices of concern (soil, sediment, surface water, groundwater, dross, slag)?
- Can local off-site sources of natural materials be used for future site restoration?
- What is the ecological and human health risk associated with the surface runoff, and sediment and aerial transport of Pb and As?

Observations from any site reconnaissance reports:

Exposed native hillsides and abutments confine the LTP on the north and south sides. The west extent of the LTP is limited by the rising slope of the valley bottom. The natural valley area located east (down slope) of the LTP has been filled to a depth of about 40 ft with tailings deposited primarily as a result of a 1964 slope failure and from subsequent erosion of the LTP. The east limit of the tailings is constrained by a site access road (constructed on a former railway embankment). A portion of the post-failure tailings have been excavated to form a small storm water detention pond at the eastern limit of the site.

The current contaminants of concern at the site include arsenic, lead, and other metals that have contaminated soil, sediments, surface water and groundwater in concentrations significantly above background levels. The full extent of off-site soil contamination and possible groundwater contamination has not been fully assessed. Runoff from the mine tailings along the Chaparral Gulch may be entering the Aqua Fria River, further downstream.

A synopsis of secondary data or information from site reports:

Site Geology: The Iron King mine is approximately located in the geographical center of the Humboldt region. The underlying bedrock is Precambrian in age. Late Cenozoic unconsolidated river wash and valley fill, with some interbedded basalt, locally mantle the Precambrian rocks, especially in the north-central part of the region. The Precambrian rocks consist of two metamorphosed volcanic formations and intrusive rocks that range in composition from quartz porphyry to gabbro. The volcanic formations originally were flows, volcanic breccias, and tuffaceous sedimentary rocks. Dynamo-thermal metamorphism of these rocks formed textures, structures, and mineral assemblages, characteristic of low-grade metamorphic rocks; however, sufficient relict textures and structures remain to permit delineation of formations. The Precambrian rocks strike north to northwest and steeply dip in a predominant westward direction.

Groundwater: Unconfined groundwater is encountered at depths between 30 and 50 ft bgs and generally the flow follows the local topography. Shallow groundwater is thought to flow east from the mine towards the Aqua Fria River and along the Chaparral Gulch. Deeper confined groundwater moves within the fracture system of the underlying metamorphic bedrock. Bedrock wells have been drilled to depths ranging from 200 to 1,000 ft bgs. The regional groundwater flow direction is not fully understood.

It is possible that the contaminated soil (material) was placed on residential properties before homes and/or fences were built and may not follow property lines. It has been noted from previous sampling events that the high concentration material is fine-grained but not necessarily distinguishable from other soils on the properties.

The possible classes of contaminants and the affected matrices: Soil: Metals ~~(primarily As and Pb)~~ across the site; Cr(VI) in the MTP, STS, and CHF; SPLP metals in the MTP, dross & slag materials in the Smelter Plateau area, STS, CHF, and DAM; dioxin/furans in dross from the Smelter Plateau Sediment (Agua Fria River): Metals (primarily As and Pb); dioxins/furans Surface water: Metals (primarily As and Pb); water quality parameters (field and laboratory measurements); total organic carbon (TOC) Groundwater: Metals (primarily As and Pb); water quality parameters (field and laboratory measurements)
The rationale for inclusion of chemical and nonchemical analyses: Matrices and parameters for analysis/measurement were selected to fill in data gaps identified by EPA Region 9.
Information concerning various environmental indicators: Mine tailings, surrounding soils and stream sediments are contaminated with arsenic, lead and other heavy metals. Dioxin/furans and Cr (VI) have also been identified at potential levels of concern during previous sampling efforts.
Project decision conditions ("If..., then..." statements): If FP XRF measurements exceed benchmarks identified in Worksheet 15, then step-out sampling will be initiated to delineate horizontal and vertical heavy metal contamination (Pb, As, Zn, Cu, Fe, Mn, Cr). If sufficient data is collected, then EPA Region 9 will develop and evaluate remedial alternatives for the IKM site. If sufficient data is collected, then EPA Region 9 will complete the FS, and a human health and ecological risk assessment for the site. If surface soil FP XRF measurements and/or TAL metals laboratory results for a residential property exceed criteria determined by Region 9, then a full risk characterization will be conducted on that property.

QAPP Worksheet #11
Project Quality Objectives/Systematic Planning Process Statements

Who will use the data?
EPA Region 9, ERT, SERAS

What will the data be used for?
Data will be used to:

- evaluate and determine final site stabilization designs
- address the data gaps identified by EPA Region 9's contractor (CH2MHILL)
- develop and evaluate remedial alternatives
- complete the FS
- assess human health and ecological risk

What types of data are needed (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?

Digital elevation data (collected by Granite Basin Engineering), rainfall data, land cover data, soil and sediment physical property data, site aerial, topographic and parcel data, property access data, material boundary and volume estimates, construction material survey data, bedrock characteristics, acid mine drainage potential (AMD), waste rock characterization, bioavailability and bioaccessibility data, horizontal and vertical delineation of heavy metals (Pb, As, Zn, Cu, Fe, Mn, Cr), slag wall stability measurements, surface geophysical measurements, physical measurements of the dam, borehole geophysics, slug testing data, depth of water column at the base of the dam, groundwater chemistry, biological assessment data within riparian corridors and upland areas, benthic community and fish observations within the streams and riparian corridors, plant density, plant community and associated vegetative coverage, and plant biomass determination.

Geotechnical Laboratory Testing (off-site subcontracted laboratory measurements):

- Geotechnical property data collected from soil borings at the MTP including: Atterberg limits (A-L), in-place moisture density (M-D), specific gravity (SG), hydraulic conductivity (permeability) 1-D consolidation (Consol), direct shear test (Shear), consolidated-undrained triaxial shear test with pore pressure measurements (CU) and soil-water characteristic curves (SWCC)
- Waste rock characterization – slake durability (Slake)
- Geotechnical property data collected from borings in the Smelter Plateau soils, STS, CHF, DAM, and upper and lower sections of CH. Properties which will be measured include grain size with a sieve and hydrometer, natural moisture content (Moisture) and A-L.
- SG of slag material from the Smelter Plateau area

Water Quality Measurements (off-site subcontracted laboratory [alkalinity, chloride, nitrate, sulfate, phosphate, silica, dissolved organic carbon, total dissolved solids, and fluoride] and field [pH, oxidation reduction potential (ORP), ferrous iron (Fe^{2+}), specific conductivity, temperature, dissolved oxygen, turbidity]) taken from:

- Surface water from the Agua Fria River and downstream of the Dam (excluding Fe^{2+})
- Groundwater from 11 existing wells
- Groundwater from 14 new wells

Acid Base Accounting ([ABA]; off-site subcontracted laboratory analysis for total moisture, neutralization potential, saturated paste pH, sulfur forms, and acid potential and ABA calculations)
collected from:

- soil borings at the MTP
- waste rock characterization from the MTP
- borings into the dross material in the Smelter Plateau area
- slag from the Smelter Plateau area
- borings in the STS
- borings in the CHF
- borings at the DAM

What types of data are needed (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)? Continued:

In Vitro Bioaccessibility Testing for Pb and As (off-site laboratory; Region 9 Laboratory) on surface samples collected from the :

- MTP
- ~~GAL~~
- ~~CHF~~
- ~~CH~~
- Residential properties during the full assessment phase

Off-site subcontracted laboratory analysis for Cr(VI) on surface samples collected from the:

- MTP
- STS
- CHF

Off-site subcontracted laboratory analysis for dioxins/furans and total organic carbon (TOC) on sediment samples collected from the Aqua Fria River.
Off-site subcontracted laboratory analysis for dioxins/furans in dross material and sediment.

Off-site laboratory (Region 9) synthetic precipitation leaching procedure (SPLP) for the RCRA-8 metals plus Zn, Cu, Al , and Mg for samples collected from:

- Soil borings in the MTP,
- Waste rock from the MTP,
- Borings into the dross material in the Smelter Plateau area,
- Slag from the Smelter Plateau area,
- Borings in the STS,
- Borings into the CHF, and
- Borings in the DAM.

Off-site laboratory (CLP) analysis for TAL Metals (including Hg) for:

- Soil borings in the MTP,
- Waste rock characterization in the MTP
- Soil borings from GAL (confirmation of XRF results)
- Slag samples in the Smelter Plateau area
- Soil borings from IKM (confirmation of XRF results)
- Soil borings from UND (confirmation of XRF results)
- Dross and soils from the Smelter Plateau area (confirmation of XRF results)
- Borings from the STS (confirmation of XRF results)
- Borings from the CHF (confirmation of XRF results)
- Borings from the DAM (confirmation of XRF results)
- Borings from CH (confirmation of XRF results)

What types of data are needed (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)? Continued:

- Residential properties during the screening phase of the risk assessment (confirmation of XRF results)
- Sediment from downstream of the dam (confirmation of XRF results)
- Sediment and surface water from the lower Chaparral Gulch/Dam confluence
- Groundwater from 11 existing monitoring wells and 11 new monitoring wells to be installed as a part of this project
- Residential properties during the full risk characterization (confirmation of XRF results)
- Plant matter and soil as part of the bioaccumulation study
- Sediment and surface water samples from the Agua Fria River and downstream of the dam
- Sediment from the upper, middle and lower Chaparral Gulch
- Groundwater seeps below the dam

Field screening for Pb, As, Zn, Cu, Fe, Mn, Cr in soils (using the FP XRF) in:

- Hand borings on the IKM property for delineation of contamination
- Borings in the lower tailings on the IKM property
- The Galena Gulch area
- Borings in the UND
- Borings in dross material and in soils in the Smelter Plateau area
- Borings in the STS
- Borings in the CHF
- Borings at the dam, the area behind the dam, and downstream of the dam
- Borings in the upper and lower sections of Chaparral Gulch
- Soils from residential properties for the screening phase of the risk assessment and the full risk characterization phase

How "good" do the data need to be in order to support the environmental decision?

- Screening level data will include: FP XRF measurements, field water quality measurements (pH, ORP, Fe^{2+}, specific conductivity, temperature, dissolved oxygen, turbidity), geotechnical properties (A-L, M-D, SG, HC, Consol, Shear, CU and SWCC, Slake, grain size, Moisture], ABA parameters and calculations, GPS coordinates, site aerial and topographic data, water depth measurements, slag wall stability measurements, construction materials and biological survey data, and geophysical (electrical resistivity, frequency-domain electromagnetic, ground penetrating radar [GPR]) readings.
- Definitive level data will include analytical results for TAL metals (including mercury [Hg]), SPLP, IVBA, TOC, dioxins/furans, Cr(VI), alkalinity, chloride, nitrate, sulfate, phosphate, silica, dissolved organic carbon, total dissolved solids (TDS), fluoride and dissolved and total Pb and As.

Worksheets #12 and #28 show the measurement performance criteria that are needed for the quality indicators. Worksheet #20 shows the field quality control (QC) samples required. The EPA Region 9 Laboratory and CLP laboratory analytical data will be validated by the EPA Environmental Services Assistance Team (ESAT) contractors. Analytical data from subcontracted laboratories will be validated by SERAS QA/QC Chemists.

How much data are needed (number of samples for each analytical group, matrix, and concentration)?
Refer to Tables 1 thru 3 in the attached FWP.

Where, when, and how should the data be collected/generated?
Field work is projected to occur from January 2014 through the Spring of 2014. A detailed description of sampling and monitoring methods, types of data to be collected, how and where the data will be collected can be found in the attached FWP and Residential Sampling Plan. See Worksheets 18 and 19 for summaries of sampling and analytical activities.

Samples to be analyzed for Pb, As, Zn, Cu, Fe, Mn, and Cr using the Niton FP XRF will be screened at an on-site laboratory. Samples will be screened through the baggie twice, one on each side. A minimum of 10% of the samples from the residential properties, analyzed by the FP XRF will be submitted to a CLP laboratory for confirmation analysis for TAL metals (including Hg). A minimum of 5% of the samples from each non-residential area will be sent to a CLP laboratory for confirmation analysis for TAL metals (including Hg). A higher percentage (20%) of dross samples will be submitted for confirmation.

Site aerial and topographic data will be acquired from Yavapai County.

A site-wide reconnaissance-level biological survey will be conducted in accordance with the US *EPA Ecological Risk assessment Guidance for Superfund: Process for Designing and Conducting Ecological Assessment*s, Interim Final (EPA/540-R-97-005). At each location, SERAS will spend sufficient time quietly observing the area, allowing the local fauna to return to normal behaviour. Observations of the local fauna will be documented. Photographic documentation of the local habitat at each sampling location will be collected. Plant species and coverage will also be photographed. Representative voucher specimens of plants will be collected for later taxonomic identification/verification.

Cores will be logged in accordance with SERAS SOP #2074, *Description and Identification of Soils.*

Prior to groundwater sampling at the new and existing area-wide monitoring wells, static water levels will be measured using an electronic indicator and recorded in conformance with SERAS SOP # 2043, *Water Level Measurement*. Field water quality parameters will be collected using the Horiba U-52 Multi-parameter Water Quality Meter with flow chamber. Fe^{+2} will be measured by the 1,10-phenanthrolene method using a Hach test kit.

A handheld GPS (Trimble GeoExplorer) will be used to collect borehole, sampling, and monitoring well location coordinates for the length of the project.

Surface geophysical readings will be collected using an Iris Instruments Pro Resistivity Meter, Geonics® EM31-MK2 and a Sensors & Software Smartcart Noggin GPR unit.

United States Geological Survey (USGS)-developed automated water samplers and rain gauges will be deployed for hydrologic monitoring and surface water sampling within the Chaparral Gulch, downstream of the dam, and in the Agua Fria River.

Who will collect and generate the data?
SERAS, ERT, EPA R9, Granit Basin Engineering (survey data), Katahdin Analytical, Cape Fear Analytical, ACZ Laboratories, ALS Environmental, Speedie & Associates, GeoSystems Analysis, Inc, and CLP personnel.

How will the data be reported?

GPS coordinates, borehole logs and geophysical logs, construction details for monitoring wells, top of casing and ground surface elevations for new wells, laboratory results, lists of raw construction material sources, construction details of the on-site dam, horizontal coordinates and elevations of slag pins, transect data for major cracks in the slag, results from surface geophysical investigations and hydrologic monitoring, volume estimate of mine-related wastes and impacted areas, and results from the biological survey, surface and borehole geophysical surveys, and hydrologic monitoring data will be reported in Technical Memorandums, prepared in accordance with SERAS Standard Operating Procedure (SOP) #4018, *Preparation of Interim or Status Reports*.

Sample collection information, sample data, and GPS coordinates for samples will be documented in SCRIBE. A final SCRIBE file will be posted to the ERT-IMS website.

Validated data for the sampling event will be reported in analytical reports prepared in accordance with SERAS SOP #4020, *Analytical Report Preparation.*

The SERAS TL will be responsible for reviewing, evaluating, summarizing, and presenting all of the data generated from this project. All reports will be posted on the project-specific ERT-Information Management System (IMS) website. Data will be disseminated to EPA Region 9 by the WAM.

How will the data be archived?

Hard copies of all deliverables will be stored in SERAS Central Files and e-copies will be stored on SERAS Local Area Network (LAN). Data will be archived by SERAS in accordance with Administrative Procedure (AP) #34, *Archiving Data Electronic Files.*

CLP and Region 9 laboratories will be archive their analytical data. Analytical data packages subcontracted to all outside laboratories will be archived by the SERAS QA/QC Group.

QAPP Worksheet #12-1
Measurement Performance Criteria Table

Matrix	Soil/Sediment/Dross/ Slag
Analytical Group	Metals (FP XRF)
Concentration Level	NA

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2012 SERAS SOP #2016	SERAS SOP # 1720	Sensitivity	< Reporting Limit (RL)	Zero check sample	A
		Precision	± 20%	Laboratory Duplicate	A
		Precision	%RSD ± 20%	Precision check sample	A
		Accuracy/Bias	Element results typically within ± 20% of true values for concentrations at least 5X the RL	Certified Reference Standard(s)	A
		Completeness	>90% Sampling Completed >90% Laboratory Analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (see Section 3.2)

QAPP Worksheet #12-2
Measurement Performance Criteria Table

Matrix	Soil/Sediment/Slag/ Waste Rock/Dross
Analytical Group	TAL metals
Concentration Level	Low to high

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2012 SERAS SOP #2016	ISM01.3	Precision (field)	≤ 35% RPD	Field Duplicate	S & A
		Accuracy (field)	Blank Concentration ≤ CRQL	Preparation Blank	A
		Precision (laboratory)	± 20% RPD	Duplicate Sample **	A
		Accuracy (laboratory)	75–125% Within control limits	*** Matrix Spike	A
		Accuracy (laboratory)	ICP-AES: %R=70-130% except Ag & Sb ICP-MS: %R=70 to 130%	Laboratory Control Sample****	A
		Accuracy	± 20 of the true value or ± 1 times the CRQL, whichever is greater	Interference Check Sample (ICS)	A
		Accuracy	%R = 75-125 (exception Ag)	Post Digestion Spike	A
		Precision	%D ± 10% (minimum sample concentration 50x MDL	Serial Dilution	A
		Accuracy/Bias	60-125%	Internal Standards (ICP-MS)	A
		Completeness	> 90% sampling completed > 90% laboratory analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21
[2]Reference number from QAPP Worksheet #23

**Reference USEPA CLP ISM01.3, Exhibit D of ICP-AES and ICP-MS for Duplicate Sample Criteria
***Reference USEPA CLP ISM01.3, Exhibit D of ICP-AES and ICP-MS for Spike Sample Criteria
****Reference USEPA CLP ISM01.3, Exhibit D of ICP-AES and ICP-MS for solid Laboratory Control Sample (LCSS)
Note: Control Limits established by USEPA for LCSS

QAPP Worksheet #12-3
Measurement Performance Criteria Table

Matrix	Surface and Groundwater
Analytical Group	TAL metals
Concentration Level	Low to high

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2013 SERAS SOP #2007	ISM01.3	Precision (field)	≤ 20% RPD	Field Duplicate	S & A
		Accuracy (field)	Blank concentration ≤ CRQL*	Preparation Blank	A
		Accuracy/Bias (Contamination)	No analyte > CRQL	Field Blank	S & A
		Precision (laboratory)	≤ 20% RPD	Duplicate Sample **	A
		Accuracy (laboratory)	75–125%; 70–130 % (50 – 150% for Ag and Sb)	*** Matrix Spike; LCSW	A
		Accuracy	±20% of true value or ±1 times the CRQL, whichever is greater	Interference Check Sample (ICS)	A
		Accuracy	%R = 75-125 (exception Ag)	Post Digestion Spike	A
		Precision	%D ±10% (minimum sample concentration 50x MDL)	Serial Dilution	A
		Accuracy/Bias	60-125%	Internal Standards (ICP-MS)	A
		Completeness	> 90% sampling completed > 90% laboratory analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21
[2]Reference number from QAPP Worksheet #23
**Reference USEPA CLP ISM01.3, Exhibit D of ICP-AES and ICP-MS for Duplicate Sample Criteria

***Reference USEPA CLP ISM01.3, Exhibit D of ICP-AES and ICP-MS for Spike Sample Criteria

QAPP Worksheet #12-4 (Samples Relinquished by Region 9 to SERAS)
Measurement Performance Criteria Table

Matrix	Soil
Analytical Group	Metals
Concentration Level	ICP-AES

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2012	SERAS SOP #1811	Precision	RPD ± 20%	Laboratory Duplicates (Matrix Spike Duplicate)	S & A
		Precision	RPD ± 35%)	Field duplicates	S & A
		Accuracy/Bias	%R = 75-125%	Matrix Spike (inorganic)	S & A
		Accuracy/Bias	%R = 80-120% or within performance acceptance limits	LCS	A
		Accuracy/Bias (Contamination)	< Reporting Limit	Method Blank	A
		Accuracy/Bias	+/-20% for elements in ICSA, < RL for others	ICS	A
		Accuracy/Bias	+/-10% if analyte concentration > 10 times RL	Serial Dilution	A
		Accuracy/Bias	%R = 90 – 110%	LAR	A
		Accuracy/Bias	%R ± 30% true value	LLQC	A
		Accuracy/Bias	%R = 80 -120	Post Digestion Spike	A
		Completeness	>90% Sampling Completed >90% Laboratory Analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21
[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-5 (Samples Relinquished by Region 9 to SERAS)
Measurement Performance Criteria Table

Matrix	Soil
Analytical Group	Mercury
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2012	SERAS SOP #1832	Precision	RPD ± 20%	Laboratory Duplicates (Matrix Spike Duplicate)	S & A
		Precision	RPD ± 35%	Field duplicates	S & A
		Accuracy/Bias	%R = 80-120%	Matrix Spike (inorganic)	A
		Accuracy/Bias	%R = 80-120% or within performance acceptance limits	LCS	A
		Accuracy/Bias (Contamination)	< RL	Method Blank	A
		Completeness	>90% Sampling Completed >90% Laboratory Analysis	Data Completeness Check	S & A
		Accuracy/Bias (Contamination)	< RL	Field Blank	S & A

[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (see Section 3.2)

QAPP Worksheet #12-6
Measurement Performance Criteria Table

Matrix	Soil/Dross/Slag/ Waste Rock
Analytical Group	SPLP Metals
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or Both (S&A)
SERAS SOP #2012	EPA R9 SOP 254 EPA R9 SOP 407 EPA R9 SOP 503 EPA R9 SOP 515	Accuracy/Bias (Contamination)	<1/2 RL	Method Blank	A
		Precision	RPD ± 20%	Sample Duplicate	A
		Precision	RPD ± 20%	Laboratory Duplicates (MS/MSD or sample and duplicate)	A
		Accuracy/Bias	<±1/2QL or calculated acceptance window, whichever is greater	Spectral Interference Check (SIC) (not for Hg)	A
		Accuracy/Bias	60-125%	Internal Standard	A
		Accuracy/Bias	%R = 90 – 110%	Linear Dynamic Range (LDR) (not for Hg)	A
		Accuracy/Bias	ICP & Hg: 85-115%	LCS	A
			ICP: 75-125% Hg: 70-130%	Matrix Spikes	S & A
		Completeness	>90% sample collection >90% sample analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)

