FINAL

September 17, 2008

PHASE II
SAMPLING AND ANALYSIS PLAN
FOR OPERABLE UNIT 3
LIBBY ASBESTOS SUPERFUND SITE

Part C: Ecological Data

Prepared by
U.S. Environmental Protection Agency
Region 8
Denver, CO

With Technical Assistance from:

Syracuse Research Corporation
Denver, CO

and

NewFields Boulder LLC
Boulder, CO

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APPROVAL PAGE

Part C of the Phase II Sampling and Analysis Plan for Operable Unit 3 of the Libby Asbestos Superfund Site has been prepared by the U.S. Environmental Protection Agency, Region 8, with technical support from Syracuse Research Corporation and NewFields Boulder LLC, and is approved without conditions.

Bonita Lavelle
Remedial Project Manager, Libby OU3

Date 9/17/08

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A.2	Phase I QC Summary
B	Standard Operating Procedures
C	Libby-Specific Laboratory Modifications

LIST OF ACRONYMS

AOC	Administrative Order on Consent
CAR	Corrective Action Request
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
COC	Chain-of-Custody
CSM	Conceptual Site Model
DO	Dissolved Oxygen
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
EDXA	Energy Dispersive X-Ray Analysis
EPA	U.S. Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbons
FS	Feasibility Study
FSDS	Field Sample Data Sheets
FSP	Field Sampling Plan
FTP	File Transfer Protocol
GC/MS	Gas chromatography/mass spectroscopy
GO	Grid opening
GPS	Global Positioning System
GSD	geometric standard deviation
HASP	Health and Safety Plan
HQ	Hazard Quotient
ICV	Initial Calibration Verification
ID	Identification
IL	Inter-laboratory
ISO	International Organization for Standardization
IS	Internal Standard
KDC	Kootenai Development Corporation
LA	Libby Amphibole
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MCE	Mixed Cellulose Ester
MCL	Maximum Contaminant Level
MDEQ	Montana Department of Environmental Quality
MFL	Million fibers per liter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NVLAP	National Voluntary Laboratory Accreditation Program
OU	Operable Unit
PAH	Polyaromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PDF	Portable Document Format

LIST OF ACRONYMS (cont.)

PE	Performance Evaluation
PLM	Polarized Light Microscopy
PLM-VE	Polarized Light Microscopy Visual Area Estimation Method
PLN	Poisson lognormal
PR	Percent Recovery
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QATS	Quality Assurance Technical Support
QC	Quality Control
RD	Recount Different
RF	Response Factors
RI	Remedial Investigation
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RS	Recount Same
RSD	Relative Standard Deviation
SAED	Selective Area Electron Diffraction
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SVOC	Semi-volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TEH	Total Extractable Hydrocarbons
TEM	Transmission Electron Microscopy
TRV	Toxicity Reference Value
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound
VPH	Volatile Petroleum Hydrocarbons

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PHASE II
SAMPLING AND ANALYSIS PLAN
FOR OPERABLE UNIT 3
LIBBY ASBESTOS SUPERFUND SITE

PART C: SAMPLING AND ANALYSES TO SUPPORT ECOLOGICAL RISK ASSESSMENT

1.0 PROJECT OVERVIEW

1.1 Purpose of this Document

This document is Part C of the Phase II Sampling and Analysis Plan (SAP) for the collection and analysis of samples to support a remedial investigation/feasibility study (RI/FS) within Operable Unit 3 (OU3) of the Libby Asbestos Superfund Site near Libby, Montana. OU3 includes the property in and around the former open pit vermiculite mine that is located northeast of the community of Libby, as well as the geographic area surrounding the former vermiculite mine that has been impacted by releases and subsequent migration of hazardous substances and/or pollutants or contaminants from the mine, including ponds, Rainy Creek, Carney Creek, Fleetwood Creek, and the Kootenai River. Rainy Creek Road is also included in OU3. The exact geographic area of OU3 has not yet been defined but will be based primarily upon the extent of contamination associated with releases from the former vermiculite mine as determined in the remedial investigation (RI) of OU3. The purpose of Part C of the Phase II SAP for OU3 is to guide the collection of data that will be used to assess the risks to ecological receptors associated with the release of mining-related contaminants to surface water, sediments, soils, air and biota. These data include information on contaminant levels in surface water and sediment, sediment toxicity, benthic invertebrate community structure and function, and fish populations. These data will be used to support an RI of OU3, the goal of which is to characterize the nature and extent of mining-related contamination in OU3, and to characterize the nature and level of risk posed by mining-related contamination to ecological receptors in OU3.