QAPP Worksheet #12-7
Measurement Performance Criteria Table

Matrix	Soil
Analytical Group[1]	Cr(VI)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SERAS SOP #2012	Katahdin SOP #CA-625-06	Accuracy	%R = 80-120%	LCS	A
		Accuracy	±25% of true value	Soluble and Insoluble Pre-Digestion Matrix Spikes	A
		Accuracy	±15% of true value	Post-Digestion Matrix Spike	A
		Precision	RPD ≤ 20%	Duplicate Sample	A
		Precision (field)	±35% RPD	Field Duplicate	S & A
		Accuracy	< RL	Method Blank	A
		Completeness	>90% sample collection >90% sample analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)

QAPP Worksheet #12-8
Measurement Performance Criteria Table

Matrix	Sediment/Dross
Analytical Group[1]	Dioxins/furans
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SERAS SOP #2012 SERAS SOP #2016	Cape Fear SOP #CF-OA-E-001 & -002	Accuracy	70 – 130%	Matrix Spike	A
		Precision (field)	±35% RPD	Field Duplicate	S & A
		Accuracy	35-197%	Labeled Cleanup Standard	A
		Accuracy	Recoveries within established laboratory limits	Labeled Extraction Standards	A
		Accuracy	Recoveries within established laboratory limits	Ongoing Precision Recovery (OPR)	A
		Precision	%RPD<20	OPR Duplicate	A
		Precision	%RPD<20	Lab Duplicate MS/MSD	A
		Accuracy	<RL or <10% of level in related samples	Method Blank	A
		Completeness	>90% sample collection >90% sample analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)

QAPP Worksheet #12-9a
Measurement Performance Criteria Table

Matrix	Water
Analytical Group[1]	Nitrite/Nitrate & Fluoride
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SERAS SOP #2013 SERAS SOP #2007	Katahdin SOP #CA-728-08 (nitrite/nitrate) Katahdin SOP #CA-742-09 (fluoride)	Accuracy	90-110%	LCS	A
		Precision (field)	±20% RPD	Field Duplicate	S & A
		Accuracy	90-110%	Matrix Spike	A
		Precision	Fluoride: RPD ± 15%	MS/MSD	A
		Precision	Nitrate: RPD ± 20 for samples >3x the PQL; <100% for samples<3x the PQL Fluoride: RPD ± 20%	Sample Duplicate	A
		Accuracy	<RL	Method Blank	A
		Accuracy/Bias (Contamination)	<RL	Field Blank	S & A
		Completeness	>90% sample collection >90% sample analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)

QAPP Worksheet #12-9b
Measurement Performance Criteria Table

Matrix	Water
Analytical Group[1]	Dissolved Organic Carbon
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SERAS SOP #2013 SERAS SOP #2007	Katahdin SOP #CA-763-07	Accuracy	90-110%	LCS	A
		Precision (field)	±20% RPD	Field Duplicate	S & A
		Accuracy	%R: 80-120%	Matrix Spike	A
		Precision	±20% RPD	Sample Duplicate	A
		Accuracy	<RL	Method Blank	A
		Accuracy/Bias (Contamination)	<RL	Field Blank	S & A
		Completeness	>90% sample collection >90% sample analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)

QAPP Worksheet #12-9c
Measurement Performance Criteria Table

Matrix	Water
Analytical Group[1]	Sulfate Phosphate Alkalinity Chloride
Concentration Level	Low

Sampling Procedure[2]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
SERAS SOP #2013 SERAS SOP #2007	Katahdin SOP #CA-721-03 (sulfate) Katahdin SOP #CA-715-06 (phosphate) Katahdin SOP #CA-739-09 (alkalinity) Katahdin SOP #CA-768-03 (chloride)	Accuracy	80-120%	LCS	A
		Precision	Sulfate & Alkalinity: ±20% RPD for concentrations >3x the PQL; RPD≤100 for results<3x PQL Phosphate & Chloride: RPD≤20	Sample Duplicate	A
		Precision (field)	±20% RPD	Field Duplicate	S & A
		Accuracy	Sulfate, Phosphate, Chloride: 75-125% Alkalinity: 80-120%	Matrix Spike	A
		Accuracy	<RL	Method Blank	A
		Accuracy/Bias (Contamination)	<RL	Field Blank	S & A
		Completeness	>90% sample collection >90% sample analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)

QAPP Worksheet #12-9d
Measurement Performance Criteria Table

Matrix	Water
Analytical Group[1]	Total Dissolved Solids
Concentration Level	Low

Sampling Procedure[2]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
SERAS SOP #2013 SERAS SOP #2007	Katahdin SOP #CA-719-07 (TDS)	Accuracy	80-120%	LCS	A
		Precision (field)	±20% RPD	Field Duplicate	S & A
		Precision	RPD≤20	Sample Duplicate	A
		Accuracy	<RL	Method Blank	A
		Accuracy/Bias (Contamination)	<RL	Field Blank	S & A
		Completeness	>90% sample collection >90% sample analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)

QAPP Worksheet #12-10
Measurement Performance Criteria Table

Matrix	Sediment
Analytical Group[1]	Total Organic Carbon
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SERAS SOP #2016	Katahdin SOP #CA-741-05	Accuracy	R = 80-120%	LCS	A
		Precision (field)	±35% RPD	Field Duplicate	S & A
		Accuracy	R = 75-125%	Matrix Spike	A
		Accuracy	<RL	Method Blank	A
		Precision	RPD ±20%	Sample Duplicate	A
		Completeness	>90% sample collection >90% sample analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)

QAPP Worksheet #12-11
Measurement Performance Criteria Table

Matrix	Water
Analytical Group[1]	Silicon
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SERAS SOP #2013 SERAS SOP #2007	Katahdin SOP #CA-627-09	Precision	RPD ± 20% if sample conc>100x IDL	Duplicate Sample	A
		Precision	RPD ± 20%	Field Duplicate	S & A
		Accuracy/Bias	%R = 80-120 limits or within performance acceptance limits	LCS	A
		Accuracy/Bias (Contamination)	< RL	Method Blank	A
		Accuracy/Bias	Interferents: ±20% of true value	ICS-A	A
		Accuracy/Bias	±20% of true value	ICS-AB	A
		Accuracy/Bias	+/-10% if analyte concentration > 50 times LOQ	Serial Dilution	A
		Accuracy/Bias	IS intensity within 70-120% of IS in ICB	Internal Standard	A
		Accuracy/Bias (Contamination)	<RL	Field Blank	S & A
		Accuracy/Bias	%R = 80-120	Post Digestion Spike	A
		Completeness	>90% Sampling Completed >90% Laboratory Analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)

QAPP Worksheet #12-12 (Relinquished by Region 9 to SERAS - ACZ Laboratories)
Measurement Performance Criteria Table

Matrix	Soil
Analytical Group[1]	IVBA (Pb & As)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SERAS SOP #2012	SOPS0048.06.13.05 SOP0028.08.13.10 SOPII022.07.13.09	Accuracy	R=80-120%	LCSW	A
		Precision	RPD ± 20%	Sample Duplicate	A
		Accuracy	R = 75-125%	Matrix Spike	A
		Precision	RPD ± 20%	Matrix Spike Duplicate	A
		Accuracy/Bias (Contamination)	Lead < 25 µg/L Arsenic < 5 µg/L	Extraction Fluid	A
		Accuracy/Bias (Contamination)	Lead < 50 µg/L Arsenic < 10 µg/L	Bottle Blank	A
		Accuracy/Bias (Contamination)	<RL	Method Blank	A
		Accuracy/Bias	R = 80-120%	ICS	A
		Accuracy/Bias	R = 30-120%	Internal Standard	A
		Completeness	>90% sample collection >90% sample analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)
[3]Represents extraction, digestion and analytical methods

QAPP Worksheet #12-13 (EPA Region 9 Laboratory)
Measurement Performance Criteria Table

Matrix	Soil
Analytical Group[1]	IVBA (Pb & As)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SERAS SOP #2012	EPA R9 SOP 256 EPA R9 SOP 407 EPA R9 SOP 503	Accuracy/Bias (Contamination)	<1/2 RL	Method Blank	A
		Precision	RPD ± 20%	Sample Duplicate	S & A
		Precision	RPD ± 20%	MS/MSD	A
		Accuracy/Bias	<±1/2QL or calculated acceptance window, whichever is greater	SIC	A
		Accuracy/Bias	60-125%	Internal Standard	A
		Accuracy/Bias	%R = 90 – 110%	Linear Dynamic Range (LDR)	A
		Accuracy/Bias	85-115%	LCS (extract)	A
		Accuracy/Bias	Element specific (<25 µg/L Pb)	Reagent Blank	A
		Accuracy/Bias	RPD ± 10%	SRM	A
		Accuracy/Bias	%R 75-125%	Matrix Spikes	S & A
		Completeness	>90% sample collection >90% sample analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)

QAPP Worksheet #12-14
Measurement Performance Criteria Table

Matrix	Plant Tissue
Analytical Group[1]	Metals
Concentration Level	ICP-MS - Low

Sampling Procedure[2]	Analytical Method/SOP[3]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SERAS SOP #2034	Katahdin SOP #CA-627-09	Precision	RPD ± 20% if sample concentration >100x IDL	Duplicate Sample	A
		Accuracy/Bias	%R = 80-120 or performance acceptance limits	LCS	A
		Accuracy/Bias (Contamination)	< RL	Method Blank	A
		Accuracy/Bias	±20% for elements in ICSA	ICS	A
		Accuracy/Bias	±10% if analyte concentration > 50 times instrument detection limit	Serial Dilution	A
		Accuracy/Bias	%R = 80 -120	Post Digestion Spike	A
		Accuracy/Bias	IS intensity within 70-120% of ICB	Internal Standard	A
		Completeness	>90% Sampling Completed >90% Laboratory Analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)

QAPP Worksheet #12-15
Measurement Performance Criteria Table

Matrix	Plant Tissue
Analytical Group[1]	Hg
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SERAS SOP #2034	Katahdin SOP #CA-611	Precision	RPD ± 20%	Laboratory Duplicates (Matrix Spike Duplicate)	S & A
		Accuracy/Bias	%R = 75-125%	Matrix Spike (inorganic)	A
		Accuracy/Bias	%R = 80-120% or within performance acceptance limits	LCS	A
		Accuracy/Bias (Contamination)	< RL	Method Blank	A
		Accuracy/Bias	%R = 80-120	Post Digestion Spike	A
		Precision	%D ± 10%	Serial Dilution	A
		Sensitivity/ Accuracy	LOD = 2-3x MDL LOQ > LOD	LOD/LOQ Study	A
		Sensitivity	IDL < RL	IDL Study	A
		Completeness	>90% Sampling Completed >90% Laboratory Analysis	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (See Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (See Section 3.2)

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Data gap analysis	Draft - Data Gap Analysis Report Iron King Mine–Humboldt Smelter Superfund Site, Dewey-Humboldt, Yavapai County, Arizona, CH2MHILL, April 2013	CH2MHILL; data gap analysis of historical work conducted on the site; includes maps and recommendations for future sampling and analysis activities	Guidance for sampling objectives	Unknown quality of the data
Previous site investigation	EA Engineering, Science, and Technology, Inc. Feasibility Study, Iron King Mine Superfund Site. May 2011.	EA Engineering, Science, and Technology, Inc. Feasibility Study, Iron King Mine Superfund Site. Pre-2010 physical/chemical data.	Background info	Possibility of limited data
Previous site investigation	EA Engineering, Science, and Technology, Inc. Remedial Investigation Report, Iron King Mine Superfund Site. March 2010.	EA Engineering, Science, and Technology, Inc. Remedial Investigation Report, Iron King Mine Superfund Site. Pre-2010 physical/chemical data.	Background info	Possibility of limited data
Previous site-specific data	GEI Consultants. Evaluation of Tailings Consolidation Options, Iron King Mine Superfund Site. June 30, 2011.	GEI Consultants. Evaluation of Tailings Consolidation Options, Iron King Mine Superfund Site. Design scenarios.	Background info	Possibility of limited data
Guidance document	Environmental Protection Agency (EPA), 2002. Guidance for Quality Assurance Project Plans for Modeling. EPA/240/R-02/007. December 2002.	U.S. EPA, reference document	Guidance for modeling	None
Text book	McCuen, R. H., 2002. Modeling Hydrologic Change: Statistical Methods. CRC Press.	Private author, methods and procedures	Hydrologic and hydraulic modeling	None

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Computer model	Natural Resources Conservation Service (NRCS), 2009. EFH2 Computer Program: Estimating Runoff and Peak Discharge. USDA, August 2009.	USDA/NRCS, reference documentation	Guidance for hydrologic model implementation and use.	Some model input data may need to be estimated or averaged over space and time, which could affect the accuracy.
Computer model	Maynord, S.T., M.T. Hebler, and S.F. Knight, 1998. User's Manual for CHANLPRO, PC Program for Channel Protection Design. U.S. Army Corps of Engineers, Waterways Experiment Station, Coastal & Hydraulics Laboratory, Vicksburg, Mississippi. Technical Report CHL-98-20. July 1998.	Corps of Engineers, reference documentation	Guidance for riprap design	Some model input data may need to be estimated or averaged, which could affect the accuracy.
Procedure/methodology	Blodgett, J.C. and C.E. McConaughy, 1986. Rock Riprap Design for Protection of Stream Channels near Highway Structures, Volume 2: Evaluation of Riprap Design Procedures. U.S. Geological Survey Water Resources Investigation Report 86-4128. Prepared in cooperation with the Federal Highway Administration.	USGS, reference document	Guidance for riprap design	Some of the calculation parameters may need to be estimated or averaged.

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Procedure/methodology	Federal Highway Administration (FHWA), 2001. Urban Drainage Design Manual. Hydrologic Engineering Circular No. 22, 2nd edition. Publication No. FHWA-NHI-01-021. U.S. Department of Transportation. Prepared in cooperation with the National Highway Institute. August 2001.	FHWA, reference document	Guidance for surface water drainage design	Some of the calculation parameters may need to be estimated or averaged.
Procedure/methodology	Natural Resources Conservation Service (NRCS), 2001. Water Management (Drainage). National Engineering Handbook, Part 650 – Engineering Field Handbook, Chapter 14. April 2001.	NRCS, reference document	Guidance for french drain design	Some parameters, such as soil properties, may need to be estimated.
Rainfall data	National Oceanic and Atmospheric Administration (NOAA). Point Precipitation Frequency Estimates, NOAA Atlas 14. National Weather Service (NWS), Hydro-meteorological Design Studies Center.	NOAA/NWS rainfall data	Determine peak runoff and channel flow discharge at the site.	Data are estimated from historical rainfall values and probability of occurrence. The longer the historical record, the more reliable are the data.

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Ecological Assessment	EPA, Ecological Risk Assessment guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final. Office of Solid Waste and Emergency Response, Washington, D.C., EPA/540-R-97-005	EPA, reference document	Completion of EPA required checklists as a part of ecological risk assessment: ecological assessment/sampling checklist; terrestrial habitat checklist; aquatic habitat checklist	None

QAPP Worksheet #14
Summary of Project Tasks

Sampling and Monitoring Tasks:
January 2014 to Spring 2014:
Sampling activities will be in conducted in accordance with the following SERAS SOPs:
SERAS SOP #2001, *General Field Sampling Guidelines*
SERAS SOP #2002, *Sample Documentation*
SERAS SOP #2003, *Sample Storage, Preservation and Handling*
SERAS SOP #2004, *Sample Packing and Shipment*
SERAS SOP #2007, *Groundwater Sampling*
SERAS SOP #2012, *Soil Sampling*
SERAS SOP #2013, *Surface Water Sampling*
SERAS SOP #2016, *Sediment Sampling*
SERAS SOP #2037, *Terrestrial Plant Community Sampling*
SERAS SOP #2038, *Vegetation Assessment Field Protocol*
SERAS SOP #2043, *Water Level Measurement*
SERAS SOP #2044, *Well Development*
SERAS SOP #2048, *Monitor Well Installation*
SERAS SOP #2052, *Operation of EM-31*
SERAS SOP #2056, *Ground Penetrating Radar*
SERAS SOP #2074, *Description and Identification of Soils*

Details of all sampling can tasks can be found in Attachment 1 (Supplemental Field Investigation Work Plan), Attachment 2 (Residential Sampling Approach) and in Worksheets 17 and 18.

Analysis Tasks:
20 soil samples collected by EPA Region 9 and relinquished to SERAS were analyzed by the SERAS Laboratory for TAL metals and by the ACZ Laboratories for Pb and As using IVBA to determine the biaoaccessibility of the metals.

The following analytical work has been projected for the remainder of this project. Sample numbers do not include field duplicates (Refer to Worksheet 20 for QC samples):

- 7,207 soil/dross samples for analysis by FPXRF (this represents a minimum number of samples to be analyzed as a step-out approach for delineation of contamination will be applied)
- 30 soil samples for Pb and As using IVBA by the Region 9 Laboratory
- 30 soil, 5 waste rock, 4 dross material, and 3 slag samples for SPLP RCRA-8 metals plus Zn, Cu, Al, Fe, and Mn by the Region 9 Laboratory
- 695 soil, 5 waste rock, 3 slag, 33 dross, 25 sediment, 16 surface water, and 50 groundwater samples for TAL metals by CLP (this represents a minimum number of samples to be analyzed as a step-out approach for delineation of contamination will be applied)
- 10 plant tissue samples for TAL metals analysis by Katahdin Analytical Services
- 22 soil samples for analysis of Cr(IV) by Katahdin Analytical Services
- 2 dross material and 5 sediment samples for analysis of dioxins/furans by Katahdin Analytical Services
- 5 surface water and 50 groundwater samples for water quality parameters (alkalinity, chloride, nitrate, sulfate, phosphate, silica, dissolved organic carbon, total dissolved solids, and fluoride) by Katahdin Analytical Services.
- 5 sediment samples for TOC by Katahdin Analytical Services
- 30 soil, 4 dross material, 5 waste rock, and 3 slag samples for ABA by Katahdin Analytical Services
- Geotechnical parameters which will be measured by Speedie & Associates:
    - 58 soil samples for grain size and Atterberg Limits
    - 38 soil samples for moisture
    - 24 soil samples for in-place moisture-density
    - 9 soil samples for specific gravity
    - 6 soil samples for hydraulic conductivity
    - 3 soil samples for 1-D consolidation, direct shear test, and consolidated-undrained triaxial shear tests
- Geotechnical parameters which will be measured by GeoSystems Analysis, Inc:
    - 5 waste rock samples for slake durability
    - 3 soil-water characteristic curves

Quality Control Tasks:
Refer to Worksheet #20 for field QC samples and Worksheets #12 and #28 for analytical QC Samples.

Secondary Data: Described in Worksheet #13.

Data Management Tasks:
Field observations and data will be recorded in field notebooks. All sampling locations will be identified by a field assigned number. Field sampling data will be recorded on field data sheets or in field books. Project reports (Technical Memorandums) will be posted to the ERT/Information Management System (IMS) website for this WA. Posting of the reports will be considered as completion of the deliverable.

Documentation and Records: All observations noted during field efforts will be documented in accordance with SERAS SOP #4001, *Logbook Documentation* and SERAS SOP #2002, *Sample Documentation*. Documents and records that will be generated during this project include: WP, UFP-QAPP, HASP, Field and Laboratory Logbooks, Site Map, Sample Labels, COC Records, Field Change Forms, Analytical Reports, Borehole Logs, and Project Reports (Technical Memorandums). Project Reports will be prepared in accordance with SERAS SOP #4018, *Preparation of Interim or Status Reports*. Analytical Reports will be prepared in accordance with SERAS SOP #4020, *Analytical Report Preparation.*
Assessment/Audit Tasks: No performance audit of field operations is anticipated for this project. Management system reviews establish compliance with prevailing management structure, policies and procedures, and ensures that the required data are obtained.
Data Review Tasks: All SERAS project deliverables will receive an internal peer review prior to release, per guidelines established in the SERAS AP #22, *Peer Review of SERAS Deliverables*. Analytical data will be reviewed by the individual laboratories prior to release of the data.

QAPP Worksheet #15-1

Matrix: Soil/Sediment/Dross (FP XRF Metals)

Analytical Group: Metals

Concentration Level: Low to high

Analyte	CAS Number	Project Action Limit (mg/kg) (Human Health**/ Ecological/ Step-out*)	Project Quantitation Limit (mg/kg)	Analytical Method (SERAS SOP #1720)		Achievable Laboratory Limits (mg/kg) [a]	
				MDLs	Method QLs (mg/kg)	MDLs	QLs[b]
Arsenic	7440-38-2	145/18/200*	22	15	NS	12	24
Copper	7440-50-8	310/28/--	39	50	NS	18	54
Chromium	7439-89-6	12000/26/--	228	45	NS	75	150
Iron	7439-89-6	5500/--/--	150	175	NS	66	200
Lead	7439-92-1	400/11/400*	16	15	NS	15	30
Manganese	7439-96-5	180/220/--	531	175	NS	75	225
Zinc	7440-66-6	2300/46/--	81	40	NS	15	45

[a] Achievable Laboratory Limits (MDLs) based on 120 second measurements of NIST reference standards and/or SiO_2 blank sample
NS – Not specified
[b] Site-specific QLs were computed in consultation with the ERT and Region 9 EPA. QLs for Pb, As, and Cr are based on 2x the MDL. QLs for all others are based on 3x the MDL
mg/kg – milligrams per kilogram
TBD – Quantitation limits will be established in the field prior to sample analysis.
* 145 mg/kg is a site-specific action limit established by Region 9 as an indication of risk to human health; 200 mg/kg represents the value at which additional step-out samples will be collected during delineation activities.
** Regional Screening Level (RSL) for residential soil with hazard quotient=0.1 obtained from:
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/docs/ressoil_sl_table_01run_NOV2013.pdf

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Soil/Sediment/Slag/Dross/Waste Rock

Analytical Group: TAL Metals

Concentration Level: Low to high

Analyte	CAS Number	Project Action Limit (Human Health/ Ecological) (mg/kg)	Project Quantitation Limit (mg/kg)	ISM01.3[a,b] Analytical Method	
				MDLs (mg/kg)	CRQLs (mg/kg)
Aluminum	7429-90-5	7700/--	20[a]	Lab Specific	20[a]
Antimony	7440-36-0	3.1/0.27	0.27[b]	Lab Specific	0.27[b]
Arsenic	7440-38-2	145*/18	0.5	Lab Specific	0.5
Barium	7440-39-3	1500/330	5	Lab Specific	5
Beryllium	7440-41-7	16/21	0.5	Lab Specific	0.5
Cadmium	7440-43-9	7/0.36	0.36[b]	Lab Specific	0.36[b]
Calcium	7440-70-2	--/--	500[a]	Lab Specific	500[a]
Chromium	7440-47-3	12000/26	1	Lab Specific	1
Cobalt	7440-48-4	2.3/13	0.5	Lab Specific	0.5
Copper	7440-50-8	310/28	1	Lab Specific	1
Iron	7439-89-6	5500/--	10[a]	Lab Specific	10[a]
Lead	7439-92-1	400/11	0.5	Lab Specific	0.5
Magnesium	7439-95-4	--/--	500[a]	Lab Specific	500[a]
Manganese	7439-96-5	180/220	0.5	Lab Specific	0.5
Mercury	7439-97-6	2.3/--	0.1	Lab Specific	0.1
Nickel	7440-02-0	150/38	0.5	Lab Specific	0.5

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Soil/Sediment/Slag/Dross/Waste Rock

Analytical Group: TAL Metals

Concentration Level: Low to high

Analyte	CAS Number	Project Action Limit (Human Health/ Ecological) (mg/kg)	Project Quantitation Limit (mg/kg)	ISM01.3[a,b] Analytical Method	
				MDLs (mg/kg)	CRQLs (mg/kg)
Potassium	7440-09-7	--/--/--	500[a]	Lab Specific	500[a]
Selenium	7782-49-2	39/0.52	0.30[b]	Lab Specific	0.30[b]
Silver	7440-22-4	39/4.2	0.5	Lab Specific	0.5
Sodium	7440-23-5	--/--/--	500[a]	Lab Specific	500[a]
Thallium	7440-28-0	0.78/--	0.5	Lab Specific	0.5
Vanadium	7440-62-2	39/7.8	2.5	Lab Specific	2.5
Zinc	7440-66-6	2300/46	1	Lab Specific	1

* Site specific action level determined by Region 9

Human health criteria are Regional Screening Level (RSL) for residential soil with hazard quotient=0.1 obtained from:
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/docs/ressoil_sl_table_01run_NOV2013.pdf

Ecological action limits are the most conservative Ecological Soil Screening Levels (EcoSSLs) for properties where ecological pathways exist (http://www.epa.gov/ecotox/ecossl/).

[a] Metals which could not be analyzed by ICP-MS will be analyzed by ICP-AES. CRQLs for analysis by ICP-AES are provided for these metals.
[b] CLP wil lapply Modified Analysis (MA) 2088.1 for ICP-MS to achieve lowerCRQLs for these metals.

QAPP Worksheet #15-3a
Reference Limits and Evaluation Table

Matrix: Surface Water

Analytical Group: TAL Metals

Concentration Level: Low to high

Analyte	CAS Number	Project Action Limit * (µg/L)	Project Quantitation Limit (µg/L)	ISM01.3 Analytical Method	
				MDLs (µg/L)	CRQLs (µg/L)
Aluminum	7429-90-5	87[a]	200	Lab Specific	200
Antimony	7440-36-0	30	2	Lab Specific	2
Arsenic	7440-38-2	150	1	Lab Specific	1
Barium	7440-39-3	3.9	4[c]	Lab Specific	4[c]
Beryllium	7440-41-7	0.66	0.66[b]	Lab Specific	0.66[b]
Cadmium	7440-43-9	0.25	0.25[b]	Lab Specific	0.25[b]
Calcium	7440-70-2	--	500	Lab Specific	500
Chromium	7440-47-3	11	2	Lab Specific	2
Cobalt	7440-48-4	3.0	1	Lab Specific	1
Copper	7440-50-8	9	2	Lab Specific	2
Iron	7439-89-6	1,000	200	Lab Specific	200
Lead	7439-92-1	2.5	1	Lab Specific	1
Magnesium	7439-95-4	--	500	Lab Specific	500
Manganese	7439-96-5	80	1	Lab Specific	1
Mercury	7439-97-6	0.77	0.2	Lab Specific	0.2
Nickel	7440-02-0	52	1[c]	Lab Specific	1[c]

QAPP Worksheet #15-3a
Reference Limits and Evaluation Table

Matrix: Surface Water

Analytical Group: TAL Metals

Concentration Level: Low to high

Analyte	CAS Number	Project Action Limit * (µg/L)	Project Quantitation Limit (µg/L)	ISM01.3 Analytical Method	
				MDLs (µg/L)	CRQLs (µg/L)
Potassium	7440-09-7	--	500[c]	Lab Specific	500[c]
Selenium	7782-49-2	5.0	5	Lab Specific	5
Silver	7440-22-4	0.36	0.36[b]	Lab Specific	0.36[b]
Sodium	7440-23-5	--	500	Lab Specific	500
Thallium	7440-28-0	0.03	0.2[c]	Lab Specific	0.2[c]
Vanadium	7440-62-2	19	5	Lab Specific	5
Zinc	7440-66-6	120	2	Lab Specific	2

*Action limits for surface water collected for the Ecological Assessment are based on the freshwater chronic criteria found at: http://response.restoration.noaa.gov/sites/default/files/SQuiRTs.pdf

[a] With a pH between 6.5 and 9.5
[b] CLP will apply MA 2047.0 for ICP-MS to achieve lower CRQLs for these metals.
[c] EPA has been made aware that CRQLs are higher than the required benchmarks. CLP modifications cannot lower the CRQLs any further.

QAPP Worksheet #15-3b
Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: TAL Metals

Concentration Level: Low to high

Analyte	CAS Number	Project Action Limit* (µg/L)	Project Quantitation Limit (µg/L)	ISM01.3 (ICP-AES) Analytical Method	
				MDLs (µg/L)	CRQLs (µg/L)
Aluminum	7429-90-5	--	200	Lab Specific	200
Antimony	7440-36-0	6	60	Lab Specific	60
Arsenic	7440-38-2	10	10	Lab Specific	10
Barium	7440-39-3	2000	200	Lab Specific	200
Beryllium	7440-41-7	4	5	Lab Specific	5
Cadmium	7440-43-9	5	5	Lab Specific	5
Calcium	7440-70-2	--	5000	Lab Specific	5000
Chromium	7440-47-3	100	10	Lab Specific	10
Cobalt	7440-48-4	--	50	Lab Specific	50
Copper	7440-50-8	1,300	25	Lab Specific	25
Iron	7439-89-6	1,000	100	Lab Specific	100
Lead	7439-92-1	15	10	Lab Specific	10
Magnesium	7439-95-4	--	5000	Lab Specific	5000
Manganese	7439-96-5	--	15	Lab Specific	15
Mercury	7439-97-6	2	0.2	Lab Specific	0.2
Nickel	7440-02-0	--	40	Lab Specific	40

QAPP Worksheet #15-3b
Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: TAL Metals

Concentration Level: Low to high

Analyte	CAS Number	Project Action Limit* (µg/L)	Project Quantitation Limit (µg/L)	ISM01.3 (ICP-AES) Analytical Method	
				MDLs (µg/L)	CRQLs (µg/L)
Potassium	7440-09-7	--	5000	Lab Specific	5000
Selenium	7782-49-2	50	35	Lab Specific	35
Silver	7440-22-4	--	10	Lab Specific	10
Sodium	7440-23-5	--	5000	Lab Specific	5000
Thallium	7440-28-0	2	25	Lab Specific	25
Vanadium	7440-62-2	--	50	Lab Specific	50
Zinc	7440-66-6	--	60	Lab Specific	60

*Based on Federal Maximum Contaminant Levels (MCLs). Sampling data from 2006 through 2012 indicate that groundwater has been impacted by arsenic and lead.

http://water.epa.gov/drink/contaminants/index.cfm

QAPP Worksheet #15-4 (SERAS Laboratory -Samples Relinquished by Region 9 to SERAS)
Reference Limits and Evaluation Table

Matrix: Soil (ICP Metals, Microwave Digestion)

Analytical Group: Metals

Concentration Level: Low to high

Analyte	CAS Number	Project Action Limit (Residential/ Nonresidential)* (mg/kg)	Project Quantitation Limit (mg/kg)	Analytical Method		Achievable Laboratory Limits (mg/kg) [a]	
				MDLs	Method QLs (mg/kg)	MDLs	QLs
Aluminum	7429-90-5	--	8.5	NS	NS	0.67	8.5
Antimony	7440-36-0	--	1.2	NS	NS	0.28	1.2
Arsenic	7440-38-2	145	1	NS	NS	0.30	1
Barium	7440-39-3	--	0.3	NS	NS	0.035	0.3
Beryllium	7440-41-7	--	0.1	NS	NS	0.016	0.1
Boron	7440-42-8	--	1	NS	NS	0.076	1
Cadmium	7440-43-9	--	0.2	NS	NS	0.0082	0.2
Calcium	7440-70-2	--	6	NS	NS	1.14	6
Chromium	7440-47-3	--	0.4	NS	NS	0.046	0.4
Cobalt	7440-48-4	--	0.2	NS	NS	0.029	0.2
Copper	7440-50-8	--	0.5	NS	NS	0.057	0.5
Iron (2599)	7439-89-6	--	7.7	NS	NS	0.407	7.7
Iron (2714)	7439-89-6	--	30	NS	NS	4.03	30
Lead	7439-92-1	400	1	NS	NS	0.138	1
Magnesium	7439-95-4	--	20	NS	NS	1.71	20
Manganese	7439-96-5	--	0.2	NS	NS	0.0606	0.2
Molybdenum	7439-98-7	--	0.5	NS	NS	0.0314	0.5
Nickel	7440-02-0	--	0.5	NS	NS	0.049	0.5
Potassium	7440-09-7	--	50	NS	NS	6.31	50
Selenium	7782-49-2	--	1.8	NS	NS	0.275	1.8
Silver	7440-22-4	--	0.5	NS	NS	0.0573	0.5
Sodium	7440-23-5	--	30	NS	NS	2.05	30

QAPP Worksheet #15-4 (SERAS Laboratory -Samples Relinquished by Region 9 to SERAS)
Reference Limits and Evaluation Table

Matrix: Soil (ICP Metals, Microwave Digestion)

Analytical Group: Metals

Concentration Level: Low to high

Analyte	CAS Number	Project Action Limit (Residential/ Nonresidential)* (mg/kg)	Project Quantitation Limit (mg/kg)	Analytical Method		Achievable Laboratory Limits (mg/kg) [a]	
				MDLs	Method QLs (mg/kg)	MDLs	QLs
Strontium	7440-24-6	--	0.2	NS	NS	0.0064	0.2
Thallium	7440-28-0	--	1.2	NS	NS	0.095	1.2
Tin	7440-31-5	--	2	NS	NS	0.088	2
Vanadium	7440-62-2	--	0.4	NS	NS	0.082	0.4
Zinc	7440-66-6	--	2.5	NS	NS	0.90	2.5

[a] Achievable Laboratory Limits based on microwave digestion of 0.50 g (dry weight) soil in 50 mL final volume. Based on 01/29/2013 MDL study
NS –Not specified
mg/kg – milligrams per kilogram
* Site specific action level determined by Region 9/human health risk assessment criteria

QAPP Worksheet #15-5 (SERAS Laboratory - Samples Relinquished by Region 9 to SERAS)
Reference Limits and Evaluation Table

Matrix: Soil (Mercury only)

Analytical Group: Metals

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (mg/kg)	Project Quantitation Limit (mg/kg)	Analytical Method		Achievable Laboratory Limits (mg/kg) [a]	
				MDLs	Method QLs	MDLs	QLs
Mercury	7439-97-6	--	0.040	NS	0.040	NA	0.040

[a] Achievable Laboratory Limits based on digestion of 0.50 g (dry weight) soil in 100 mL final volume
mg/kg – milligrams per kilogram
NA – Not applicable; MDL determined by lowest calibration standard
NS = Not specified
mg/kg – milligrams per kilogram

QAPP Worksheet #15-6
Reference Limits and Evaluation Table

Matrix: Soil/Dross/Slag/Waste Rock

Analytical Group: SPLP Metals

Concentration Level: Low

Analyte	CAS Number	Project Action Limit* (mg/L)	Project Quantitation Limit (mg/L)	Analytical Method		Achievable Laboratory Limits	
				MDLs (mg/L)	Method QLs (mg/L)	MDLs (mg/L)	QLs (mg/L)
Arsenic	7440-38-2	0.006	0.2	NS	NS	Lab-specific	0.2
Aluminum	7429-90-5	0.010	10	NS	NS	Lab-specific	10
Barium	7440-39-3	2	0.5	NS	NS	Lab-specific	0.5
Cadmium	7440-43-9	--	0.005	NS	NS	Lab-specific	0.05
Chromium	7440-47-3	0.100	0.1	NS	NS	Lab-specific	0.1
Copper	7440-50-8	1.3	0.4	NS	NS	Lab-specific	0.4
Iron	7439-89-6	--	10	NS	NS	Lab-specific	10
Lead	7439-92-1	0.015	0.3	NS	NS	Lab-specific	0.3
Manganese	7439-96-5	--	0.5	NS	NS	Lab-specific	0.5
Mercury	7439-97-6	0.002	0.00003	NS	NS	Lab-specific	0.00003
Selenium	7782-49-2	0.050	0.2	NS	NS	Lab-specific	0.2
Silver	7440-22-4	--	0.1	NS	NS	Lab-specific	0.1
Zinc	7440-66-6	0.120	0.8	NS	NS	Lab-specific	0.8

NA = Not applicable. Will be used to determine mobility of inorganic analytes present in soil, dross, slag and waste rock materials.
NS = Not Specified

*Based on Federal Maximum Contaminant Levels (MCLs). http://water.epa.gov/drink/contaminants/index.cfm

QAPP Worksheet #15-7
Reference Limits and Evaluation Table

Matrix: Soil

Analytical Group: Cr (VI)

Concentration Level: Low

Analyte	CAS Number	Project Action Limit* (mg/kg)	Project Quantitation Limit (mg/kg)	Analytical Method		Achievable Laboratory Limits	
				MDLs (mg/kg)	Method QLs (mg/kg)	MDLs (mg/kg)	QLs (mg/kg)
Cr(VI)	7740-47-3	0.29	0.50	NS	NS	0.228	0.50

NS = Not Specified
MDL Study – 4/4/2008
Regional Screening Level (RSL) for residential soil with hazard quotient=0.1 obtained from:
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/docs/ressoil_sl_table_01run_NOV2013.pdf

QAPP Worksheet #15-8
Reference Limits and Evaluation Table

Matrix: Sediment/Dross

Analytical Group: Dioxins/Furans

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (pg/g) (Residential/ Ecological)[a]	Project Quantitation Limit (pg/g)	Analytical Method		Achievable Laboratory Limits	
				MDLs (pg/g)	Method QLs (pg/g)	MDLs* (pg/g)	QLs (pg/g)
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	4.5/0.85	1.00	NS	NS	0.333	1.00
1,2,3,7,8-Pentachloro-dibenzo-p-dioxin (PeCDD)	40321-76-4	--	5.00	NS	NS	1.67	5.00
1,2,3,4,7,8-Hexachloro-dibenzo-p-dioxin (HxCDD)	39227-28-6	--	5.00	NS	NS	1.67	5.00
1,2,3,6,7,8-HxCDD	57653-85-7	--	5.00	NS	NS	1.67	5.00
1,2,3,7,8,9-HxCDD	19408-74-3	--	5.00	NS	NS	1.67	5.00
1,2,3,4,6,7,8-Heptachloro-dibenzo-p-dioxin (HpCDD)	35822-39-4	--	5.00	NS	NS	1.67	5.00
1,2,3,4,6,7,8.9-Octachloro-dibenzo-p-dioxin (OCDD)	3268-87-9	--	10.0	NS	NS	3.33	10.0
2,3,7,8-Tetrachlorodibenzo-furan (TCDF)	51207-31-9	--	1.00	NS	NS	0.333	1.00
1,2,3,7,8-Pentachloro-dibenzofuran (PeCDF)	57117-41-6	--	5.00	NS	NS	1.67	5.00
2,3,4,7,8-PeCDF	57117-31-4	--	5.00	NS	NS	1.67	5.00
1,2,3,4,7,8-Hexachloro-dibenzofuran (HxCDF)	70648-26-9	--	5.00	NS	NS	1.67	5.00

QAPP Worksheet #15-8
Reference Limits and Evaluation Table

Matrix: Sediment/Dross

Analytical Group: Dioxins/Furans

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (pg/g) (Residential/ Ecological)[a]	Project Quantitation Limit (pg/g)	Analytical Method		Achievable Laboratory Limits	
				MDLs (pg/g)	Method QLs (pg/g)	MDLs* (pg/g)	QLs (pg/g)
1,2,3,6,7,8-HxCDF	57117-44-9	--	5.00	NS	NS	1.67	5.00
1,2,3,7,8,9-HxCDF	72918-21-9	--	5.00	NS	NS	1.67	5.00
2,3,4,6,7,8-HxCDF	60851-34-5	--	5.00	NS	NS	1.67	5.00
1,2,3,4,6,7,8-Heptachloro-dibenzofuran (HpCDF)	67562-39-4	--	5.00	NS	NS	1.67	5.00
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	5.00	NS	NS	1.67	5.00
1,2,3,4,6,7,8,9-Octachloro-dibenzofuran (OCDF)	39001-02-0	--	10.0	NS	NS	3.33	10.0

*MDL based on study from 5/20/2013 Cape Fear Analytical, LLC
NS = Not Specified
[a] Regional Screening Level (RSL) for residential soil with hazard quotient=0.1 obtained from:
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/docs/ressoil_sl_table_01run_NOV2013.pdf
Ecological risk assessment criteria based on EPA Region 3 freshwater sediment benchmark:
http://www.epa.gov/reg3hscd/risk/eco/btag/sbv/fwsed/screenbench.htm

QAPP Worksheet #15-9
Reference Limits and Evaluation Table

Matrix: Surface Water and Groundwater

Analytical Group: Water Quality Parameters

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (mg/L)	Project Quantitation Limit (mg/L)	Analytical Method		Achievable Laboratory Limits	
				MDLs (mg/L)	Method QLs (mg/L)	MDLs (mg/L)	QLs (mg/L)
Alkalinity	NA	NA	5.0	NS	NS	0.228	5.0
Chloride	7782-50-5	250	2.0	NS	NS	0.595	2.0
Nitrite/Nitrate	14797-55-8	NA	0.05	NS	NS	0.00324	0.05
Sulfate	18785-72-3	250	1.0	NS	NS	0.289	1.0
Phosphate	98059-61-1	NA	0.10	NS	NS	0.0461	0.10
Dissolved Organic Carbon	NA	NA	1.0	NS	NS	0.102	1.0
TDS	NA	500	10	NS	NS	5.02	10
Fluoride	7782-41-4	2.0	0.10	NS	NS	0.007	0.10
Silica (SiO2)	99439-28-8	NA	0.5	NS	NS	0.034	0.5

NS = Not Specified
*Based on secondary MCLs. Groundwater data collected from 2006 through 2012 indicate that the groundwater has been impacted by sulfate, chloride and TDS.

QAPP Worksheet #15-10
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: Total Organic Carbon (TOC)

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (µg/g)	Project Quantitation Limit (µg/g)	Analytical Method		Achievable Laboratory Limits	
				MDLs (µg/g)	Method QLs (µg/g)	MDLs (µg/g)	QLs (µg/g)
TOC	7440-44-0	NA	400	NS	NS	84.8	400

NA = Not applicable
NS = Not specified

QAPP Worksheet #15-11 (ACZ Laboratories – Samples Relinquished by Region 9 to SERAS)
Reference Limits and Evaluation Table

Matrix: Soil

Analytical Group: IVBA Metals (Pb & As)

Concentration Level: Low

Analyte	CAS Number	Project Action Limit * (mg/L)	Project Quantitation Limit (mg/L)	Analytical Method		Achievable Laboratory Limits (mg/L)	
				MDLs (mg/L)	Method QLs (mg/L)	MDLs	QLs
Arsenic	7740-38-2	--	0.02	NS	NS	0.004	0.02
Lead	7439-92-1	--	0.01	NS	NS	0.002	0.01

NS = Not specified
Analytical results will be used to compare bioaccessibility of As and Pb among residential and non-residential areas.

QAPP Worksheet #15-12
Reference Limits and Evaluation Table

Matrix: Soil

Analytical Group: IVBA Metals (Pb & As)

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (mg/L)	Project Quantitation Limit (mg/L)	Analytical Method		Achievable Laboratory Limits (mg/L)	
				MDLs (mg/L)	Method QLs (mg/L)	MDLs	QLs
Arsenic	7740-38-2	--	0.2	NS	NS	Lab Specific	0.2
Lead	7439-92-1	--	0.3	NS	NS	Lab Specific	0.3

NS = Not specified
Analytical results will be used to compare bioaccessibility of As and Pb among residential and non-residential areas.