This SAP contains the elements required for both a field sampling plan (FSP) and quality assurance project plan (QAPP). This SAP has been developed in accordance with Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans (EPA 2001) and the Guidance on Systematic Planning Using the Data Quality Objectives Process – EPA QA/G4 (EPA 2006). The SAP is organized as follows:

Section 1 – Project Overview
Section 2 – Background and Problem Definition
Section 3 – Summary of Phase I Data

Section 4 – Data Quality Objectives
Section 5 – Sampling Program Design
Section 6 – Sampling Method Requirements
Section 7 – Laboratory Testing Requirements
Section 8 – Sample Documentation
Section 9 – Laboratory Analysis Requirements
Section 10 – Quality Control
Section 11 – Data Management
Section 12 – Assessment and Oversight
Section 13 – Data Validation and Usability
Section 14 – References

1.2 Project Management and Organization

Project Management

EPA is the lead regulatory agency for Superfund activities within OU3. The EPA Remedial Project Manager (RPM) for OU3 is Bonita Lavelle, EPA Region 8. Ms. Lavelle is a principal data user and decision-maker for Superfund activities within OU3.

The Montana Department of Environmental Quality (MDEQ) is the support regulatory agency for Superfund activities within OU3. The MDEQ Project Manager for OU3 is Catherine LeCours. EPA will consult with MDEQ as provided for by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the National Contingency Plan, and applicable guidance in conducting Superfund activities within OU3.

EPA has entered into an Administrative Order on Consent (AOC) with Respondents W.R. Grace & Co.-Conn. and Kootenai Development Corporation (KDC). Under the terms of the AOC, W.R. Grace & Co.-Conn. and KDC will implement this SAP. The designated Project Coordinator for Respondents W.R. Grace & Co.-Conn. and KDC is Robert Medler of Remedium Group, Inc.

Technical Support

EPA will be supported in this project by a number of contractors, including:

- Syracuse Research Corporation (SRC) will assist in the development of sampling and analysis plans, in the evaluation and interpretation of the data, and preparation of the baseline risk assessments for OU3.

- NewFields Boulder LLC, working as a subcontractor to SRC, will provide support in development of sampling and analysis plans, evaluation and interpretation of data, mapping and other GIS applications, and design and evaluation of the feasibility study.

Field Sampling Activities

All field sampling activities described in this SAP will be performed by W.R. Grace & Co.-Conn. and KDC, in strict accord with the sampling plans developed by EPA. W.R. Grace & Co.-Conn. and KDC will be supported in this field work by Parametrix. Individuals responsible for implementation of field sampling activities are listed below:

- Parametrix Project Officer: Bill Stubblefield
- Parametrix Deputy Project Officer: Sue Robinson
- Parametrix Field Supervisor: Joe Volosin
- Parametrix Quality Control Officer: Brad Hermanson
- Parametrix Field Quality Control Officer: Jeff Wirtz

On-Site Field Coordinator

Access to the mine is currently restricted and is controlled by EPA. The on-site point of contact for access to the mine is Courtney Zamora of the U.S. Department of Transportation, John A. Volpe National Transportation Systems Center (Volpe).

Sample Preparation and Analysis

All samples collected as part of the Phase II investigation will be sent for preparation and/or analysis at laboratories selected and approved by EPA.

- All analyses of surface water samples for asbestos will be performed by EMSL Analytical, Inc.
- All analyses of sediment samples for asbestos will be performed by Hygeia Laboratories, Inc. or EMSL Analytical, Inc.
- All analyses of samples for non-asbestos analytes will be performed by Energy Laboratories, Inc. (ELI)
- All samples of sediment to be analyzed for asbestos will be prepared for analysis by EPA's soil preparation facility in Denver, CO, operated by CDM.
- All validation and verification activities for asbestos and non-asbestos data will be performed by SRC or their subcontractors.
- All benthic invertebrate samples will be processed and identified by Aquatic Associates Inc. in Fort Collins, CO.

Data Management

Administration of the master OU3 database for OU3 will be performed by EPA contractors (SRC and NewFields). The primary database administrator will be Lynn Woodbury of SRC. She will be responsible for sample tracking, uploading new data, performing error checks to identify inconsistent or missing data, and ensuring that corrections are made as needed. When the OU3 database has been populated, checked and validated, relevant asbestos data will be transferred into the Libby2 database for final storage as directed by EPA.

2.0 BACKGROUND AND PROBLEM DEFINITION

2.1 Site Description

Libby is a community in northwestern Montana that is located near a large open-pit vermiculite mine. Vermiculite from the mine at Libby is known to be contaminated with amphibole asbestos that includes several different mineralogical classifications, including richterite, winchite, actinolite and tremolite. For the purposes of EPA investigations at the Libby Superfund Site, this mixture is referred to as Libby Amphibole (LA).

Historic mining, milling, and processing of vermiculite at the site are known to have caused releases of vermiculite and LA to the environment. Inhalation of LA associated with the vermiculite is known to have caused a range of adverse health effects in exposed humans, including workers at the mine and processing facilities (Amandus and Wheeler 1987, McDonald et al. 1986, McDonald et al. 2004, Sullivan 2007, Rohs et al. 2007), as well as residents of Libby (Peipens et al. 2003). Based on these adverse effects, EPA listed the Libby Asbestos Site on the National Priorities List in October 2002.

Starting in 2000, EPA began taking a range of cleanup actions at the site to eliminate sources of LA exposure to area residents and workers using CERCLA (or Superfund) authority. Given the size and complexity of the Libby Asbestos Site, EPA designated a number of Operable Units (OUs). In the early stages, efforts were focused mainly on wastes remaining at former vermiculite processing areas including OU1 (the export plant) and OU2 (the screening plant). As work progressed, attention shifted to cleanup of current homes and workplaces in the main residential/commercial areas of Libby, designated by EPA as OU4. To date, Superfund investigation and cleanup activities have been conducted by EPA within OU4 and some of the historic processing areas in and around the town of Libby. Environmental investigations of the nearby town of Troy, designated as OU7, began in the summer of 2007. The Phase I RI for OU3 was implemented in September-October of 2007.

Figure 2-1 shows the location of the mine and a preliminary study area boundary for OU3. EPA established the preliminary study area boundary for the purpose of planning and developing the scope of the RI/FS for OU3. This study area boundary may be revised as data are obtained during the RI for OU3 on the nature and extent of environmental contamination associated with releases that may have occurred from the mine site.

2.2 Basis for Concern at OU3

EPA is concerned with environmental contamination in OU3 because the area is used by humans for logging and a variety of recreational activities, and also because the area is habitat for a wide

range of ecological receptors (both aquatic and terrestrial). Contaminants of potential concern to EPA in OU3 include not only LA, but any other mining-related contaminants that may have been released to the environment.

2.3 Scope and Strategy of the RI at OU3

As noted above, EPA is conducting an RI in OU3 in order to characterize the nature and extent of environmental contamination in OU3 and to evaluate risks to humans and ecological receptors from mining-related contaminants in the environment.

Respondents W.R. Grace & Co.-Conn. and KDC performed the first round of RI sampling (referred to as Phase I) in OU3 in the fall of 2007 in accord with the Phase I SAP for Operable Unit 3 (USEPA 2007). The primary goal of the Phase I investigation was to obtain preliminary data on the levels and spatial distribution of asbestos and also other non-asbestos contaminants that might have been released to the environment in the past as a consequence of the mining and milling activities at the site.