QAPP Worksheet #15-13
Reference Limits and Evaluation Table

Matrix: Plant Tissue

Analytical Group: Metals

Concentration Level: Low

Analyte	CAS Number	Project Action Limit* (mg/kg dry weight)	Project Quantitation Limit (mg/kg)	Analytical Method		Achievable Laboratory Limits	
				MDLs	Method QLs (mg/kg)	MDLs (mg/kg)	QLs[1] (mg/kg)
Aluminum	7429-90-5	NS	30	NS	NS	0.51	30
Antimony	7440-36-0	NS	0.10	NS	NS	0.020	0.10
Arsenic	7440-38-2	18	0.50	NS	NS	0.15	0.50
Barium	7440-39-3	NS	0.20	NS	NS	0.037	0.20
Beryllium	7440-41-7	NS	0.10	NS	NS	0.0041	0.10
Cadmium	7440-43-9	32	10	NS	NS	0.0076	0.10
Calcium	7440-70-2	NS	0.40	NS	NS	3.83	10
Chromium	7440-47-3	NS	0.10	NS	NS	0.05	0.40
Cobalt	7440-48-4	13	0.30	NS	NS	0.0054	0.10
Copper	7440-50-8	70	10	NS	NS	0.071	0.30
Iron	7439-89-6	NS	0.10	NS	NS	2.40	10
Lead	7439-92-1	120	0.20	NS	NS	0.0070	0.10
Magnesium	7439-95-4	NS	0.20	NS	NS	1.37	10
Manganese	7439-96-5	220	100	NS	NS	0.042	0.20
Nickel	7440-02-0	38	0.10	NS	NS	0.026	0.20
Potassium	7440-09-7	NS	100	NS	NS	4.6	100
Selenium	7782-49-2	0.52	0.10	NS	NS	0.039	0.50
Silver	7440-22-4	560	0.50	NS	NS	0.0066	0.10
Sodium	7440-23-5	NS	1.0	NS	NS	2.6	100

QAPP Worksheet #15-13
Reference Limits and Evaluation Table

Matrix: Plant Tissue

Analytical Group: Metals

Concentration Level: Low

Analyte	CAS Number	Project Action Limit* (mg/kg dry weight)	Project Quantitation Limit (mg/kg)	Analytical Method		Achievable Laboratory Limits	
				MDLs	Method QLs (mg/kg)	MDLs (mg/kg)	QLs[1] (mg/kg)
Thallium	7440-28-0	NS	0.10	NS	NS	0.0094	0.10
Vanadium	7440-62-2	NS	0.20	NS	NS	0.11	0.50
Zinc	7440-66-6	160	0.10	NS	NS	0.13	1.0

[1]QLs are based on a solid material without any solids adjustment for moisture
* Project action limits are based on Ecological Soil Screening Levels for plants listed at http://www.epa.gov/ecotox/ecossl/
NS = Not specified

QAPP Worksheet #15-14
Reference Limits and Evaluation Table

Matrix: Plant Tissue

Analytical Group: Hg

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (mg/kg)	Project Quantitation Limit (mg/kg)	Analytical Method		Achievable Laboratory Limits	
				MDLs	Method QLs (mg/kg)	MDLs (mg/kg)	QLs (mg/kg)
Mercury	7439-97-6	NL	0.040	NS	NS	NS	0.040

NS = Not specified
NL – Not listed in Eco-Tox database

QAPP Worksheet #16
Project Schedule Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Accelerated Lead Sampling	SERAS	8/12/13	8/16/13	Trip Report	TBD
FP XRF Analysis	SERAS	8/12/13	8/16/13	Technical Memo	TBD
Site Historic Railway Survey	SERAS	8/27/13	9/20/13	Survey	TBD
Construction Material Survey	SERAS	8/27/13	9/13/13	Survey	TBD
Site Aerial Survey & Topo	SERAS, EPA R9	8/27/13	8/30/13	Survey	TBD
Initial SAP	SERAS	8/27/13	9/20/13	SAP	9/20/13
H&S Plan	SERAS	9/5/13	10/23/13	H&S Plan	Prior to field activities
Work Plan Preparation	SERAS	9/6/13	9/25/13	Work Plan (WP)	9/25/13
QAPP Preparation	SERAS	9/6/13	12/23/13	QAPP	12/23/13
Surveying Subcontract – RFP thru Award	SERAS	9/17/13	11/13/13	NA	NA
Dust Suppression - RFP thru Award	SERAS	9/17/13	12/3/13	NA	NA
Draft Expanded SAP	SERAS	9/20/13	11/7/13	DRAFT Final Field Sampling Plan (FSP)	11/7/13
EPA Review of Draft FSP	ERT, EPA R9	11/7/13	11/14/13	NA	NA
Final FSP	SERAS	11/14/13	11/20/13	Final FSP	11/20/13
Drilling – RFP thru Award (Borings)	SERAS	1/13/14	4/14/14	NA	NA
Obtain Access to Private Properties	SERAS, ERT, EPA R9	11/3/13	2/14/14	NA	NA

QAPP Worksheet #16
Project Schedule Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Drilling Subcontract – RFP thru Award (11 New Wells)	SERAS	11/7/13	1/7/14	NA	NA
Site Mobilization – Set-up field office and field laboratory; handle logistics	SERAS, ERT, EPA R9	11/12/13	11/14/13	Technical Memo	TBD
Borehole Geophysics - RFP thru Award (11 New Wells)	SERAS	11/8/13	12/12/13	NA	NA
Survey Dam and Pin Installation	SERAS	1/13/14	1/17/14	Survey	TBD
Residential; MTP, Smelter and Clayton Property Sampling	SERAS, ERT	1/21/14	3/11/14	Technical Memo	TBD
Shallow Borings, MTP, Smelter Tailings, Chaparral Gulch and Dam	SERAS	2/24/14	4/4/14	Technical Memo	TBD
Dross Sampling	SERAS, ERT	1/21/14	2/5/14	Technical Memo	TBD
Sample Analysis	EPA R9	12/9/13	6/13/14	Technical Memo	TBD
Surface Geophysics of Smelter Tailings	SERAS, ERT	1/2/14	1/8/14	Technical Memo	TBD
Drill 11 New Wells and Collect Borehole Geophysics	SERAS	1/13/14	2/21/1	Technical Memo	TBD
Install and Initiate Stream Monitoring Stations	SERAS, ERT	3/7/14	4/4/14	Technical Memo	TBD
Acquire Stream Monitoring Data	SERAS, ERT	4/7/14	9/22/14	Technical Memo	TBD

QAPP Worksheet #16
Project Schedule Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
3 Borings/Wells MTP (Geotechnical Sampling, CPT, Well Completion)	SERAS	4/7/14	4/30/14	TBD	TBD
Well Survey	SERAS	5/1/14	5/8/14	Survey	TBD
Groundwater Sampling	SERAS	5/9/14	5/29/14	Technical Memo	TBD
Biological Survey and Assessment	SERAS, ERT	4/7/14	4/10/14	Technical Memo	TBD
Groundwater Sample Analysis		5/30/14	6/26/14	Analytical report	TBD
Dust Control activities	SERAS	4/7/14	4/18/14	NA	NA
Waste volume Estimate	SERAS	TBD	TBD	Letter Report of Waste Rock Volume	TBD
Final Technical Memo	SERAS	5/27/14	9/22/14	Technical memorandum	TBD

NA Not applicable
TBD To be determined

QAPP Worksheet #17
Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):

Sampling designs and approaches were determined by Region 9 and their contractor (CH2MHILL). Sampling locations and depths, matrices to be sampled, and sample numbers were chosen by Region 9 to fill data gaps identified in the Iron King Mine-Humboldt Smelter Superfund Site *Draft Data Gap Analysis Report* (April 2013). Additional data is required to develop and evaluate remedial alternatives, further delineate potentially impacted areas, evaluate the impact of groundwater and surface water transport of smelter-related materials to the surrounding areas, and to complete an ecological and human health risk assessment.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]:

Field duplicates will be collected at a rate of 5% for all matrices. Matrix spike/matrix spike duplicates (MS/MSDs) will be analyzed at a rate of 5%. One field blank per day of surface water and groundwater sampling will also be submitted for analysis.

FP XRF results will be confirmed at a rate of 5% for non-residential areas and 10% for residential properties.

Refer to Attachments 1 and 2 for a detailed description of sampling & monitoring designs, rationales and methodologies.

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples[1] (identify field duplicates[2])	Sampling SOP Reference	Rationale for Sampling Location
January 2014 through Spring 2014							
MTP-SB*-# (3 deep borings; 2 in Upper MTP, 1 in Lower MTP)	Soil	Undisturbed & unconsolidated samples at 10 foot intervals	M-D HC SG SWCC GS A-L Consol Shear CU	NA	24 6 6 3 20 20 3 3 3	2012	Delineation
		Per borehole: at surface, at perched water zones, in saturated tailings, below tailings	TAL ABA Cr(VI) @ surface SPLP	Low to High	12	2012	Delineation
WR-*	Waste Rock	Surface	Slake TAL ABA SPLP	Low to High	5	2012	Delineation
MTP-IVBA-*	Soil	Surface	IVBA (Pb & As)	Low	10	2012	Bioaccessibility
IKM-SB*-# (minimum of 11 borings)	Soil	Minimum: top and bottom of borehole	Metals** (FP XRF)	Low to High	22	2012	Delineation
			TAL	Low to High	~2	2012	Confirmation

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples[1] (identify field duplicates[2])	Sampling SOP Reference	Rationale for Sampling Location
IKM-SB*-# (130 hand borings)	Soil	NE of main retention pond: 2 @ surface & 1 ft.; 2 @ surface, 1ft. & 2 ft. North of MTP: surface 1 ft. & 3 ft. N/NE of MTP: Surface & 1 ft. Waste Rock Area: surface & 1 ft South of MTP: surface & 1 ft.	Metals** (FP XRF)	Low to High	285	2012	Delineation
			TAL	Low to High	~15	2012	Confirmation
GAL-SB*-# (12 hand borings)	Soil	Surface & 1 ft.	Metals** (FP XRF)	Low to High	24	2012	Delineation
			TAL	Low to High	2	2012	Confirmation
~~GAL-IVBA *~~	~~Soil~~	~~Surface~~	~~IVBA (Pb & As)~~	~~Low~~	~~5~~	~~2012~~	~~Bioaccessibility~~
UND*-* (~38-40 hand borings)	Soil	Surface & 1 ft.	Metals** (FP XRF)	Low to High	~80	2012	Delineation
			TAL	Low to High	~7	2012	Confirmation
ASH-SB*-#	Dross	Top & Bottom of Dross	Metals** (FP XRF)	Low to High	164	2012	Delineation
			TAL	Low to High	54	2012	Confirmation

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples[1] (identify field duplicates[2])	Sampling SOP Reference	Rationale for Sampling Location
ASH-* (unconslidated)	Dross	Surface	SPLP Metals ABA	Low	≤4	2012	Delineation
			Dioxins/Furans	Low	2	2012	Delineation
PS-SB*-# (15 borings)	Soil	Surface, intermediate depth TBD, bottom	Metals** (FP XRF)	Low to High	45	2012	Delineation
			TAL	Low to High	3	2012	Confirmation
		TBD (to include range of materials encountered)	GS Moisture A-L	NA	6	2012	Characterization
SL-SS-#	Slag	Surface	TAL Metals SPLP Metals ABA SG	Low to High	3	2012	Characterization/ Delineation
STS-SB*-# (40 borings)	Soil	Surface & at 5 ft intervals to bottom	Metals** (FP XRF)	Low to High	>120	2012	Delineation
			TAL	Low to High	6	2012	Delineation/ Confirmation
		From 2 of the 40 borings: 1 from upper portion of tailings, 1 from lower portion of tailings	SPLP Metals Cr(VI) @ surface ABA	Low to High	4	2012	Delineation

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples[1] (identify field duplicates[2])	Sampling SOP Reference	Rationale for Sampling Location
STS-SB*-# (40 borings)	Soil	TBD	GS Moisture A-L	NA	4	2012	Characterization
CHF-SB*-# (50 borings)	Soil	Surface & at 5 ft intervals to bottom	Metals** (FP XRF)	Low to High	<150	2012	Transects/ delineation
			TAL	Low to High	8	2012	Confirmation/ delineation
		From 4 of the 50 borings: 1 from upper portion of tailings, 1 from lower portion of tailings	SPLP Metals Cr(VI) @surface ABA	Low to High	8	2012	Delineation
		Between 2 & 4 ft.	GS Moisture A-L	NA	10	2012	Characterization
CHF-IVBA-*	Soil	Surface	IVBA (Pb & As)	Low	5	2012	
DAM-SB*-# (6 borings)	Soil	Surface, bottom , and 3 intermediate depths TBD	Metals** (FP XRF)	Low to High	30	2012	Delineation
			TAL	Low to High	2	2012	Confirmation
		From 3 borings: middle inteval TBD and bottom	GS Moisture A-L	NA	6	2012	Characterization
		From 3 borings: upper and lower zone	TAL Metals SPLP Metals ABA	Low to High	6	2012	Delineation

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples[1] (identify field duplicates[2])	Sampling SOP Reference	Rationale for Sampling Location
CH-SB*-# (15 borings; near 3rd Street)	Soil	Surface, & 5ft. intervals to bottom depth	Metals** (FP XRF)	Low to High	>45	2012	Delineation
			TAL	Low to High	3	2012	Confirmation
		2 to 4 ft. interval	GS Moisture A-L	NA	6	2012	Characterization
~~CH-IVBA-*~~ ~~(Chaparral Gulch near 3rd Street)~~	~~Soil~~	~~Surface~~	~~IVBA~~ ~~(Pb & As)~~	~~Low~~	~~2~~	~~2012~~	~~Bioaccessibility~~
CH-SB*-# (29 borings; between 3rd Street & Smelter)	Soil	Surface, & 5ft. intervals to bottom depth	Metals** (FP XRF)	Low to High	>72	2012	Delineation
			TAL	Low to High	4	2012	Confirmation
		2 to 4 ft. interval	GS Moisture A-L	NA	6	2012	Characterization
~~CH-IVBA-*~~ ~~(Chaparral Gulch between 3rd Street & Smelter)~~	~~Soil~~	~~Surface~~	~~IVBA~~ ~~(Pb & As)~~	~~Low~~	~~1~~	~~2012~~	~~Bioaccessibility~~
BIOPL-*	Plant tissue	NA	TAL Metals	Low	10	2037	Ecological Assessment
BIOSS-*	Soil	Near surface	TAL Metals	Low	10	2012	Ecological Assessment
AG-SED-*	Sediment	Near surface	TAL Metals	Low to high	12	2016	Delineation
AG-SED-*	Sediment	Near surface	Dioxins/Furans TOC	Low	5	2016	Delineation

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples[1] (identify field duplicates[2])	Sampling SOP Reference	Rationale for Sampling Location
AG-SW-*	Surface Water	Surface	TAL Metals	Low to high	12	2013	Delineation
			WQ	Low	3	2013	Characterization
BIOSED-*	Sediment	Near surface	TAL Metals	Low to high	12	2016	Ecological Assessment
CHD-SED*-#	Sediment	Surface and total depth	Metals** (FP XRF)	Low to High	18	2016	Delineation
			TAL Metals	Low to high	1	2016	Confirmation
CHD-SW-*	Groundwater Seep	Subsurface	TAL Metals WQ	Low to high	2	2013	Delineation
RA-* (Residential Screening)	Soil	<0.2 ft	Metals** (FP XRF)	Low to High	150	2012	Delineation
			TAL Metals	Low to High	15	2012	Confirmation
RS-*	Soil	<0.2 ft	Metals** (FP XRF)	Low to High	6,000	2012	Risk Assessment
			TAL Metals	Low to High	600	2012	Confirmation
			Metals** (IVBA)	Low to High	20	2012	Bioaccessibility

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples[1] (identify field duplicates[2])	Sampling SOP Reference	Rationale for Sampling Location
BIOSW-*	Surface Water	Surface	TAL Metals	Low to High	2	2007	Bioaccessibility/ Delineation
MW-* (13 new wells; 11 existing wells)	Groundwater	TBD	WQ Parameters TAL Metals	Low	50	2007	Delineation

[1]The number of samples listed in this column is the initial number of samples to be collected. Because the objective in most areas is to further delineate impacted matrices and a step-out sampling approach will be employed, the number of samples per area and matrix are expected to increase.
[2]Field duplicates will be collected at rates/numbers specified in Worksheets 17 and 20. Determination of where to collect field duplicates will be made in the field.

RS = Residential Risk Assessment Screening
MTP = IKM Main Tailings Pile
IKM = Iron King Property (peripheral areas))
UND = Undeveloped Areas
SL = Smelter Plateau Area – slag material
STS = Smelter Tailings Swale (above floodplain)
CHF = Chaparral Gulch Floodplain
CHD = Chaparral Gulch (downstream of Dam)
MW = Monitor Wells

RA = Residential Full Risk Assessment Characterization
WR = IKM Main Tailings Pile – waste rock
GAL = Galena Gulch
ASH = Smelter Plateau Area – dross material
PS = Smelter Plateau Area – Plateau soils
CH = Chaparral Gulch (upstream of floodplain)
DAM = Dam/Area behind the Dam
AF = Agua Fria

SS = surface soil
SB = soil boring
SED = sediment
SW = surface Water

IVBA = Bioaccessibility Soil Sample (*In Vitro* Bioaccessibility Testing)
BIOPL = Bioassessment Plant Samples
BIOSS = Bioassessment Soil Samples
BIOSED = Bioassessment Sediment Samples

WQ = water quality parameters
FP XRF = Field Portable X-ray Fluorescence
ABA = Acid Base Accounting
TOC = Total Organic Carbon

TAL = Target Analyte List – 23 metals
SPLP = Synthetic Precipitation Leaching Procedure
Cr(VI) = Hexavalent Chromium

* = Incremental number starting at 1 for each sampling area (e.g., WR, PS) or type (e.g. IVBA, borehole) and incrementing upwards to the total number of boreholes and/or samples in that area or of that type.
# = depth
TBD = to be determined
~ = approximately
dup=duplicate
**metals: Pb, As, Zn, Cu, Fe, Mn, Cr

QAPP Worksheet #19
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference [1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Samples Collected by EPA Region 9 and Relinquished to SERAS September 2013							
Soil	TAL Metals	Low to high	SERAS SOP #1811/1832	0.5 - 2.0 g	1, 8 oz., glass	Cool to <6 ° C	6 months Hg: 28 days
Soil	Metals: IVBA (Pb & As)	Low	ACZ SOP #SOPII022.07.13.09	NS	1, 8-oz glass	Filtered extracts: Cool to 4° C	6 months until extraction/ One week from extraction
January 2014 – Spring 2014							
Soil (NITON XLt792YW)	Metals (As, Pb, Zn, Cu, Mn, Cr, Fe)	Low to high	SERAS SOP#1720	10- 20 g	1 ziptop baggie	Dried/seived	NA
Soil/Sediment/Slag/ Waste Rock	TAL Metals	Low to high	ISM01.3	250 grams	(1) 8 oz. wide mouth glass jar w/Teflon lined cap or 1 ziptop baggie	Cool to <6 ° C	6 months 28 days for Hg
Plant tissue (seeds/grasses)	TAL Metals	Low	Katahdin SOPs #CA-627-09 #CA-611-09	--	1 ziptop baggie	Cool to 4° C	Dried/6 months 28 days for Hg
Sediment	TOC	NA	Katahdin SOP #CA-741-05	100 g	1, 4 oz. glass jar	Cool to 4° C	28 days
Sediment/Dross material	Dioxins/furans	Low	Cape Fear SOP #CF-OA-E-001 and -002	10 g	1, 8 oz amber glass jar	Cool to <6 ° C	30 days to extract; 45 days to analyze
Water	TAL Metals	Low	ISM01.3	1 L	1, 1-L poly MS/MSD: 2, 1-L poly	Acidify to pH<2 with HNO_3 and cool to <6 ° C	Hg: 28 days; Other Metals: 6 months

QAPP Worksheet #19
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference [1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Soil (SPLP extracts)	SPLP (RCRA 8 + 5)	Low to high	EPA R9 SOP 254 EPA R9 SOP 407 EPA R9 SOP 503 EPA R9 SOP 515	--	1, 16 oz. jar	Cool to ≤ 6 ° C	SPLP Extraction with in 28 days for Hg and 6 months for all other metals; From preparation/ extraction to analysis 28 days for Hg and 6 months for all other metals
Soil	Cr (VI)	Low to high	Katahdin SOP #CA-625-06	2.5 g	1, 4 oz. amber glass jar w/Teflon lined cap (zero head space)	Cool to 4ºC	30 days to digest/ and additional 7 days to analyze
Soil	Acid Base Accounting (ABA)	NA	ASTM D2974-07a; Neutralization Potential; Grind; Saturated Paste pH; ASTM E1915-09; ABA	250-500 g	2, 8 oz. glass	Cool to 4ºC	180 days
Soil	IVBA (As and Pb)	Low to high	EPA R9 SOP 256 EPA R9 SOP 407 EPA R9 SOP 503	50 g of air dried soil <2mm	1, 8-oz glass	Filtered extracts: Cool to 4º C	180 days
Geotechnical Testing							
Soil	Moisture-Density	NA	ASTM D2937	NA	6 inches	Undisturbed; room temperature; indirect sunlight	NA
Soil	Hydraulic conductivity	NA	ASTM D5084	NA	6 inches – Shelby Tube	Undisturbed; room temperature; indirect sunlight	NA
Soil	Specific Gravity	NA	ASTM D854	8 oz., <0.475 mm	8 oz., <0.475 mm	Room temperature; indirect sunlight	NA
Soil	Grain Size	NA	ASTM D422	~1 pound	3, 16n oz. jars	Room temperature; indirect sunlight	NA

QAPP Worksheet #19
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference [1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Soil	Atterberg Limits	NA	ASTM D4318	8 oz., <0.425 mm	8 oz., <0.425 mm	Room temperature; indirect sunlight	NA
Soil	Moisture	NA	ASTM D2216	NA	2, 8 oz. jars	Room temperature; indirect sunlight	NA
Soil	Consolidation Test	NA	ASTM D2435	NA	6 inches	Undisturbed; room temperature; indirect sunlight	NA
Soil	Direct Shear Test	NA	ASTM D2080	NA	6 inches (6 rings min.)	Undisturbed; room temperature; indirect sunlight	NA
Soil	Consolidation Test	NA	ASTM D4767	NA	18 inches	Undisturbed; room temperature; indirect sunlight	NA
Soil	Soil Water Characteristic Curves	NA	ASTM D6836	NA	1, 8 oz. jar	Room temperature; indirect sunlight	NA
Rock	Slake durability	NA	ASTM D4644	10 pieces (~1")	10 pieces (~1")	Room temperature; indirect sunlight	NA
Water Quality Parameters							
Water	Alkalinity	Low	Katahdin SOP #CA-739-09	100 mL	1, 1-L poly	Cool to 4° C; settled	14 days
Water	Chloride	Low	Katahdin SOP #CA-768-03	100 mL	1, 1-L poly	Cool to 4° C	28 days
Water	Nitrate	Low	Katahdin SOP #CA-728-08	100 mL	1, 1-L poly	Cool to 4° C Acidify to pH<2 with H_2SO_4	28 days
Water	Sulfate	Low	Katahdin SOP #CA-721-03	100 mL	1, 1-L poly	Cool to <6° C	28 days
Water	Phosphate	Low	Katahdin SOP #CA-715-06	100 mL	1, 1-L poly	Cool to 4° C; Acidify to pH<2 with H_2SO_4	28 days
Water	Silicon	Low	Katahdin SOP #CA-627-09	100 mL	1, 1-L poly	Acidify to pH<2 with HNO_3	6 months