One component of the RI at OU3 includes characterizing exposure and risk to aquatic receptors that reside in surface water bodies that may be impacted by releases from the mined area. This includes the waters of Fleetwood Creek, Carney Creek, Rainy Creek, the on-site tailings and Mill Ponds, and potentially (if data indicate), the Kootenai River. Typically, water flow in these surface water features varies seasonally, being highest during the spring snowmelt period. Variation in water flow rate is potentially important because flow might have effects on the concentrations and amounts of asbestos and/or non-asbestos contaminants being carried by the water. It is not known if asbestos or any other constituent will show similar patterns in the Rainy Creek watershed, but if such seasonal variations do occur, it is important to characterize the timing and magnitude of the variations. For this reason, a Phase IIA SAP for surface water and sediment (USEPA, 2008a) was prepared (ahead of other components) to ensure that sample collection can include the spring runoff period.

One component of the RI at OU3 includes characterizing exposure and risk to human receptors that may be impacted by releases from the mined area. A Phase IIB SAP was prepared to describe the collection of ambient air and groundwater data to support the characterization of exposure and risks to human health (USEPA, 2008b).

An additional component of the RI at OU3 includes characterizing exposure and risk to ecological receptors other than those addressed by the Phase IIA SAP. This Phase IIC SAP is prepared to describe the collection of data to support the characterization of exposure and risk to aquatic receptors exposed to sediments and surface water impacted by releases from the mined area.

A Problem Formulation document has been prepared by EPA (USEPA, 2008c) which represents the systematic planning step that identifies the major concerns and issues to be considered in the ecological risk assessment (ERA) and describes the basic approaches that may be used to characterize ecological risks. The Problem Formulation identifies the ecological setting at OU3, the nature of contamination and the ecological receptors that may come into contact with contaminated media. Conceptual site models (CSMs) are developed that summarize the understanding of contaminant sources, fate and transport pathways, and exposure pathways that are possible for each group of ecological receptors. Risk management objectives for OU3 are identified as well as risk management goals and the general strategies that are available to assess risks for ecological receptors.

The Problem Formulation reviews the strategies that are available for the evaluation of risks to ecological receptors from non-asbestos and asbestos contamination at OU3. The Phase IIC SAP represents implementation of a subset of elements of the presented strategies. Additional SAPs may be developed by EPA in the future to guide data collection as necessary to implement other aspects of the strategy for assessing ecological risks at OU3.

3.0 SUMMARY OF PHASE I DATA

Detailed data from the Phase I investigation for both asbestos and non-asbestos analytes are provided in Attachment A.1. Attachment A.2 presents a summary and interpretation of the quality control samples collected as part of the Phase I investigation that are specific to the surface water, sediment, mine waste, forest soil and tree bark results discussed below. Detailed surface water and sediment data from the Phase I investigation for both asbestos and non-asbestos analytes are available in *Phase II Sampling and Analysis Plan for Operable Unit 3 Libby Asbestos Superfund Site Part A: Surface Water and Sediment* (USEPA, 2008a). The following sections summarize the sampling and analytical results of the Phase I investigation. Data reported here include summary statistics on the detection frequency and observed levels of each analyte evaluated in each medium (surface water, sediment, mine waste, forest soil, duff, and tree bark).

In considering these data, it is important to note that detection of a chemical in a site medium may not indicate that a release has occurred, since many of the detected chemicals occur naturally in the environment. In addition, concentration values may tend to vary over geographic area and time (e.g., concentrations may potentially be higher during spring runoff than during the fall). The area within which human and/or ecological receptors come into contact with LA or mining-related chemicals may vary by receptor. Therefore, it is important to collect data that provide adequate spatial and temporal representativeness before comparing to benchmarks or using the data to assess potential risk to humans or environmental receptors.

3.1 Surface Water

Sampling Stations

During Phase I, surface water samples were collected at a total of 24 locations, as shown in Figure 3-1. As seen, sampling stations include a number of locations along Carney Creek, Fleetwood Creek, and Rainy Creek, including ponds and impoundments on these streams, as well as seeps and springs that were located nearby.

Chemical Analyses

All surface water samples collected during Phase I were analyzed for asbestos, metals and metalloids, petroleum hydrocarbons, anions, and other water quality parameters. In addition, surface water samples collected from stations TP-TOE1 and LRC-2 were analyzed for a broad suite of other chemicals, including volatile organic chemicals (VOCs), semi-volatile organic chemicals (SVOCs), pesticides, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), nitrogen-containing compounds, and selected radionuclides. These locations were selected specifically to characterize waters generated by the confluence of flows

from the upper and lower portions of the mined area. Table 3-1 lists the analytical methods that were employed, and Table 3-2 shows the analyses that were performed at each station.

Asbestos Results for Phase I

Table 3-3 summarizes the results of the analysis of surface water and seeps for asbestos (LA). Results are expressed in terms of million fibers per liter (MFL). As seen, concentration values of total LA ranged widely (more than four orders of magnitude), from < 0.1 to 125 MFL.

Figure 3-2 is a map that displays the spatial pattern of results. The highest levels were observed in samples located in ponds or impoundments, including the tailings impoundment, the Mill Pond, and the pond on Fleetwood Creek, as well as from several seeps along the south side of the mined area. Levels of LA in the ponds exceed the human health maximum contaminant level (MCL) for asbestos of 7 MFL based on particles longer than 10 um. Levels in lower Rainy Creek (below the Mill Pond) tended to be relatively low. A sample collected just upstream of the confluence of Rainy Creek and the Kootenai River (LRC-6) was non-detect as were the samples collected just below the tailings impoundment toe drain (TP-TOE1).

Non-asbestos Results for Phase I

Table 3-4 includes summary statistics on the frequency and level of analytes detected in surface water samples analyzed as part of the Phase I investigation. As seen, no VOCs, SVOCs, PCBs, or PAHs were detected in any surface water sample collected. Metals were detected at every station. Specifically, barium and the cations calcium, magnesium, potassium and sodium were detected at every station. Copper was only detected at Station LRC-4, vanadium was only detected at Station CCS-1, and iron was only detected in Carney Creek (Station CC-1) and in two seeps (Stations CCS-1 and CCS-16). Manganese was detected in the tailings impoundment (including the toe drains) and in some seeps (Stations CCS-6 and CCS-16). Nitrogen compounds were detected in Rainy Creek, including the tailings impoundment and in the pond on Fleetwood Creek. The anions fluoride, sulfate and phosphorus were detected at all stations and chloride was detected at all stations except those located on Upper Rainy Creek (Stations URC-1 and URC-2). Several indicators of petroleum hydrocarbons were detected along Fleetwood Creek (Stations FC-2 and FC-Pond) and in two seeps (Stations CCS-1 and CCS-14).

3.2 Sediment

Sampling Stations

During Phase I, sediment samples were collected at a total of 24 locations, as shown in Figure 3-1 at the same locations as surface water samples. As seen, sampling stations include a number of locations along Carney Creek, Fleetwood Creek, and Rainy Creek, including ponds and impoundments on these streams, as well as seeps and springs that were located nearby.

Chemical Analyses

All sediment samples collected during Phase I were analyzed for asbestos, metals and metalloids, petroleum hydrocarbons, and several sediment quality parameters. In addition, sediment samples collected from stations LRC-2 and TP-TOE2 were analyzed for a broad suite of other chemicals, including cyanide, pesticides, PCBs, VOCs, SVOCs, and PAHs. Table 3-5 lists the analytical methods that were employed, and Table 3-6 shows the analyses that were performed at each station.