QAPP Worksheet #19
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference [1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Water	Dissolved Organic Carbon	Low	Katahdin SOP #CA-763-07	80 mL	(2) 40 mL VOA vial	Filtered then preserve with H_2SO_4; Cool to 4° C	28 days
Water	TDS	Low	Katahdin SOP #CA-719-07	100 mL	1, 1-L poly	Cool to 4° C	7 days
Water	Fluoride	Low	Katahdin SOP #CA-742-09	100 mL	1, 1-L poly	Cool to 4° C	28 days

NS: not specified

QAPP Worksheet #20 (January 2014 – Spring 2014)
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Samples	No. of Field Duplicate Pairs	Inorganic No. of MS	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Soil/Sediment Dross/Slag (NITON XLt792YW)	Metals (As, Pb, Zn, Cu, Mn, Cr, Fe)	Low to high	SOP#1720	7,202	NA	NA	NA	NA	NA	7,202
Soil	TAL Metals	Low to high	ISM01.3	695	35	35	NA	NA	NA	730
Waste Rock	TAL Metals	Low to high	ISM01.3	5	1	1	NA	NA	NA	6
Dross	TAL Metals	Low to high	ISM01.3	33	2	2	NA	NA	NA	35
Sediment	TAL Metals	Low to high	ISM01.3	25	2	2	NA	NA	NA	27
Slag	TAL Metals	Low to high	ISM01.3	3	1	1	NA	NA	NA	4
Soil (SPLP extracts)	SPLP (RCRA 8 + 5)	Low	EPA R9 SOP 254 EPA R9 SOP 407 EPA R9 SOP 503 EPA R9 SOP 515	30	NA	2	NA	NA	NA	32
Waste Rock (SPLP extracts)	SPLP (RCRA 8 + 5)	Low	EPA R9 SOP 254 EPA R9 SOP 407 EPA R9 SOP 503 EPA R9 SOP 515	5	NA	1	NA	NA	NA	5
Dross (SPLP extracts)	SPLP (RCRA 8 + 5)	Low	EPA R9 SOP 254 EPA R9 SOP 407 EPA R9 SOP 503 EPA R9 SOP 515	4	NA	1	NA	NA	NA	4
Slag (SPLP extracts)	SPLP (RCRA 8 + 5)	Low	EPA R9 SOP 254 EPA R9 SOP 407 EPA R9 SOP 503 EPA R9 SOP 515	3	NA	1	NA	NA	NA	3
Soil	IVBA (As and Pb)	Low	EPA R9 SOP 256 EPA R9 SOP 407 EPA R9 SOP 503	30	NA	2	NA	NA	NA	30
Soil	Cr (VI)	Low to high	Katahdin SOP #CA-625-06	24	2	2	NA	NA	NA	26

QAPP Worksheet #20 (January 2014 – Spring 2014)
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Samples	No. of Field Duplicate Pairs	Inorganic No. of MS	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Soil	Acid Base Accounting (ABA)	NA	ASTM D2974-07a; Neutralization Potential; Grind; Saturated Paste pH; ASTM E1915-09; ABA	30	NA	NA	NA	NA	NA	30
Dross	Acid Base Accounting (ABA)	NA	ASTM D2974-07a; Neutralization Potential; Grind; Saturated Paste pH; ASTM E1915-09; ABA	4	NA	NA	NA	NA	NA	2
Slag	Acid Base Accounting (ABA)	NA	ASTM D2974-07a; Neutralization Potential; Grind; Saturated Paste pH; ASTM E1915-09; ABA	3	NA	NA	NA	NA	NA	3
Waste Rock	Acid Base Accounting (ABA)	NA	ASTM D2974-07a; Neutralization Potential; Grind; Saturated Paste pH; ASTM E1915-09; ABA	5	NA	NA	NA	NA	NA	5
Plant tissue (seeds/ grasses)	TAL Metals	Low	Katahdin SOPs #CA-627-09 #CA-611-09	10	NA	1	NA	NA	NA	10
Sediment	TOC	NA	Katahdin SOP #CA-741-05	5	1	NA	NA	NA	NA	6
Sediment	Dioxins/ furans	Low	Cape Fear SOP #CF-OA-E-001 and -002	5	1	NA	NA	NA	NA	6

QAPP Worksheet #20 (January 2014 – Spring 2014)
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Samples	No. of Field Duplicate Pairs	Inorganic No. of MS	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Dross	Dioxins/ furans	Low	Cape Fear SOP #CF-OA-E-001 and -002	2	1	NA	NA	NA	NA	3
Surface Water	TAL Metals	Low	ISM01.3	16	1	1	1 per day of sampling	NA	NA	~18
Groundwater	TAL Metals	Low	ISM01.3	50	3	3	1 per day of sampling	NA	NA	~52
Groundwater/ Surface water	Alkalinity	Low	Katahdin SOP #CA-739-09	50 groundwater 5 surface water	3 groundwater 1 surface water	NA	1 per day of sampling	NA	NA	~58
Groundwater/ Surface water	Chloride	Low	Katahdin SOP #CA-768-03	50 groundwater 5 surface water	3 groundwater 1 surface water	NA	1 per day of sampling	NA	NA	~58
Groundwater/ Surface water	Nitrite/Nitrate	Low	Katahdin SOP #CA-728-08	50 groundwater 5 surface water	3 groundwater 1 surface water	NA	1 per day of sampling	NA	NA	~58
Groundwater/ Surface water	Sulfate	Low	Katahdin SOP #CA-721-03	50 groundwater 5 surface water	3 groundwater 1 surface water	NA	1 per day of sampling	NA	NA	~58
Groundwater/ Surface water	Phosphate	Low	Katahdin SOP #CA-715-06	50 groundwater 5 surface water	3 groundwater 1 surface water	NA	1 per day of sampling	NA	NA	~58
Groundwater/ Surface water	Silica	Low	Katahdin SOP #CA-627-09	50 groundwater 5 surface water	3 groundwater 1 surface water	NA	1 per day of sampling	NA	NA	~58
Groundwater/ Surface water	Dissolved Organic Carbon	Low	Katahdin SOP #CA-763-07	50 groundwater 5 surface water	3 groundwater 1 surface water	NA	1 per day of sampling	NA	NA	~58
Groundwater/ Surface water	TDS	Low	Katahdin SOP #CA-719-07	50 groundwater 5 surface water	3 groundwater 1 surface water	NA	1 per day of sampling	NA	NA	~58
Groundwater/ Surface water	Fluoride	Low	Katahdin SOP #CA-742-09	50 groundwater 5 surface water	3 groundwater 1 surface water	NA	1 per day of sampling	NA	NA	53

QAPP Worksheet #21
Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
1720	Operation of the Niton XLT 792YW Field Portable X-Ray Fluorescence Unit, Revision 2, 12/7/12	SERAS	Field X-ray Fluorescence Analyzer	No	
2001	General Field Sampling Guidelines, Rev.1, 6/7/13	SERAS		No	
2002	Sample Documentation, 10/03/94	SERAS		No	
2003	Sample Storage, Preservation and Handling, 8/11/94	SERAS		No	
2004	Sample Packing and Shipment, 11/30/2001	SERAS		No	
2005	Quality Assurance/Quality Control Samples, 8/11/94	SERAS		No	
2006	Sampling Equipment Decontamination, 08/11/94	SERAS		No	
2007	Groundwater Well Sampling, 1/26/95	SERAS	Peristalic pump	No	
2012	Soil Sampling, 2/18/00	SERAS	Hand trowel Hand auger Soil Borings	No	
2013	Surface Water Sampling, 2/15/02	SERAS		No	
2016	Sediment Sampling, 11/17/94	SERAS		No	
2034	Plant Biomass Determination, 11/17/94	SERAS		No	
2037	Terrestrial Plant Community Sampling, 10/19/94	SERAS		No	
2038	Vegetation Assessment Field Protocol, 6/24/1996	SERAS		No	
2043	Water Level Measurement, Rev. 1, 5/28/13	SERAS	Electronic indicator	No	

QAPP Worksheet #21
Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
2044	Well Development, Rev. 0.1, 9/06/01	SERAS		No	
2048	Monitor Well Installation, 07/12/01	SERAS		No	
2052	Operation of the Geonics EM-31-MK2 Terrain Conductivity Meter, 9/30/2010	SERAS	Conductivity Meter	No	
2056	Ground Penetrating Radar, 9/30/2010	SERAS	Smartcart	No	
2074	Description and identification of Soils, 02/23/04	SERAS		No	
4005	Chain of Custody Procedures, 10/13/01	SERAS		No	
June 2003	Syscal Pro User's Manual	SERAS	Resistivity Meter	No	
Jan 2002	Protem 47D Operating Manual for 20/30 Gate Model	Geonics	Transient Electromagnetic Meter	No	
Version 1.0, Rev B, May 2012	GeoExplorer 3000 Series	Trimble	GPS	No	

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
NITON XLt792YW	NA	Check condition of connectors and cables	NA	NA	With each use	Good condition	Replace or send in for factory service	XRF Analyst	1720
	Check energy calibration	NA	Perform energy calibration	NA	With each use and every 4 to 6 hours during sample analysis	Proper calibration	Power down, power up, logon, wait 10 minutes, re-check calibration; if continues to fail, send in for factory service	XRF Analyst	1720
	Check resolution	NA	After energy calibration	NA	With each use	Consistent with previous performance, typically less than 250 eV	If significantly higher than 250 eV, check SRMs and/or send in for factory service	XRF Analyst	1720
	NA	Check battery condition	NA	NA	With each use	Charged	Replace and/or charge as necessary	XRF Analyst	1720
	Check zero sample	NA	Analyze SiO_2 or sand blank	NA	With each use	All results non-detects	Repeat, if continues to fail, check SRMs and/or send in for factory service/calibration	XRF Analyst	1720
	Check target element response with reference standard	NA	Analyze reference standards	NA	With each use	Element results typically within ±20% of true values for concentrations 5x RL. For ERA SRM, %RSD ±20%	Repeat. If still fails, send in for factory service/calibration	XRF Analyst	1720

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Trimble GPS	NA	As per manufacturer's instructions	As per manufacturer's instructions	Check Battery	Daily	Able to pick up signal	Recharge or replace battery	Field personnel	Trimble Users Manual
Horiba Multiparameter Water Quality Meter	pH/ORP Probe	Clean probe/keep moist	Calibration relative to standardized solutions	Visual Inspection	Monthly and/or Before each use	Reads standard solution within +/- 10 percent	Clean, Recalibrate; Send to manufacturer for repair and calibration	Field personnel	Per manufacturer's recommen-dations.
	DO Probe	Clean probe/keep moist	Calibration relative to standardized solutions	Visual Inspection	Monthly and/or Before each use	Reads standard solution within +/- 10 percent	Replace membrane and HCL solution, Recalibrate; Send to manufacturer for repair and calibration	Field personnel	Per manufacturer's recommen-dations.
	Turbidity Probe	Clean probe/keep moist	Calibration relative to standardized solutions	Visual Inspection	Monthly and/or Before each use	Reads standard solution within +/- 10 percent	Clean, Recalibrate; Send to manufacturer for repair and calibration	Field personnel	Per manufacturer's recommen-dations.
	Conductivity Probe	Clean probe/keep moist	Calibration relative to standardized solutions	Visual Inspection	Monthly and/or Before each use	Reads standard solution within +/- 10 percent	Clean, Recalibrate; Send to manufacturer for repair and calibration	Field personnel	Per manufacturer's recommen-dations..
Syscal Pro Resistivity Meter	Resistivity check for electrode coupling	Keep batteries charged	Comparison with standardized area	Visual inspection	Annually	Reproducible data in standardized area	Send to manufacturer for repair and calibration	Geo personnel	User's Manual
Geonics EM31-MK2 Terrain Conductivity Meter	Nulling	Keep batteries charged. Set polycorder clock prior to survey	Functional checks, battery check and comparison with standardized area	Visual inspection	Prior to each use	Functional checks Zero reading: +/- 0.1 ppt; Phase check: +/- 0.2 mS/m; Sensitivity 22 -26 mS/m and reproducible data in standardized area	Send to manufacturer for repair and calibration	Geo personnel	SERAS SOP #2052

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Ground Penetrating Radar SmartCart Noggin	Calibrate Odometer with measuring Tape	Keep batteries charged	Comparison with standardized area	Visual inspection	Annually	Reproducible data in standardized area	Send to manufacturer for repair and calibration	Geo personnel	SERAS SOP #2056
Water level meter	NA	Check batteries	NA	Visual inspection	Annually	Three consecutive measurements from same location within 0.02 ft	Document	Geo personnel	SERAS SOP #2043

QAPP Worksheet #23
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
Samples Collected by EPA Region 9 and Relinquished to SERAS September 2013						
SOPII022.07.13.09	Elemental Analysis by Agilent 7500ce ICPMS EPA M200.8/M6020; July 19, 2012	Definitive	IVBA for Pb and As	ICP-MS	ACZ Laboratories, Inc.	No
SOPSO048.06.13	In Vitro Bioaccessibility Assay for Metals in Soil, June 14, 2013	Definitive	IVBA for Pb and As	NA	ACZ Laboratories, Inc.	No
SERAS SOP 1811	Digestion and Analysis of Metals by Inductively Coupled Plasma/Atomic Emission Spectrometry (ICP-AES); 1/10/12, Rev. 4.0	Definitive	Metals	ICP-AES	ERT/SERAS Laboratory	No
SERAS SOP 1832	Digestion and Analysis of Mercury by Cold-Vapor atomic Absorption (CVAA); 01/10/12; Rev. 4.0	Definitive	Mercury	Leeman Hg Analyzer	ERT/SERAS Laboratory	No
January 2014 through Spring 2014						
ISM01.3	USEPA Contract Laboratory Program Statement of Work for Multi-Media, Multi-Concentration Inorganic Analysis; December 2006	Definitive	Target Analyte List Metals (Metals not included in the Target Analyte List for ICP-MS will be run by ICP-MS; because of high concentrations noted in Mn results, Mn will also be measured using ICP-AES)	ICP-AES/ICP-MS	CLP Laboratory	Modified analyses (MA) will be run for soil/sediment/dross/ slag/waste rock and surface water analysis by ICP-MS to achieve lower detection limits: MA 2088.1 MA 204.7

QAPP Worksheet #23
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
EPA R9 SOP 254	Standard Operating Procedure 254, Bioaccessibility SPLP Extraction; 03/01/11, Rev. 1	NA	SPLP (extraction)	NA	EPA Region 9 Laboratory	No
EPA R9 SOP 256	Standard Operating Procedure 256, Bioaccessibility Extraction; 06/03/11, Rev. 1	NA	IVBA – Pb & As (extraction)	NA	EPA Region 9 Laboratory	No
EPA R9 SOP 407	Standard Operating Procedure 407, Preparation of Leachate Procedure Extracts for Metals Analysis; 10/10/11, Rev. 2	Definitive	IVBA – Pb & As and SPLP (digestion)	NA	EPA Region 9 Laboratory	No
EPA R9 SOP 503	Standard Operating Procedure 503, Standard Determination of Trace Elements in Solids and Leachate Procedure Extracts by ICP-AES; 12/14/12 Rev. 5	Definitive	IVBA – Pb & As and SPLP (determination)	ICP-AES	EPA Region 9 Laboratory	No
EPA R9 SOP 515	Standard Operating Procedure 515, Determination of Mercury in Water by CVAA Spectrometry; 7/98, Rev. 8	Definitive	Hg	Cetac M-7500 Mercury Analyzer	EPA Region 9 Laboratory	No
ASTM D2974	ASTM D2974-07a Standard Methods for Moisture, Ash and Organic Matter of Peat and Other Organic Soils	Screening	Total Moisture	NA	ALS Environmental through Katahdin Analytical Services	No

QAPP Worksheet #23
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
Neutralization Potential	Field and Laboratory Methods Applicable to Overburden and Minesoils; US EPA Industrial Environmental Research Laboratory, March 1978; EPA-600/2-78-054, Section 3.2.3, p.47	Screening	Neutralization Potential	NA	ALS Environmental through Katahdin Analytical Services	No
Grind	Field and Laboratory Methods Applicable to Overburden and Minesoils; US EPA Industrial Environmental Research Laboratory, March 1978; EPA-600/2-78-054, Section 3.1.2, p.42	Screening	Sample Preparation - Grind	NA	ALS Environmental through Katahdin Analytical Services	No
Saturated Paste pH	Field and Laboratory Methods Applicable to Overburden and Minesoils; US EPA Industrial Environmental Research Laboratory, March 1978; EPA-600/2-78-054, Section 3.2.2, p.45	Screening	Saturated Paste pH	NA	ALS Environmental through Katahdin Analytical Services	No
ASTM E1915	ASTM E1915-09 Standard Test Methods for Analysis of Metal Boring Ores and Relate materials for Carbon, Sulfur and Acid-Base Characteristics	Screening	Sulfur forms	NA	ALS Environmental through Katahdin Analytical Services	No

QAPP Worksheet #23
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
Acid-base accounting	Field and Laboratory Methods Applicable to Overburden and Minesoils; US EPA Industrial Environmental Research Laboratory, March 1978; EPA-600/2-78-054, Section 1.3.1, p.3	Screening	Acid potential and acid-base accounting	NA	ALS Environmental through Katahdin Analytical Services	No
CF-OA-E-001	Standard Operating Procedure for Dioxin/Furan/PCB Congener Sample Processing; August 2013, Rev.11	Definitive	Dioxin/furans	HRGC/HRMS	Cape Fear Analytical through Katahdin Analytical Services	No
CA-627-09	Trace Metals Analysis by ICP-MS Using USEPA Method 6020, August 2013, Rev. 9	Definitive	TAL Metals (Plant Tissue)	ICP-MS	Katahdin Analytical Services	No
CA-611-09	Digestion and Analysis of Solid Samples for Mercury by USEPA Method 7471, April 2012, Rev. 9	Definitive	TAL Metals (Plant Tissue)	CETAC M6100 Mercury Analyzer	Katahdin Analytical Services	No
CA-625-06	Alkaline Digestion and Subsequent Determination of Hexavalent Chromium in Solid Samples Using EPA SW846 Methods 3060 and 7196, CA-625-06; May 2013, Rev. 6	Definitive	Cr(VI)	Spectrophotometer	Katahdin Analytical Services	No

QAPP Worksheet #23
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
CA-741-05	Determination of Total Organic Carbon in Solids Using the EPA Region II Method Lloyd Kahn and SW846 9060 Mod, CA-741-05; February 2013, Rev.5	Definitive	TOC	Carbonaceous Analyzer	Katahdin Analytical Services	No
ASTM-2216	ASTM D2216-10 Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass	Screening	Natural Moisture Content	NA	Speedie & Associates, Inc.	No
ASTM D2937	ASTM D2937-10, Standard Test method for Density of Soil in Place by the Drive-Cylinder Method	Screening	Moisture Density	NA	Speedie & Associates, Inc.	No
ASTM D5084	ASTM D5084-10, Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter	Screening	Saturated Hydraulic Conductivity	NA	Speedie & Associates, Inc.	No
ASTM D854	ASTM D854-10, Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer	Screening	Specific Gravity	NA	Speedie & Associates, Inc.	No
ASTM D4664	ASTM D4664-08, Standard Test Method for Slake Durability of Shales and Similar Weak Rocks	Screening	Slake Durability	NA	GeoSystems Analysis, Inc.	No

QAPP Worksheet #23
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
ASTM D6836	ASTM D6836 - 02(2008)e2, Standard Test Methods for Determination of the Soil Water Characteristic Curve for Desorption Using a Hanging Column, Pressure Extractor, Chilled Mirror Hygrometer, and/or Centrifuge	Screening	Moisture Characteristic Curves	NA	GeoSystems Analysis, Inc.	No
ASTM D422	ASTM D422 - 63(2007) Standard Test Method for Particle-Size Analysis of Soils	Screening	Gradation	NA	Speedie & Associates, Inc.	No
ASTM D4318	ASTM D4318 - 10 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils	Screening	Atterberg Limits	NA	Speedie & Associates, Inc.	No
ASTM D2435	ASTM D2435 / D2435M - 11 Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading	Screening	Consolidation Test	NA	Speedie & Associates, Inc.	No
ASTM D3080	ASTM D3080 / D3080M - 11 Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions	Screening	Direct Shear test	NA	Speedie & Associates, Inc.	No

QAPP Worksheet #23
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
ASTM D4767	ASTM D4767 - 11 Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils	Screening	Consolidated-Undrained Triaxial Shear test with Pore Pressure	NA	Speedie & Associates, Inc.	No
CA-739-09	Titrimetric Determination of Total Alkalinity by EPA Method 310.1 and SM 2320 B Using the Mettler DL25 Autotritaor, and Calculation of the Component Forms of Alkalinity by SM 4500-CO_2D, CA-739-09; May 2012, Rev. 9	Definitive	Alkalinity	Autotitrator	Katahdin Analytical Services	No
CA-768-03	Colorimetric Analysis of Chloride Using the Automated Konelab Multiwavelength Photometric Analyzer, CA-768-03; May 2012, Rev. 3	Definitive	Chloride	Automated Konelab Multiwavelength Photometric Analyzer	Katahdin Analytical Services	No
CA-728-08	Total Nitrate/Nitrite, Nitrite & Nitrate with cadmium Reduction by Automated Colorimetry, CA-728-08; May 2012, Rev. 8	Definitive	Nitrite/Nitrate	LACHAT Automated Analyzer	Katahdin Analytical Services	No

QAPP Worksheet #23
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
CA-721-03	Turbidmetric Determination of Sulfate: EPA Method 375.4, Standard methods 4500SO_4E (18^{th}) and 426C (15^{th}), EPA SW846 Method 9038 and ASTM Method D516-02, CA-721-03; April 2007, Rev. 3	Definitive	Sulfate	Turbidimeter	Katahdin Analytical Services	No
CA-715-06	Analysis of TPO4 (Total Phosphorous) Using Block Digestion and Flow Injection Colorimetry (LACHAT); EPA Method 365.4, CA-715-06; June 2010, Rev. 6	Definitive	Phosphate	LACHAT Automated Analyzer	Katahdin Analytical Services	No
CA-627-09	4500 Silica - Standard Methods for the Examination of Water and Wastewater	Definitive	Silicon	ICP-MS	Katahdin Analytical Services	No
CA-763-07	Analysis of TOC, DOC, and TIC in Aqueous Samples Using the Shimadzu Carbon Analyzer: EPA Method 415.1, SW846 9060 and SM 5310B, CA-763-07; May 2012, Rev. 7	Definitive	Dissolved Organic Carbon	Shimadzu Carbon Analyzer	Katahdin Analytical Services	No
CA-719-07	Total Dissolved Solids (Filterable Residue) by EPA Method 160.1 and Standard Methods 2540 C, CA-719-07; May 2012, Rev. 7	Definitive	TDS	NA	Katahdin Analytical Services	No

QAPP Worksheet #23
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
CA-742-09	Anions by Ion Chromatography Using EPA Method 300.0 and SW-846 9056, CA-742-09; June 2012, Rev. 9	Definitive	Fluoride	Ion Chromatograph	Katahdin Analytical Services	No

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Samples Relinquished by Region 9 to SERAS						
ICP	Blank and high standard, ICV/ICB after calibration, CCV/CCB every 10 samples	Each day of use	ICV/CCV +/-10% ICB/CCB < RL	Perform maintenance, rerun calibration	Analyst	SERAS SOPs #1811
Leeman Hg Analyzer	Initial 5-point, ICV/ICB after calibration, CCV/CCB after every 10 samples	Each day of use	r=0.995 (initial), ICV & CCV = +/-10%, ICB/CCB < +/- RL	Perform maintenance, rerun calibration	Analyst	SERAS SOPs #1832 and 1827
ICP-MS	Initial calibration (ICAL), ICV/ICB after calibration, CCV/CCB every 10 samples and at end of run, ICSA and ICSB after ICV/ICB	Prior to each analytical workgroup	ICV/CCV ± 10%	Re-analyze	ACZ Laboratories Analyst	SOPII022.07.013.09
			r >0.995	Recalibrate/ reanalyze		
			ICB/CCB <3X MDL	Reanalyze all associated samples that are <10X the blank and >0; Recalibrate if ICB outside of acceptance criteria.		
			Recovery of analytes with known mass interferences <PQL	Recalibrate and re-analyze		
			Recovery ± 20%	Re-analyze		

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
ICP-AES / ICP-MS / CCVA	See ISM01.3; as per instrument manufacturer's recommended procedures	ICP-AES or ICP-MS Initial calibration: daily or once every 24 hours and each time the instrument is set up. ICP-AES or ICP-MS Continuing calibration: beginning and end of run and frequency of 10% or every 2 hours during an analysis run.	ICP-AES: As per instrument manufacturer's recommended procedures, with at least 2 standards. ICP-MS: As per instrument manufacturer's recommended procedures, with at least 2 standards. A minimum of three replicate integrations are required for data acquisition.	ICP-AES or ICP-MS: inspect the system, correct problem, re-calibrate, and reanalyze samples.	EPA CLP Laboratory ICP-AES/ICP-MS Technician	ISM01.3
Spectrophotometer	ICAL: minimum of 5 points plus calibration blank, ICV after calibration, CCV/CCB after every 10 samples and at end of run	ICAL quarterly and prior to sample analysis	Correlation coefficient ≥0.995 ICV±10% CCV within 10% of true value, CCB <RL Post-digestate recovery ± 15% if sample <4X spike	Inspect instrument; correct problem; rerun calibration and re-extract and/or reanalyze affected samples	Katahdin Analyst	CA-625-06
ICP-MS	ICAL: blank and calibration standard for each analyte, followed by ICV, and CCV every 10 samples, CB after each ICV/CCV, QLS (after ICAL and after every 40 samples)	ICAL: beginning of each analytical sequence	ICV/CCV±10% and RSD<5% CB < ½ QL QLS ± 30%	Inspect instrument; correct problem; rerun calibration and re-extract and/or reanalyze affected samples	EPA Region 9 Analyst	R9 SOP 503

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Cetac M-7500 Mercury Analyzer	ICAL: 5 point calibration, ICV & SCV after each ICAL, CCV every 10 samples and end of run, CB after each ICV/CCV, QLS after each batch and after 40 analytical samples	ICAL: daily or for every batch	Correlation coefficient ≥0.995 ICV/SCV ±5 % CCV ± 10% CB < ½ QL QLS ± 40%	Inspect instrument; correct problem; rerun calibration and re-extract and/or reanalyze affected samples	EPA Region 9 Analyst	R9 SOP 515
HRGC/HRMS	Initial 5 point calibration	Prior to analysis, whenever the continuing calibration falls outside the acceptance criteria, and at a minimum annually	Ratio of areas of integrated ion current for homologous series quantitation ions must be within control limits (Table 3) simultaneously in one run. For each selected ion current profile (SICP) and for each GC signal, the signal to noise (S/N) ratio must be better than or equal to 10. %RSD for the mean RFs must be within ±20% for the natives and ±35% for the internal standards	Re-calibrate	Cape Fear Analyst	CF-OA-E-001
	Continuing Calibration	Once every 12 hours	Concentrations within limits listed in Table 7, ion ratios within limits in Table 3	Identify source of problem, correct problem, re-calibrate		
LACHAT Auto Analyzer	Initial 5 point calibration, followed by ICV, CCV every 10 samples and end of run	ICAL prior to analysis	Correlation coefficient ≥0.995 ICV/CCV ± 10%	Investigate source of problem, recalibrate and/or reanalyze	Katahdin Analyst	CA-728-08

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
LACHAT Auto Analyzer	Initial 6 point calibration, ICV (1 per prep batch), CCV (after every 10 samples), CCB (after every 10 samples and at close of run)	ICAL prior to sample analysis	r≥0.995 ICV ± 20% CCV ± 10% CCB<RL	Investigate source of problem, recalibrate and/or reanalyze	Katahdin Analyst	CA-715-06
Shimadzu Carbon Analyzer	Initial 5 point calibration plus blank, followed by CCV (at beginning of run, after every 10 samples, and at end of run) and CCB (after every CCV)	ICAL at a minimum every 3 months or as necessary	r≥0.995 CCV ± 10% CCB<RL	Investigate, re-digest, recalibrate, reanalyze	Katahdin Analyst	CA-763-07
CETAC M6100 Mercury Analyzer	Initial 5 point calibration plus blank, followed by ICV & ICB (before beginning sample run), CCV & CCB (at beginning of run, after every 10 samples, and at end of run)	Daily ICAL, and prior to analysis	r≥0.995 ICV/CCV ± 20% ICB/CCB<RL	Investigate, recalibrate, reanalyze	Katahdin Analyst	CA-611-09
Automated Konelab Multiwavelength Photometric Analyzer	Initial 6 point calibration, ICV (1 per prep batch of 20) CCV (at beginning of run, after every 10 samples, and at end of run)	ICAL: Prior to sample analysis	r≥0.995 ICV/CCV ± 20%	Investigate source of problem, recalibrate, reanalyze samples back to last acceptable CCV	Katahdin Analyst	CA-768-03
Turbidimeter	ICAL: blank = 5 standards, ICV (1 per prep batch of 20), CCV (after every 4 samples)	ICAL: At a minimum when the conditioning reagent and/or $BaCl_2$ solution is made. Prior to sample analysis.	r≥0.995 ICV/CCV ± 20%	Investigate source of problem, recalibrate, reanalyze samples back to last acceptable CCV	Katahdin Analyst	CA-721-03

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Ion Chromatograph	ICAL: blank + 5 standards (lowest standard at or below PQL), ICV (one per batch of 20), CCV (at beginning of run, after every 10 samples, and at end of run), CCB immediately following each CCV	ICAL: Every 6 months or with each change in instrument operating conditions or instrument	r≥0.995 Recovery of lowest standard 50-150% ICV±10% CCV±10% and all analytes within established RT windows CCB<RL	Investigate, recalibrate, reanalyze	Katahdin Analyst	CA-742-09
ICP-MS	Initial 3 point calibration plus a calibration blank (ICB), followed by ICV and. CCV. CCV every 10 samples thereafter and at end of run	Daily ICAL and prior to analysis	r≥0.998 ICV/CCV ±10% ICB/CCB<RL	Investigate and correct problem, recalibrate, reanalyze	Katahdin Analyst	CA-627-09

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Samples Relinquished by Region 9 to SERAS								
ICP-MS	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	ACZ Laboratories Analyst/ Technician	NA
ICP-AES	Check Argon Supply Pressure	NA	NA	With each use	Sufficient Argon for ICP operation	Change tank	SERAS Analyst	SERAS SOP #1811
	Inspect Drainage Container	NA	NA	With each use	Sufficient space	Empty		
	Check Chiller System	NA	NA	With each use	Normal operation	Call Service Engineer		
	Check Autosampler	NA	NA	With each use	Normal operation	Call Service Engineer		
	Check IS Mix Kit Tubing	NA	NA	With each use	NA	Replace as necessary		
	Check Argon Pressure to Instrument	NA	NA	With each use	100 lbs psig	Call Service Engineer		
	Check Nebulizer	NA	NA	With each use	Normal spray	Replace or Call Service Engineer		
	Check Spray Chamber	NA	NA	With each use	Clean	Clean and/or replace spray chamber/O-rings		
	Check Torch/ Radial Window	NA	NA	With each use	Clean	Ultrasonic, acid or mild soap cleaning as appropriate		
	Check exhaust system	NA	NA	With each use	Normal operation	Call maintenance		
Leeman Hg Analyzer	Drainage container	NA	NA	With each use	NA	Empty	SERAS Analyst	SERAS SOP 1832
	Check sampling probe	NA	NA	With each use	NA	Replace		
	Check stannous chloride line to pump	NA	NA	With each use	NA	Replace line/clean		

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
	Check pump winding tube	NA	NA	With each use	NA	Clean/replace		
	Check optical cell	NA	NA	As required	NA	Clean		
	Check autosampler arm	NA	NA	As required	NA	Lubricate		
	Check lamp alignment	NA	NA	As required	NA	Adjust		
	Check drying tube	NA	NA	As required	NA	Replace		
Spectro-Photometer, ICP- MS, CETAC M6100 Mercury Analyzer Carbonaceous Analyzer, Autotitrator, Automated Konelab Multiwavelength Photometric Analyzer, LACHAT Automated Analyzer, Shimadzu Carbon Analyzer, Ion Chromatograph, Turbidimeter	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	Katahdin Laboratory Services Analyst/ Technician	NA
ICP-AES / ICP-MS / CVAA	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	Acceptable re-calibration; see ISM01.3	Inspect the system, correct problem, re-calibrate and/or reanalyze samples.	EPA CLP Laboratory ICP-AES / ICP-MS Technician	ISM01.3
ICP-AES	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	EPA Region 9 Analyst/ Technician	NA

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Cetac M-7500 Mercury Analyzer	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	EPA Region 9 Analyst/ Technician	NA
HRGC/HRMS	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	Cape Fear Analyst/ Technician	NA
ICP-MS	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations	Katahdin Laboratory Services Analyst/ Technician	NA

[1]Specify the appropriate reference letter or number from Analytical SOP References table (Worksheet #23)

QAPP Worksheet #26
Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): SERAS, ERT, EPA R9
Sample Packaging (Personnel/Organization): SERAS, ERT
Coordination of Shipment (Personnel/Organization): SERAS
Type of Shipment/Carrier: Overnight carrier, Fed Ex
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Jay Patel, SERAS ICP/MS; CLP Laboratory; EPA R9 Laboratory, Katahdin Analytical Services, ALS Environmental, Cape Fear Analytical, Speedie & Associates; GeoSystems analysis, Inc., ACZ Laboratories, Lawrence Martin, SERAS Sample Receiving/Hazardous Waste,
Sample Custody and Storage (Personnel/Organization): Jay Patel, SERAS ICP/MS; CLP Laboratory; EPA R9 Laboratory, Katahdin Analytical Services, ALS Environmental, Cape Fear Analytical, Speedie & Associates; GeoSystems analysis, Inc., ACZ Laboratories, Lawrence Martin, SERAS Sample Receiving/Hazardous Waste
Sample Preparation (Personnel/Organization): Jay Patel, SERAS ICP/MS; CLP Laboratory; EPA R9 Laboratory, Katahdin Analytical Services, ALS Environmental, Cape Fear Analytical, Speedie & Associates; GeoSystems Analysis, Inc., ACZ Laboratories, Shiv Sahni, SERAS Extraction Chemist; Amit Vaidya, SERAS GC/MS Chemist
Sample Determinative Analysis (Personnel/Organization): CLP Laboratory; EPA R9 Laboratory, Katahdin Analytical Services, ALS Environmental, ACZ Laboratories, Jay Patel, SERAS ICP/MS, Cape Fear Analytical
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): To be determined in the field.
Sample Extract/Digestate Storage (No. of days from extraction/digestion): Per laboratory SOP
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: EPA Region 9, CLP Laboratory, Lawrence Martin/SERAS, Katahdin Analytical Services, ALS Environmental, Cape fear analytical, Speedie & Associates; GeoSystems Analysis, Inc., ACZ Laboratories
Number of Days from Analysis: 60 days

QAPP Worksheet #27
Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Samples for analysis by FP XRF will be hand delivered to the on-site XRF Operator. Following analysis by FP XRF, samples will be stored on-site. Confirmation samples for the FP XRF will be submitted to a CLP laboratory for analysis for TAL Metals. Sample packaging and shipment will be done in accordance with SERAS SOP #2004, *Sample Packaging and Shipment.* Scribe will be used for sample management, as well as generation of sample documentation, such as, labels and COC records. All COC records will receive a peer review in the field prior to shipment of samples in accordance with SERAS SOP # 4005, *Chain of Custody Procedures* and shipped according to SERAS SOP #2005.
Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal): A sample custodian at the designated laboratory will accept custody of the shipped samples, check them for discrepancies, integrity, etc., and relinquish them to the appropriate department for analysis.
Sample Identification Procedures: Will be in accordance with SERAS SOP #2002, *Sample Documentation*. In addition, sample identification numbering scheme will be devised and implemented in a manner that will facilitate clear and easy association of the analytical data. See Table 4 of Attachment .
Chain-of-custody Procedures: In accordance with SERAS SOP #4005, *Chain of Custody Procedures.*

QAPP Worksheet #28-1
QC Samples Table

Matrix	Soil/Sediment/Dross/ Slag
Analytical Group	Metals (FP XRF)
Concentration Level	Low to high
Sampling SOP	SERAS SOP #2012 SERAS SOP #2016
Analytical Method/ SOP Reference	SERAS SOP #1720
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS/ERT
Analytical Organization	SERAS/ERT
No. of Sample Locations	7,202

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Zero Check Sample	Pre-operation check; Every 4 to 6 hours of sample analysis	< RL	Repeat, if continues to fail, check SRMs and/or send in for factory service or calibration	Analyst	Sensitivity	Same as Method/SOP QC Acceptance Limits
Precision Check Sample(s)	Every 10 samples	RSD ± 20%	Calculated after site activities completed; Qualify data if > 20%	Analyst	Precision	Same as Method/SOP QC Acceptance Limits
Certified Reference Standard(s)	Pre-operation check and every 10-20 samples	Element results typically within ± 20% of true values for concentrations at least 5-times the RL	Repeat. If continues to fail, send in for factory service/or calibration	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits

QAPP Worksheet #28-2
QC Samples Table

Matrix	Soil/Sediment/Slag/ Waste Rock
Analytical Group	TAL Metals
Concentration Level	Low to high
Sampling SOP	SERAS SOP #2012 SERAS SOP #2016
Analytical Method/ SOP Reference	CLP ISM01.3
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	CLP
No. of Sample Locations	695 soil 5 waste rock 25 sediment 3 slag 33 dross

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 in 20	NA	Document, report	SERAS TL	Precision	±35%
Preparation Blank	1 per ≤ 20 samples	Blank concentration < CRQL	Suspend analysis until source rectified; redigest and reanalyze affected samples	EPA CLP Laboratory ICP-AES/ICP-MS Technician	Accuracy	Blank concentration < CRQL
Spike	1 per ≤ 20 samples	%R = 75-125% within control chart limits	Flag outliers	EPA CLP Laboratory ICP-AES/ICP-MS Technician	Accuracy	%R = 75-125% within control chart limits
Duplicate Sample	1 per ≤ 20 samples	± 20% RPD**	Flag outliers	EPA CLP Laboratory ICP-AES/ICP-MS Technician	Precision	± 20% RPD**
Post-Digestion Spike	after any analyte (except Ag and Hg) fails spike %R	%R = 75-125	Flag outliers	EPA CLP Laboratory ICP-AES/ICP-MS Technician	Accuracy	%R = 75-125

QAPP Worksheet #28-2
QC Samples Table

Matrix	Soil/Sediment/Slag/ Waste Rock
Analytical Group	TAL Metals
Concentration Level	Low to high
Sampling SOP	SERAS SOP #2012 SERAS SOP #2016
Analytical Method/ SOP Reference	CLP ISM01.3
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	CLP
No. of Sample Locations	695 soil 5 waste rock 25 sediment 3 slag 33 dross

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Interference Check Sample [ICP Analysis Only]	beginning, end and periodically during run (2 times every 8 hours)	± 20% of true value or ± 1 times the CRQL, whichever is greater	Check calculations and instruments, reanalyze affected samples	EPA CLP Laboratory ICP-AES/ICP-MS Technician	Accuracy	± 20% of true value or ± 1 times the CRQL, whichever is greater
Serial Dilution	1 per batch	%D ±10% (minimum sample concentration 50x MDL)	Document	EPA CLP Laboratory ICP-AES/ICP-MS Technician	Precision	%D ±10% (minimum sample concentration 50x MDL)

QAPP Worksheet #28-3
QC Samples Table

Matrix	Water
Analytical Group	TAL Metals
Concentration Level	Low to high
Sampling SOP(s)	SERAS SOP #2013 SERAS SOP #2007
Analytical Method/SOP Reference	CLP ISM01.3
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	CLP
No. of Sample Locations	16 surface water 44 groundwater

Lab QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 in 20	NA	Document, report	SERAS TL	Precision	±20%
Field Blank	1 per day of sampling	<CRQL	Document, report	ESAT Validator	Accuracy/Bias (contamination)	<CRQL
Preparation Blank	1 per ≤ 20 samples	Blank concentration< CRQL	Suspend analysis until source rectified; re-digest and reanalyze affected samples	EPA CLP Laboratory ICP-AES/ICP-MS Technician	Accuracy	Blank concentration< CRQL
Matrix Spike; LCSW	1 per ≤ 20 samples	75-125%; 70-130% (50-150% for Ag and Sb)	Flag outliers	EPA CLP Laboratory ICP-AES/ICP-MS Technician	Accuracy	75-125%; 70-130% (50-150% for Ag and Sb)
Duplicate Sample	1 per ≤ 20 samples	NA	Flag outliers	EPA CLP Laboratory ICP-AES/ICP-MS Technician	Precision	± 20% RPD
Post-Digestion Spike	after any analyte (except Ag) fails spike %R	%R = 75-125% (exception Ag)	Flag outliers	EPA CLP Laboratory ICP-AES/ICP-MS Technician	Accuracy	%R = 75-125% (exception Ag)

QAPP Worksheet #28-3
QC Samples Table

Matrix	Water
Analytical Group	TAL Metals
Concentration Level	Low to high
Sampling SOP(s)	SERAS SOP #2013 SERAS SOP #2007
Analytical Method/SOP Reference	CLP ISM01.3
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	CLP
No. of Sample Locations	16 surface water 44 groundwater

Lab QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Serial Dilution	1 per batch	%D ±10% (minimum sample concentration 50x MDL)	Document	EPA CLP Laboratory ICP-AES/ICP-MS Technician	Precision	%D ±10% (minimum sample concentration 50x MDL)
Interference Check Sample [ICP Analysis Only]	beginning, end and periodically (not less than once per 20 samples)	± 20% of true value or ± 1 times the CRQL, whichever is greater	Check calculations and instruments, reanalyze affected samples	EPA CLP Laboratory ICP-AES/ICP-MS Technician	Sensitivity	± 20% of true value or ± 1 times the CRQL, whichever is greater

QAPP Worksheet #28-4 (Relinquished to SERAS by Region 9)
QC Samples Table

Matrix	Soil
Analytical Group	Metals
Concentration Level	Low
Sampling SOP	NA
Analytical Method/ SOP Reference	SERAS SOP #1811
Sampler's Name	Region 9
Field Sampling Organization	Region 9
Analytical Organization	SERAS/ERT
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory Matrix Spikes (inorganic)	Every 20 samples	75-125%	Rerun - no reprep is necessary; Qualify data	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits
Laboratory Matrix Spikes Duplicates	Every 20 samples (between MS/MSD)	RPD ± 20%	Rerun first, reprep if necessary or Qualify data	Analyst/Group Leader	Precision	Same as Method/SOP QC Acceptance Limits
LCS	Every 20 samples of same matrix	80-120% or within vendor PALs	Reanalyze first, then rerun batch or Qualify data	Analyst/Group Leader	Accuracy/Precision	Same as Method/SOP QC Acceptance Limits
Lower Level Check Std	At beginning and end of each analytical run	Within upper and lower control limits or +/- 30% of the true value)	Rerun, recalibrate if necessary	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits
ICS (Interference Check Sample)	Once each 8-hour shift	+/-20% for elements in ICSA, <RL for others	Rerun or recalibrate	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits
ICV/CCV (Initial Calibration Verification/Continuing Calibration Verification)	ICV Immediately following calibration and CCV every 10 samples	+/- 10% of true value; RSD between replicate injections<5%	Check instrument, reanalyze, Recalibrate	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits

QAPP Worksheet #28-4 (Relinquished to SERAS by Region 9)
QC Samples Table

Matrix	Soil
Analytical Group	Metals
Concentration Level	Low
Sampling SOP	NA
Analytical Method/ SOP Reference	SERAS SOP #1811
Sampler's Name	Region 9
Field Sampling Organization	Region 9
Analytical Organization	SERAS/ERT
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
ICB/CCB (Initial Calibration Blank/Continuing Calibration Blank)	ICB Immediately following the ICV and CCB following each CCV	< RL	Rerun samples unless sample concentration is >10X the concentration in the CCB; investigate source of contamination	Analyst	Accuracy/Bias Contamination	Same as Method/SOP QC Acceptance Limits
Method Blank	One per batch of 20 samples/same matrix	< RL	Reprep if concentration in samples is not at least 10X concentration in blank, investigate source of contamination	Analyst	Accuracy/Bias Contamination	Same as Method/SOP QC Acceptance Limits
Field Duplicate	1:20 samples or per project specifications	NA	Document in final deliverable	Task Leader	Precision	RPD ± 35%