Asbestos Results for Phase I

Sediment samples were dried and divided into two fractions (coarse and fine) by sieving. Concentrations of LA in the coarse fraction were measured gravimetrically and expressed as a mass percent (grams of LA per 100 grams of coarse fraction). Concentrations in the fine fraction were measured using polarized light microscopy using a visual area estimation approach (PLM-VE). Results for PLM-VE are expressed as mass percent if the concentration is 1% or higher (Bin C). If the estimated concentration is <1%, the results are expressed semi-quantitatively, according to the following scheme:

PLM-VE Result	Range of Mass Percent
Bin A (ND)	None detected (likely < 0.05%)
Bin B1 (Trace)	LA detected, > 0% but < 0.2%
Bin B2 (<1%)	LA detected, >0.2% but < 1%
>1%	Results presented as percentage without qualifier

Table 3-7 summarizes the analytical results for asbestos (LA) in sediment. As seen, nearly all (22 out of 24) of the sediment samples collected contain LA. In the fine fraction, values ranged from non-detect (at URC-1 and FC-1) up to 7% at CCS-9. In the coarse fraction, levels generally ranged from non-detect to 0.5%.

LA was detected in most samples, except those collected in the upper-most reaches of Rainy Creek and Fleetwood Creek. Concentrations of 1% or higher (Bin C) were detected in multiple locations. The highest levels observed were in samples collected from on-site seeps. Figure 3-3 shows the spatial pattern of LA in the fine fraction of sediment.

Non-asbestos Results for Phase I

Table 3-8 summarizes the results for analytes detected in sediment samples analyzed as part of the Phase I investigation. As seen, a number of inorganic constituents were detected, as were several indicators of petroleum hydrocarbons. The laboratory noted that the composition of

some of the petroleum hydrocarbons detected did not resemble the composition expected for man-made fuels, and might be natural in origin. In addition, methyl acetate was detected in two samples (TP-TOE2, LRC-2) and pyrene was detected in one sample (TP-TOE2). No other chemicals were detected in any sample. Table 3-8 also includes screening benchmarks for toxicity to benthic invertebrates for each analyte (detected). These benchmarks are reviewed and listed in the Problem Formulation document for OU3 (USEPA, 2008c). Maximum detected concentrations of aluminum, chromium, copper, lead, manganese, and nickel exceed one or both of the respective toxicity benchmarks. The concentrations for these metals are plotted geographically in Figure 3-4.

As noted above, it is not appropriate to draw any strong conclusions regarding whether or not a release has occurred or whether any of the values are of potential concern until additional data are collected to ensure adequate representativeness of the data.

3.3 Mine Waste/Site Soils

Sampling Stations

During Phase I, mine waste and/or soil samples were collected at several locations as shown in Figure 3-5. These samples focused on each of the principal mine waste materials identified to date including mine waste rock, impounded tailings, and coarse tailings as well soils in the former mill area and materials used for construction of unpaved sections of Rainy Creek Road. These samples are divided into six categories:

Road	MS-1 to MS-2
Tailings Impoundment	MS-4 and M-5
Coarse Tailings	MS-6 to MS-9
Cover Material	MS-10 to MS-13; MS-21 to MS-24
Waste Rock	MS-14 to MS-20; MS-26 to MS-30; MS-32
Outcrop	MS-25; MS-31; MS-33 to MS-38

Chemical Analyses

All mine waste and soil samples were analyzed for asbestos, metals and metalloids, petroleum hydrocarbons, as well as pH, moisture content and organic carbon content. This was with the exception of outcrop samples which were not analyzed for petroleum hydrocarbons. In addition, samples from the tailings impoundment were analyzed for a broad suite of other chemicals. Table 3-9 lists the analytical methods that were used, and Table 3-10 shows the analyses that were performed at each sampling location.