QAPP Worksheet #28-4 (Relinquished to SERAS by Region 9)
QC Samples Table

Matrix	Soil
Analytical Group	Metals
Concentration Level	Low
Sampling SOP	NA
Analytical Method/ SOP Reference	SERAS SOP #1811
Sampler's Name	Region 9
Field Sampling Organization	Region 9
Analytical Organization	SERAS/ERT
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Serial Dilution Test	Matrix spike sample	RPD < 10% if analyte concentration >10x RL	Qualify data	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits
LAR (Linear analytical range)	Semi-annually	%R = 90 -110%	New LAR is determined based on LAR study	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits
Post Digestion Spike	If the MS/MSD recoveries are unacceptable, one per batch of 20 samples/same matrix.	%R = 80 -120%	Qualify data or run dilution test	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits
MDL Study	Annual	MDL times 5 must be less than RL	Elevate RLs	Analyst	Sensitivity	Same as Method/SOP QC Acceptance Limits

QAPP Worksheet #28-5 (Relinquished to SERAS by Region 9)
QC Samples Table

Matrix	Soil
Analytical Group	Metals (Mercury)
Concentration Level	Low
Sampling SOP	NA
Analytical Method/ SOP Reference	SERAS SOP #1832
Sampler's Name	Region 9
Field Sampling Organization	Region 9
Analytical Organization	SERAS/ERT
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike (inorganics)	Every 20 samples	80-120%	Rerun - no reprep is necessary	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits
Laboratory Duplicates (Matrix Spike Duplicates)	Every 20 samples (between MS/MSD)	± 20%	Rerun first, reprep if necessary	Analyst/Group Leader	Precision	Same as Method/SOP QC Acceptance Limits
Field Duplicate	1:20 samples or per project specifications	NA	Document in final deliverable	Task Leader	Precision	± 35%
LCS	Every 20 samples of same matrix	80-120% or within vendor PALs	Reanalyze first, then rerun batch	Analyst/Group Leader	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits
Method Blank	One per batch of 20 samples/same matrix	< RL	Reprep if concentration in samples is not at least 10X concentration in blank	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits

QAPP Worksheet #28-6
QC Samples Table

Matrix	Soil/Dross/Slag/Waste Rock
Analytical Group	SPLP
Concentration Level	Low
Sampling SOP	SERAS SOP #2012
Analytical Method/ SOP Reference	EPA R9 SOPs 254, 407, 503,515
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	EPA Region 9
No. of Sample Locations	30 soil 4 dross 3 slag 5 waste rock

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Sample Duplicate	Per extraction fluid per day	RPD ± 20%	Document, Report	Analyst	Precision	RPD ± 20%
Method Blank (MB)	Per extraction fluid per day	< ½ RL	If result<5x MB rerun to verify and if still unacceptable re-prep and re-analyze associated samples. If result is ND or >5x MB report without qualification	Analyst	Accuracy/Bias	< ½ RL
LCS	Every 20 samples of same matrix	85-115%	Reanalyze first, then rerun batch	Analyst	Accuracy/Bias	80-120%
Matrix Spike	Every 20 samples of same matrix	ICP: 75-125% Hg: 70-130%	Reanalyze and qualify	Analyst	Accuracy/Bias	75-125%
Matrix Spike Duplicate	Every 20 samples of same matrix	80-120%	Qualify results	Analyst	Precision	80-120%

QAPP Worksheet #28-6
QC Samples Table

Matrix	Soil/Dross/Slag/Waste Rock
Analytical Group	SPLP
Concentration Level	Low
Sampling SOP	SERAS SOP #2012
Analytical Method/ SOP Reference	EPA R9 SOPs 254, 407, 503,515
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	EPA Region 9
No. of Sample Locations	30 soil 4 dross 3 slag 5 waste rock

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
SIC	After ICAL as needed per analyte (not for Hg)	±1/2 QL or calculated acceptance window, whichever is greater	Re-run or re-calibrate	Analyst	Accuracy/Bias	±1/2 QL or calculated acceptance window, whichever is greater
LDR	Annually (not for Hg)	%R = 90 -110%	Dilute and re-analyze	Analyst	Accuracy/Bias	%R = 90 -110%
Internal Standard	Every sample (not for Hg)	60-125%	Flush instrument with rinsate blank and re-analyze	Analyst	Accuracy/Bias	60-125%
Field Duplicate	1:20 samples or per project specifications	NA	Document, report	Task Leader	Accuracy/Bias	RPD ±35%
MDL Study	Annual	MDL < ½ QL	Elevate RLs	Analyst	Sensitivity	MDL < ½ QL

QAPP Worksheet #28-7
QC Samples Table

Matrix	Soil
Analytical Group	Cr(VI)
Concentration Level	Low
Sampling SOP	SERAS SOP #2012
Analytical Method/ SOP Reference	Katahdin SOP #CA-625-06
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	22

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 in 20	RPD ±35%	Document, report	Task Leader	Precision	RPD ±35%
LCS	1 per digestion batch of 20 or fewer samples	%R = 80-120%	Investigate source of problem; re-digest & re-analyze batch	Analyst	Accuracy	%R = 80-120
Soluble & Insoluble Pre-digestion Matrix Spike	1 per digestion batch of 20 or fewer samples	R ±25% of true value, if sample <4x spike added	Correct problem and re-homogenize, re-digest and re-analyze	Analyst	Accuracy	R ±25% of true value, if sample <4x spike added
Laboratory Duplicate	1 per digestion batch of 20 or fewer samples	RPD ±20%, if both the sample and duplicate are ≥ four times the PQL	Flag results	Analyst	Precision	RPD ±20%, if both the sample and duplicate are ≥ four times the PQL
Method Blank	One per batch of 20 samples/same matrix	< RL	Re-prep, re-analyze	Analyst	Accuracy/Bias	< RL

QAPP Worksheet #28-7
QC Samples Table

Matrix	Soil
Analytical Group	Cr(VI)
Concentration Level	Low
Sampling SOP	SERAS SOP #2012
Analytical Method/ SOP Reference	Katahdin SOP #CA-625-06
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	22

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Post-digestion matrix spike	1 per digestion batch of 20 or fewer samples	R ±15% of true value, if sample <4x spike added	If check indicates interference, dilute and re-analyze sample	Analyst	Accuracy	R ±15% of true value, if sample <4x spike added

QAPP Worksheet #28-8
QC Samples Table

Matrix	Sediment/Dross
Analytical Group	Dioxins/furans
Concentration Level	Low
Sampling SOP	SERAS SOP #2012 SERAS SOP #2016
Analytical Method/ SOP Reference	Cape Fear SOP #CF-OA-E-002
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Cape Fear thru Katahdin Analytical
No. of Sample Locations	2 dross 5 sediment

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per batch of 20 or less	Target analyte< QL or <10% of level in related samples	Re-extract, re-analyze	Analyst	Accuracy/Bias (Contamination)	Target analyte< QL or <10% of level in related samples
Field Duplicate	1 in 20	NA	Document, report	Task Leader	Precision	± 35%
Labeled Extraction Standards	All samples	Recoveries within established laboratory limits (Table 7 of SOP)	Evaluate data quality. If needed, re-extract and re-analyze the sample.	Analyst	Accuracy	Recoveries within established laboratory limits (Table 7 of SOP)
Labeled Cleanup Standard	All samples	35-197%	Evaluate data quality. If needed, re-extract and re-analyze the sample.	Analyst	Accuracy	35-197%

QAPP Worksheet #28-8
QC Samples Table

Matrix	Sediment/Dross
Analytical Group	Dioxins/furans
Concentration Level	Low
Sampling SOP	SERAS SOP #2012 SERAS SOP #2016
Analytical Method/ SOP Reference	Cape Fear SOP #CF-OA-E-002
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Cape Fear thru Katahdin Analytical
No. of Sample Locations	2 dross 5 sediment

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
OPR	1 per batch of 20 or less	Recoveries within established laboratory limits (Table 6 of SOP)	Perform routine instrument maintenance	Analyst	Accuracy	Recoveries within established laboratory limits (Table 6 of SOP)
Matrix Spike	1 per batch of 20 or less	70-130%	Investigate source of problem. Document.	Analyst	Accuracy	70-130%
Matrix Spike Duplicate	1 per batch of 20 or less	%RPD < 20%	Investigate source of problem. Document.	Analyst	Precision	%RPD < 20%
Lab Duplicate	1 per batch of 20 or less	%RPD < 20%	Contact client for guidance	Analyst	Precision	%RPD < 20%
OPRD	1 per batch of 20 or less	Same as OPR and %RPD < 20%	Perform routine instrument maintenance. Document.	Analyst	Precision	Same as OPR and %RPD < 20%

QAPP Worksheet #28-9a
QC Samples Table

Matrix	Surface Water and Groundwater
Analytical Group	WQ: Nitrate & Fluoride
Concentration Level	Low
Sampling SOP	SERAS SOP #2013 SERAS SOP #2007
Analytical Method/ SOP Reference	Katahdin SOPs #CA-728-08 #CA-742-09
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	49

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Blank	1 per day of sampling	< RL	Flag data	SERAS QA/QC Chemist	Accuracy/Bias (Contamination)	< RL
Method blank	1 per batch of 20 or less	< RL	Investigate source of contamination. Report results <PQL. Report and flag results >10x blank result. Re-analyze all other samples associated with the failing blank.	Analyst	Accuracy/Bias (Contamination)	< RL
Field Duplicate	1 in 20	NA	Document, report	SERAS TL	Precision	±20%

QAPP Worksheet #28-9a
QC Samples Table

Matrix	Surface Water and Groundwater
Analytical Group	WQ: Nitrate & Fluoride
Concentration Level	Low
Sampling SOP	SERAS SOP #2013 SERAS SOP #2007
Analytical Method/ SOP Reference	Katahdin SOPs #CA-728-08 #CA-742-09
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	49

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS	1 per batch of 20 or less	90 – 110% R	Report samples <PQL if it fails high; Recalibrate and/or re-analyze other samples	Analyst	Accuracy	90 – 110% R
Field Blank	1 per day of sampling	< RL	Flag data	SERAS QA/QC Chemist	Accuracy/Bias (Contamination)	< RL
Matrix Spike (MS)	1 per batch of 10 or less	90 – 110% R	Evaluate samples and associated QC. If LCS results are acceptable. Flag data. If LCS and MS are unacceptable re-prep and re-analyze samples and QC	Analyst	Accuracy	90 – 110% R

QAPP Worksheet #28-9a
QC Samples Table

Matrix	Surface Water and Groundwater
Analytical Group	WQ: Nitrate & Fluoride
Concentration Level	Low
Sampling SOP	SERAS SOP #2013 SERAS SOP #2007
Analytical Method/ SOP Reference	Katahdin SOPs #CA-728-08 #CA-742-09
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	49

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike Duplicate	1 per batch of 20 or less	RPD ±15%	Investigate, re-analyze sample in duplicate, if RPD is still out, report original result with flag	Analyst	Precision	RPD ±15%
Lab Duplicate	1 per batch of 20 or less	Nitrate: RPD ± 20 for samples >3x the PQL; <100% for samples<3x the PQL Fluoride: %RPD ± 20%	Investigate, re-analyze sample in duplicate, if RPD is still out, report original result with flag	Analyst	Precision	Nitrate: RPD ± 20 for samples >3x the PQL; <100% for samples<3x the PQL Fluoride: %RPD ± 20%

QAPP Worksheet #28-9b
QC Samples Table

Matrix	Surface Water and Groundwater
Analytical Group	WQ: DOC
Concentration Level	Low
Sampling SOP	SERAS SOP #2013 SERAS SOP #2007
Analytical Method/ SOP Reference	Katahdin SOP #CA-763-075
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	49

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Blank	1 per day	<RL	Flag data	SERAS QA/QC Chemist	Accuracy/Bias (Contamination)	<RL
Method blank	1 per batch of 20 or less	<RL	Investigate source of contamination. Report results <PQL. Report and flag results >10x blank result. Re-analyze all other samples associated with the failing blank.	Analyst	Accuracy/Bias (Contamination)	<RL
Field Duplicate	1 in 20	NA	Document, report	SERAS TL	Precision	±20%
LCS	1 per batch of 20 or less	90 – 110% R	Report samples <PQL if it fails high; Recalibrate and/or re-analyze other samples	Analyst	Accuracy	90 – 110% R

QAPP Worksheet #28-9b
QC Samples Table

Matrix	Surface Water and Groundwater
Analytical Group	WQ: DOC
Concentration Level	Low
Sampling SOP	SERAS SOP #2013 SERAS SOP #2007
Analytical Method/ SOP Reference	Katahdin SOP #CA-763-075
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	49

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike (MS)	1 per batch of 10 or less	80 – 120% R	Evaluate samples and associated QC. If LCS results are acceptable. Flag data.	Analyst	Accuracy	80 – 120% R
Sample Duplicate	1 per batch of 20 or less	%RPD < 20%	If lab QC in criteria and matrix interference suspected, flag data	Analyst	Precision	%RPD < 20%

QAPP Worksheet #28-9c
QC Samples Table

Matrix	Surface Water and Groundwater
Analytical Group	WQ: Sulfate, phosphate, alkalinity, chloride
Concentration Level	Low
Sampling SOP	SERAS SOP #2013 SERAS SOP #2007
Analytical Method/ SOP Reference	Katahdin SOP #CA-721-03 #CA-715-06 #CA-739-09 #CA-768-03
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	49

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 in 20	NA	Document, report	SERAS TL	Precision	±20%
LCS	1 per batch of 20 or less	80 – 120% R	Report samples <PQL if it fails high; Recalibrate and/or re-analyze other samples	Analyst	Accuracy	80 – 120% R
Method blank	1 per batch of 20 or less	<RL	Investigate source of contamination. Report results <PQL. Flag results >10x blank result. Re-analyze all other samples associated with the failing blank.	Analyst	Accuracy/Bias (Contamination)	<RL

QAPP Worksheet #28-9c
QC Samples Table

Matrix	Surface Water and Groundwater
Analytical Group	WQ: Sulfate, phosphate, alkalinity, chloride
Concentration Level	Low
Sampling SOP	SERAS SOP #2013 SERAS SOP #2007
Analytical Method/ SOP Reference	Katahdin SOP #CA-721-03 #CA-715-06 #CA-739-09 #CA-768-03
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	49

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike (MS)	1 per batch of 10 or less	Sulfate, Phosphate, Chloride: 75-125% Alkalinity: 80 – 120%	Evaluate samples and associated QC. If LCS results are acceptable. Flag data.	Analyst	Accuracy	Sulfate, Phosphate, Chloride: 75-125% Alkalinity: 80 – 120%
Field Blank	1 per day	<RL	Flag data	SERAS QA/QC Chemist	Accuracy/Bias (Contamination)	<RL

QAPP Worksheet #28-9c
QC Samples Table

Matrix	Surface Water and Groundwater
Analytical Group	WQ: Sulfate, phosphate, alkalinity, chloride
Concentration Level	Low
Sampling SOP	SERAS SOP #2013 SERAS SOP #2007
Analytical Method/ SOP Reference	Katahdin SOP #CA-721-03 #CA-715-06 #CA-739-09 #CA-768-03
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	49

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Sample Duplicate	1 per batch of 20 or less	Sulfate & Alkalinity: ±20% RPD for concentrations >3x the PQL; RPD≤100 for results<3x PQL Phosphate & Chloride: RPD≤20	Alkalinity, Phosphate, Chloride: Investigate & re-analyze in duplicate; if RPD still >20 report with notation. Sulfate: If QC in criteria, flag data, else reanalyze	Analyst	Precision	Sulfate & Alkalinity: ±20% RPD for concentrations >3x the PQL; RPD≤100 for results<3x PQL Phosphate & Chloride: RPD≤20

QAPP Worksheet #28-9d
QC Samples Table

Matrix	Surface Water and Groundwater
Analytical Group	WQ:TDS
Concentration Level	Low
Sampling SOP	SERAS SOP #2013 SERAS SOP #2007
Analytical Method/ SOP Reference	Katahdin SOP # CA-719-07
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	49

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 in 20	NA	Document, report	SERAS TL	Precision	±20%
Field Blank	1 per day	<RL	Flag data	SERAS QA/QC Chemist	Accuracy/Bias (Contamination)	<RL
LCS	1 per batch of 20 or less	80 – 120% R	Report samples <PQL if it fails high; Recalibrate and/or re-analyze other samples	Analyst	Accuracy	80 – 120% R
Method blank	1 per batch of 20 or less	TDS < PQL	Investigate source of contamination. Report results <PQL. Flag results >10x blank result. Re-analyze all other samples associated with the failing blank.	Analyst	Accuracy/Bias (Contamination)	TDS < PQL

QAPP Worksheet #28-9d
QC Samples Table

Matrix	Surface Water and Groundwater
Analytical Group	WQ:TDS
Concentration Level	Low
Sampling SOP	SERAS SOP #2013 SERAS SOP #2007
Analytical Method/ SOP Reference	Katahdin SOP # CA-719-07
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	49

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Sample Duplicate	1 per batch of 10 or less	RPD ≤ 20	Investigate & re-analyze in duplicate; if RPD still >20 report with notation.	Analyst	Precision	RPD ≤ 20

QAPP Worksheet #28-10
QC Samples Table

Matrix	Sediment
Analytical Group	TOC
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	Katahdin SOP #CA-741-05
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	5

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 in 20	NA	Document, report	SERAS TL	Precision	±35%
LCS	1 per batch of 20 or less	80 – 120% R	Report samples <PQL if it fails high; Recalibrate and/or re-analyze other samples	Analyst	Accuracy	80 – 120% R
Method blank	1 per batch of 20 or less	<RL	Investigate source of contamination. Report results <PQL. Flag results >10x blank result. Re-analyze all other samples associated with the failing blank	Analyst	Accuracy/Bias (Contamination)	<RL

QAPP Worksheet #28-10
QC Samples Table

Matrix	Sediment
Analytical Group	TOC
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	Katahdin SOP #CA-741-05
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	5

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix spike	1 per 10	75-125%	If LCS in criteria and matrix interference suspected, flag data; else re-analyze.	Analyst	Accuracy	75-125%
Sample Duplicate	1 per batch of 10 or less	RPD ± 20	Investigate & re-analyze in duplicate; if RPD still >20 report with notation.	Analyst	Precision	RPD ± 20

QAPP Worksheet #28-11
QC Samples Table

Matrix	Surface Water Groundwater
Analytical Group	WQ: Silicon
Concentration Level	Low
Sampling SOP	SERAS SOP 2013 SERAS SOP 2007
Analytical Method/ SOP Reference	Katahdin SOP #CA-627-09
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	49

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Post-digestion matrix spike	Every 20 samples	%R = 80 -120	Flag results and/or analyze sample by method of standard additions	Analyst	Accuracy/Bias	%R = 80 -120
Duplicate Sample	Every 20 samples	RPD ± 20% if sample conc > 100x IDL	Flag results	Analyst	Precision	RPD ± 20% if sample conc > 100x IDL
LCS	Every 20 samples of same matrix	80-120% or within performance acceptance limits	Investigate source of problem; re-digest & re-analyze all associated samples, unless LCS>120% and sample result <PQL	Analyst	Accuracy/Bias	80-120% or within performance acceptance limits
Field Duplicate	1:20	NA	Document, report	SERAS TL	Precision	RPD ±20%

QAPP Worksheet #28-11
QC Samples Table

Matrix	Surface Water Groundwater
Analytical Group	WQ: Silicon
Concentration Level	Low
Sampling SOP	SERAS SOP 2013 SERAS SOP 2007
Analytical Method/ SOP Reference	Katahdin SOP #CA-627-09
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	49

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
ICS A	Before analyzing samples; every 12 hours during a run	Interferents: ±20% of true value	Do not use sample results for failing elements	Analyst	Accuracy/Bias Contamination	Interferents: ±20% of true value
ICS AB	Before analyzing samples; every 12 hours during a run	±20% of true value	Do not use sample results for failing elements, unless ICS-AB >120% and sample result <PQL	Analyst	Accuracy/Bias Contamination	±20% of true value
Serial Dilution	1 per digestion batch	+/-10% if analyte concentration > 50 times instrument detection limit	Flag result or dilute and re-analyze sample to eliminate interference	Analyst	Accuracy/Bias	+/-10% if analyte concentration > 50 times instrument detection limit
Internal Standard	Every sample, every standard	IS intensity within 70-120% of IS in ICB		Analyst	Accuracy/Bias	IS intensity within 70-120% of IS in ICB
Field Blank	1 per day	<RL	Flag data	SERAS QA/QC Chemist	Accuracy/Bias	<RL

QAPP Worksheet #28-12 (Relinquished to SERAS by Region 9)
QC Samples Table

Matrix	Soil
Analytical Group	Metals: IVBA (Pb & As)
Concentration Level	Low
Sampling SOP	NA
Analytical Method/ SOP Reference	ACZ SOP #SOPII022.07.13.09
Sampler's Name	Region 9
Field Sampling Organization	Region 9
Analytical Organization	SERAS/ERT
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCSW	1 per batch of 20 or less	R = 80-120%	Re-prep; re-analyze	Analyst	Accuracy	R = 80-120%
Sample Duplicate	1 per batch of 20 or less	RPD ±20%	Document, report	Analyst	Precision	RPD ±20%
Matrix Spike	1 per batch of 10 or less	R= 75–125%	If sample < 4 X the spike concentration, qualify data	Analyst	Accuracy	R= 75–125%
Matrix Spike Duplicate	1 per batch of 10 or less	RPD ±20%	Qualify data	Analyst	Precision	RPD ±20%
Extraction Fluid	1 per 10	Lead < 25 µg/L Arsenic < 5 µg/L	Remake solution	Analyst	Accuracy/Bias (Contamination)	Lead < 25 µg/L Arsenic < 5 µg/L
Bottle Blank	1 per batch of 20 or less	Lead < 50 µg/L Arsenic < 10 µg/L	Investigate, correct, re-extract	Analyst	Accuracy/Bias (Contamination)	Lead < 50 µg/L Arsenic < 10 µg/L
Method Blank	1 per batch of 20 or less	<RL	Investigate, rerun	Analyst	Accuracy/Bias (Contamination)	<RL
ICS	Per ICV/ICB	R = 80-120%	Rerun, recalibrate	Analyst	Accuracy/Bias	R = 80-120%

QAPP Worksheet #28-12 (Relinquished to SERAS by Region 9)
QC Samples Table

Matrix	Soil
Analytical Group	Metals: IVBA (Pb & As)
Concentration Level	Low
Sampling SOP	NA
Analytical Method/ SOP Reference	ACZ SOP #SOPII022.07.13.09
Sampler's Name	Region 9
Field Sampling Organization	Region 9
Analytical Organization	SERAS/ERT
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standard	Every sample	R = 30-120%	Recalculate using an alternative IS; if all IS are outside criteria, re-analyze on a 5X greater dilution. If samples are 'U' and ISTD recovery is high, qualify the data.	Analyst	Accuracy/Bias	R = 30-120%

QAPP Worksheet #28-13
QC Samples Table

Matrix	Soil
Analytical Group	Metals: IVBA (Pb & As)
Concentration Level	Low
Sampling SOP	SERAS SOP #2012
Analytical Method/ SOP Reference	EPA R9 SOPs 256, 407, 503
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Region 9
No. of Sample Locations	30

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spikes	1 per batch of 20 or less	75-125%	Qualify data	Analyst	Accuracy/Bias	75-125%
Matrix Spike Duplicates	1 per batch of 20 or less	RPD ± 20%	Qualify data	Analyst	Precision	RPD ± 20%
LCS (extract)	1 per batch of 20 or less	85-115%	Reanalyze first, then rerun batch or qualify data	Analyst	Accuracy/Bias	85-115%
SIC	Daily	<± 1/2 QL or calculated acceptance window, whichever is greater	Rerun or recalibrate	Analyst	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits

QAPP Worksheet #28-13
QC Samples Table

Matrix	Soil
Analytical Group	Metals: IVBA (Pb & As)
Concentration Level	Low
Sampling SOP	SERAS SOP #2012
Analytical Method/ SOP Reference	EPA R9 SOPs 256, 407, 503
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Region 9
No. of Sample Locations	30

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per batch of 20 or fewer samples	< ½ RL	If sample result< 5x MB rerun MB once to verify, if still outside criteria re-prep and re-run samples; If sample result> 5x MB or nondetect report without qualification	Analyst	Accuracy/Bias Contamination	< ½ RL
Sample Duplicate	1:20	±20%	Document, report	SERAS TL	Precision	±20%
LDR	Annually or when analytical conditions are changed	%R =% 90 -110%	Sample results > 90% of the upper LDR limit must be diluted and reanalyzed	Analyst	Accuracy/Bias	%R =% 90 -110%
Reagent Blank (extraction fluid)	1 per batch of 20 or fewer samples	Specific per analyte (< 25µg/L Pb)	Not specified	Analyst	Accuracy/Bias	Specific per analyte (< 25µg/L Pb)

QAPP Worksheet #28-13
QC Samples Table

Matrix	Soil
Analytical Group	Metals: IVBA (Pb & As)
Concentration Level	Low
Sampling SOP	SERAS SOP #2012
Analytical Method/ SOP Reference	EPA R9 SOPs 256, 407, 503
Sampler's Name	SERAS Field Personnel
Field Sampling Organization	SERAS
Analytical Organization	Region 9
No. of Sample Locations	30

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standard	Every standard and sample	60-125%	Re-extract, reanalyze affected samples, document	Analyst	Accuracy/Bias	60-125%

QAPP Worksheet #28-14
QC Samples Table

Matrix	Plant Tissue
Analytical Group	Metals
Concentration Level	Low
Sampling SOP	SERAS SOP #2037
Analytical Method/ SOP Reference	Katahdin SOP #CA-627-09
Sampler's Name	Gussman
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	10

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Post-digestion matrix spike	Every 20 samples	%R = 80 -120	Flag results and/or analyze sample by method of standard additions	Analyst	Accuracy/Bias	%R = 80 -120
Duplicate Sample	Every 20 samples	RPD ±20% if sample conc >100x IDL	Flag results	Analyst	Precision	RPD ±20% if sample conc >100x IDL
Field Duplicate	1 in 20	±35%	Document, report	SERAS Task Leader	Precision	±35%
LCS	Every 20 samples of same matrix	80-120% or performance acceptance limits	Investigate source of problem; re-digest & re-analyze all associated samples, unless LCS>120% and sample result <PQL	Analyst	Accuracy/Bias	80-120% or performance acceptance limits

QAPP Worksheet #28-14
QC Samples Table

Matrix	Plant Tissue
Analytical Group	Metals
Concentration Level	Low
Sampling SOP	SERAS SOP #2037
Analytical Method/ SOP Reference	Katahdin SOP #CA-627-09
Sampler's Name	Gussman
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	10

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
ICS	Before analyzing samples; every 12 hours during a run	Interferents: ±20% of true value	Do not use sample results for failing elements	Analyst	Accuracy/Bias Contamination	Interferents: ±20% of true value
Serial Dilution	1 per digestion batch	±10% if analyte concentration > 50 times instrument detection limit	Flag result or dilute and re-analyze sample to eliminate interference	Analyst	Accuracy/Bias	±10% if analyte concentration > 50 times instrument detection limit

QAPP Worksheet #28-15
QC Samples Table

Matrix	Plant Tissue
Analytical Group	Metals (Hg)
Concentration Level	Low
Sampling SOP	NA
Analytical Method/ SOP Reference	Katahdin SOP #CA-611
Sampler's Name	Gussman
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	10

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Post-digestion matrix spike	Every 20 samples	%R = 80 -120	Flag results and/or analyze sample by method of standard additions	Analyst	Accuracy/Bias	%R = 80 -120
Laboratory Duplicate Sample	Every 20 samples	RPD ±20%	Flag results	Analyst	Precision	RPD ±20%
Field Duplicate	1 in 20	NA	Document, report	SERAS Task Leader	Precision	±35%
LCS	Every 20 samples of same matrix	80-120% or performance acceptance limits	Investigate source of problem; re-digest & re-analyze all associated samples, unless LCS>120% and sample result <PQL	Analyst	Accuracy/Bias	80-120% or performance acceptance limits
Matrix Spike	Every 20 samples	75-125%	Flag results	Analyst	Accuracy/Bias	75-125%

QAPP Worksheet #28-15
QC Samples Table

Matrix	Plant Tissue
Analytical Group	Metals (Hg)
Concentration Level	Low
Sampling SOP	NA
Analytical Method/ SOP Reference	Katahdin SOP #CA-611
Sampler's Name	Gussman
Field Sampling Organization	SERAS
Analytical Organization	Katahdin Analytical
No. of Sample Locations	10

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
IDL Study	Prior to analysis of samples	IDL <RL	Repeat IDL study. Raise PQL	Analyst	Sensitivity	IDL <RL
LOD/LOQ Study	Prior to analysis of samples	LOD = 2-3x MDL LOQ > LOD	Repeat study.	Analyst	Sensitivity/Accuracy	LOD = 2-3x MDL LOQ > LOD
Serial Dilution	1 per digestion batch	±10%	Flag result or dilute and re-analyze sample to eliminate interference	Analyst	Accuracy/Bias	±10%

QAPP Worksheet #29
Project Documents and Records Table

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
Site Logbook Chain of Custody Records Sample Labels Field Change Form (if necessary)	XRF Logbook	Digestion and Analysis Logs TCLP Extraction Logs Preventive Maintenance Logs Instrument Printouts Calibration Data Internal COC Records Spreadsheet summaries, graphical analysis, maps, specific model data inputs, GIS digital elevation data and aerial imagery	Validation Report Model simulation data and results	Technical Memorandum QAPP XRF Trip Report WP

QAPP Worksheet #30
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number
Samples Collected by Region 9 in August 2013							
Soil	IVBA (As & Pb)	Low	NA	SOPSO048.06.13.05 & SOPII022.07.13.09	10 business days	ACZ Laboratories 2773 Downhill Drive Steamboat Springs, Co 80487 Tim VanWyngarden (970) 879-6590 ext 103	NA
Soil	TAL Metals, % Solids	Low to High	NA	SERAS SOP 1811 & SERAS SOP 1832	20 business days following receipt of samples	Jay Patel ERT/SERAS Laboratory Edison, NJ (732) 494-4052	NA
November 2013 – Spring 2014							
Soil/Sediment/ Slag/Dross/ Waste Rock/ Groundwater/ Surface Water	TAL Metals	Low to High	Refer to Worksheet 18	ISM01.3	35 days	CLP-assigned Laboratory	USEPA R9 Laboratory
Soil/ Waste Rock/ Dross/Slag	SPLP Metals (RCRA 8 + Zn, Cu, Al, Fe and Mn)	Low to High	Refer to Worksheet 18	R9 SOP 254 R9 SOP 407 R9 SOP 503 R9 SOP 515	35 days	Sample Receiving USEPA R9 Laboratory 1337 South 46th Street, Bldg 201 Richmond, CA 94804 (510) 412-2389	NA
Tissue	TAL Metals	Low	Refer to Worksheet 18	SW846 6020A	Prelims 10 business days from receipt of the samples; complete data package 15 business days from receipt of the samples	Gregory Lull Katahdin Analytical 600 Technology Way Scarborough, ME 04074 (207) 874-2400	NA

QAPP Worksheet #30
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number
Soil	IVBA (As & Pb)	Low to High	Refer to Worksheet 18	R9 SOP 256 R9 SOP 407 R9 SOP 503	35 days	Sample Receiving USEPA R9 Laboratory 1337 South 46th Street, Bldg 201 Richmond, CA 94804 (510) 412-2389	NA
Soil	Cr(VI)	Low	Refer to Worksheet 18	EPA 7196	Prelims 10 business days from receipt of the samples; complete data package 15 business days from receipt of the samples	Gregory Lull Katahdin Analytical 600 Technology Way Scarborough, ME 04074 (207) 874-2400	NA
Soil/Dross Material/ Sediment	Dioxin	Low	Refer to Worksheet 18	SW 846/8290 (EPA 1613)	Prelims 15 business days from receipt of the samples; complete data package 20 business days from receipt of samples	Gregory Lull Katahdin Analytical 600 Technology Way Scarborough, ME 04074 (207) 874-2400 (Cape Fear Analytical, LLC)	NA
Sediment	TOC	NA	Refer to Worksheet 18	SW 846 9060A mod	Prelims 10 business days from receipt of the samples; complete data package 15 business days from receipt of the samples	Gregory Lull Katahdin Analytical 600 Technology Way Scarborough, ME 04074 (207) 874-2400	NA

QAPP Worksheet #30
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number
Groundwater/ Surface Water	Alkalinity; Chloride; Nitrie/Nitrate; Sulfate; Phosphate; Silicon; Dissolved Organic Carbon; TDS; Fluoride	NA	Refer to Worksheet 18	SM2320B EPA 325.2 EPA 353.2 EPA 375.4 EPA 365.4 SW 846 6010 SM5310B SM2540C EPA 300	Prelims 10 business days from receipt of the samples; complete data package 15 business days from receipt of the samples	Gregory Lull Katahdin Analytical 600 Technology Way Scarborough, ME 04074 (207) 874-2400	NA
Soil/ Waste Rock/ Dross/ Slag	ABA	NA	Refer to Worksheet 18	ASTM D2974-07a; Neutralization Potential; Grind; Saturated Paste pH; ASTM E1915-09; ABA	15 business days from receipt of the samples	Gregory Lull Katahdin Analytical 600 Technology Way Scarborough, ME 04074 (207) 874-2400 (ALS Environmental)	NA
Soil	Geotechnical Measurements (moisture density, hydraulic conductivity, specific gravity, grain size, Atterberg limits, natural moisture, consolidation, shear test, consolidated undrained triaxial shear test)	NA	Refer to Worksheet 18	ASTM D2937 ASTM D5084 ASTM D854 ASTM D422 ASTM D4318 ASTM D2216 ASTM D2435 ASTM D3080 ASTM D4767	15 business days from receipt of each batch of samples	Adam Arp-Romero, P.E. Speedie & Associates, Inc. 4025 E. Huntington Dr. Ste. #140 Flagstaff, AZ 86004 (928) 526-6681	NA

QAPP Worksheet #30
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number
Soil	Geotechnical Parameter – Soil Water Characteristic Curves	NA	Refer to Worksheet 18	ASTM 6836	15 business days from receipt of each batch of samples	Mike Yao, Ph.D. GeoSystems Analysis Inc. 393 N. Dodge Blvd. Tucson, AZ 85716 Phone: 520-628-9330 Cell: 520-270-8252	NA
Rock	Geotechnical Parameter – Slake Durability	NA	Refer to Worksheet 18	ASTM D4644	15 business days from receipt of each batch of samples	Mike Yao, Ph.D. GeoSystems Analysis Inc. 393 N. Dodge Blvd. Tucson, AZ 85716 Phone: 520-628-9330 Cell: 520-270-8252	NA

QAPP Worksheet #31
Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Laboratory Accreditation Audit	Every 3 years	Internal	NELAC accrediting agency	Regulatory Agency	Debbie Killeen, QA/QC Officer SERAS Laboratory	Debbie Killeen, QA/QC Officer SERAS Laboratory	NELAC Accrediting Authority
Laboratory Audit	Annual	Internal	ERT/SERAS Laboratory	Debbie Killeen, QA/QC Officer SERAS Laboratory	Lab Operations Personnel	Lab Operations Personnel	QA/QC Officer
Performance Evaluation Samples	Annual	Internal	Regulatory Agency	Regulatory Agency	Debbie Killeen, QA/QC Officer SERAS Laboratory	Debbie Killeen, QA/QC Officer SERAS Laboratory	Regulatory Agency
Laboratory Technical Systems/ Performance Audits	As per regulatory program	External	Regulatory Agency	Regulatory Agency	EPA CLP Laboratory	EPA CLP Laboratory	EPA or other Regulatory Agency
Performance Evaluation Samples	As per regulatory program	External	Regulatory Agency	Regulatory Agency	EPA CLP Laboratory	EPA CLP Laboratory	EPA or other Regulatory Agency
Laboratory Technical Systems/ Performance Audits	As per regulatory program	External	Regulatory Agency	Regulatory Agency	QA/QC Officer, EPA R9 Lab	Laboratory Manager, EPA R9 Lab	EPA or other Regulatory Agency
Performance Evaluation Samples	As per regulatory program	External	Regulatory Agency	Regulatory Agency	QA/QC Officer, EPA R9 Lab	Laboratory Manager, EPA R9 Lab	EPA or other Regulatory Agency
Laboratory Accreditation Audit	Every 2 years	External	NELAC Accrediting Agency	New Jersey Department of Environmental Protection (NJ DEP)	QA Officer, Katahdin Analytical Services	QA Officer, Katahdin Analytical Services	NJ DEP

QAPP Worksheet #31
Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Laboratory Accreditation Audit	Every 2 years	External	NELAC Accrediting Agency	Utah Department of Health (DOH)	QA Officer, Cape Fear Analytical Services QA Officer, ACZ Laboratories	QA Officer, Cape Fear Analytical Services QA Officer, ACZ Laboratories	Utah DOH
Laboratory Accreditation Audit	Every 2 years	External	NELAC Accrediting Agency	Texas Commission on Environmental Quality	QA Officer, ALS Environmental	QA Officer, ALS Environmental	Texas Commission on Environmental Quality

QAPP Worksheet #32
Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Field Observations/ Deviations from Work Plan	Logbook	D. Aloysius, Response TL, SERAS	Immediately	Field Change Form	D. Aloysius, Response TL, SERAS	Within 24 hours of change
Peer review of reports	Directly on deliverable	D. Aloysius, TL, SERAS	Prior to deliverable due date	Comments directly on deliverable	D. Aloysius, TL, SERAS	Prior to deliverable due date
Laboratory Accreditation Audit	Audit Report	Debbie Killeen, QA/QC Officer, SERAS	30 days	Corrective Action Plan	Regulatory Agency	Within 30 Days
Laboratory Audit	Audit Report	Jay Patel, ICP/ICP-MS. Chemist, SERAS	45 days	Corrective Action Plan	Debbie Killeen, QA/QC Officer, SERAS	Within 45 Days
Laboratory Accreditation Audit	Audit Report	QA Officer, Katahdin Analytical Services	30 days	Corrective Action Plan	QA Officer, Katahdin Analytical Services	Within 30 Days
Laboratory Accreditation Audit	Audit Report	QA Officer, Cape Fear Analytical Services QA Officer, ACZ Laboratories	30 days	Corrective Action Plan	QA Officer, Cape Fear Analytical Services QA Officer, ACZ Laboratories	Within 30 Days
Laboratory Accreditation Audit	Audit Report	QA Officer, ALS Environmental	30 days	Corrective Action Plan	QA Officer, ALS Environmental	Within 30 Days
Laboratory Technical Systems/ Performance Audits	Written Report	EPA CLP Laboratory	30 days	Letter	Laboratory Manager, EPA CLP Laboratory	14 days
Performance Evaluation Samples	Electronic Report	EPA CLP Laboratory	30 days	Letter or Written Report	Laboratory Manager, EPA CLP Laboratory	14 days

Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Laboratory Technical Systems/ Performance Audits	Written Report	Region 9 Laboratory	30 days	Letter	Laboratory Manager, EPA R9 Laboratory	14 days
Performance Evaluation Samples	Electronic Report	Region 9 Laboratory	30 days	Letter or Written Report	Laboratory Manager, EPA R9 Laboratory	14 days

QAPP Worksheet #33
QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Technical Report	Monthly	20th of the month following performance period	Dave Aloysius, Task Leader/SERAS	ERT Project Officer and WAM
QA Report	Quarterly	February, May, August, November	Deborah Killeen, QA/QC Officer/SERAS	ERT Project Officer and Quality Coordinator

QAPP Worksheet #34
Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Raw data	Verify that all acquired data have been backed-up, either to a shared drive or external storage media (e.g., compact disc).	Internal	D. Aloysius/SERAS
Processed data	Verify that all processed and graphed data are correct	Internal	D. Aloysius/SERAS
Model assessment	Review model theory, mathematical structure and required input parameters to verify that the model will perform the required tasks in order to meet the objectives of the study.	Internal	D. Aloysius/SERAS
Modeling and related calculations	Verify correct data input	Internal	D. Aloysius/SERAS
Technical memorandums	Verify that transcription errors are not present	Internal	Peer Review team
FP XRF Report/Trip Report	Reviewed for accuracy	Internal	Peer Review Team
Chain of Custody Record	Reviewed by field sampling personnel in field.	Internal	D. Aloysius/SERAS S. Grossman/SERAS C. Gussman/SERAS
Completeness Check	Review of Planning Documents, Analytical Data Package, Sampling Documents and External Reports, as applicable, using the UFP-QAPP Checklist	Internal	D. Aloysius/SERAS S. Grossman/SERAS C. Gussman/SERAS SERAS QA/QC Chemists

QAPP Worksheet #35
Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
January 2014 – Spring 2014			
IIa	SOPs	Ensure that the sampling methods/procedures outlined in the QAPP were followed and any deviations noted. Examine COC forms against QAPP and laboratory contract requirements (e.g., analytical methods, sample identification, etc.).	D. Aloysius/SERAS T. Johnson/ERT WAM
IIb	SOPs	Determine potential impacts from noted/approved deviations, in regard to PQOs.	D. Aloysius/SERAS
IIa	COC Records	Examine COC records and match with requested analyses.	J. Patel, SERAS A.Vaidya, SERAS S.Sahni, SERAS
IIa	Laboratory data package	Examine packages against QAPP and laboratory contract requirements, and against COC forms (e.g., holding times, sample handling, analytical methods, sample identification, data qualifiers, QC samples, etc.).	QA/QC Chemist, SERAS Laboratory Personnel Data Validation Personnel
IIb	Laboratory data package	Determine potential impacts from noted/approved deviations, in regard to PQOs. Examples include PQLs and QC sample limits (precision/accuracy).	QA/QC Chemist, SERAS ESAT and EPA R9 Data Validation Personnel

QAPP Worksheet #36
Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
Samples Collected by Region 9 in August 2013					
IIa/IIb	Soil	TAL Metals	Low to high	SERAS SOP #1017, *Data Validation Procedures for Routine Inorganic Analysis*	SERAS QA/QC Chemist
IIa/IIb	Soil	IVBA (Pb & As)	Low to high	SERAS SOP #1017, *Data Validation Procedures for Routine Inorganic Analysis*	SERAS QA/QC Chemist
January 2014 through Spring 2014					
IIa/IIb	Soil/Sediment/Slag/ Dross/Rock/Water	TAL Metals	Low to high	Data Validation SOP for Inorganic Analysis of Low/Medium Concentration Total Metals under SOW ILM0 5.4	ESAT Data Validation Personnel
IIa/IIb	Soil/Sediment	SPLP Metals; IVBA	Low to high	Data Validation SOP for Inorganic Analysis of Low/Medium Concentration Total Metals under SOW ILM0 5.4	EPA Region 9 Personnel
IIa/IIb	Soil/Water	Cr(VI), Water Quality Parameters, IVBA, TOC	Low	SERAS SOP #1017, *Data Validation Procedures for Routine Inorganic Analysis*	SERAS QA/QC Chemist
IIa/IIb	Sediment/Dross	Dioxins/furans	Low	SERAS SOP #1019, *Data Validation Procedures for Dioxin/Furan Analysis by HRGC/HRMS*	SERAS QA/QC Chemist

☑ Worksheet Not Applicable (State Reason) Usability of the data will be determined by EPA Region 9 and EPA ERT.

QAPP Worksheet #37
Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:
Describe the evaluative procedures used to assess overall measurement error associated with the project:
Identify the personnel responsible for performing the usability assessment:
Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

ATTACHMENT 1
Draft Supplemental Field Investigation Workplan
Iron King Mine Site UFP-QAPP
December 2013

ATTACHMENT 2
Residential Sampling Approach
Iron King Mine Site UFP-QAPP
December 2013