Asbestos Results for Phase I

Similar to sediment samples, mine waste samples were dried and divided into two fractions (coarse and fine) by sieving and analyzed as described above. Table 3-11 and Figure 3-6 summarize the results of the analysis of asbestos (LA) in mine waste and soil samples. All soil samples with the exception of the sample collected from station MS-23 (cover material) contained LA. Of these, 3 are classified as Bin B1 (<0.2%), 27 are classified as Bin B2 (0.2% to 1%), and 7 are estimated to contain LA levels from 2-8%. In general, asbestos concentrations were highest in outcrop followed by wasterock and coarse tailings.

Non-asbestos Results for Phase I

Table 3-12 includes summary statistics on the frequency and level of analytes detected in mine waste samples analyzed as part of the Phase I investigation. As seen, no SVOCs or PCBs were detected in any mine waste sample collected. Metals were detected at every station. Specifically, aluminum, barium, chromium, cobalt, iron, manganese, nickel, vanadium and zinc were detected at every station. Copper was detected at every station except the outcrop station MS-37. Lead was detected at every station except at two outcrop stations (MS-36 and MS-37). Arsenic was only detected in road material (Stations MS-1, MS-2, and MS-3) and cover material (Station MS-24). Thallium was only detected in material from the tailings impoundment (Stations MS-4 and MS-5) and outcrop material (Station MS-33). Antimony was only detected in cover material from Station MS-24 and mercury was only detected in outcrop material from Station MS-25. Phosphorus was detected at every station and fluoride was detected in mine waste samples collected from the tailings impoundment (Stations MS-4 and MS-5). PAHs were also detected in mine waste material from the tailings impoundment (Stations MS-4 and MS-5). Several indicators of petroleum hydrocarbons were detected in mine waste material collected along the road (Stations MS-1, MS-2 and MS-3), from the tailings impoundment (Stations MS-4 and MS-5), from all stations for cover material (Stations MS-10, MS-11, MS-12, MS-13, MS-21, MS-22, MS-23, MS-24), and from waste rock material (Stations MS-14, MS-16, MS-18, MS-19, MS-20, MS-26, MS-27, MS-28 and MS-32). Pentachlorophenol was detected in one sample collected from the tailings impoundment (Station MS-5) and methyl acetate was detected in both samples collected from the tailings impoundment (Stations MS-4 and MS-5).

3.3 Tree Bark

Sampling Stations

Tree bark samples were collected along a number of transects that radiate away from the mine, with longer transects (more sampling locations) on the predominant downwind direction (northeast) as shown in Figure 3-7.

Tree bark samples were targeted for collection from Douglas fir trees ranging in size from 8-10 inches in diameter at a sampling height of 4-5 ft. This size recommendation was made based on the assumption of a correlation between size and age, and that trees ranging in size from 8-10 inches in diameter were at least 30 years old, and hence would have been exposed to airborne releases during mining operations.

In the field, all tree bark samples were collected from Douglas fir trees at a height of 4-5 ft. In three instances (SL15-06, SL75-13 and SL197-07), no trees of 8 inches in diameter were located near transect sampling points, so smaller trees were sampled (6.7, 7.1 and 7.0 inches in diameter, respectively). In addition, only larger trees (>10 inches in diameter) were available for sampling near transect sampling points at 47 other stations (MWH, 2007).

One to two tree cores were collected per transect (10% of all tree samples) to allow an evaluation of tree age. This was successfully implemented in the field, resulting in age data for 12 of the 74 trees for which tree bark was sampled (16%).

Analysis

All tree bark samples were analyzed for asbestos. Tree cores were transmitted to the Laboratory of Tree-Ring Research at the University of Arizona for age analysis by counting of tree rings.

Asbestos Results for Phase I

Table 3-13 presents the results, expressed as million LA structures per cm^2 and mass percent. Figure 3-8 plots actual sampling locations and indicates the results using a color-coding system. Figure 3-9 to 3-15 plot the data for each transect, incorporating the surface topography along the transect. The raw TEM data from the analysis are provided in Attachment A.1.

As shown, although there is moderate spatial variability, there is a general tendency for the highest levels (> 2.5 million structures per cm^2) to occur within about 2 to 3 miles of the mined area, with a tendency for values to diminish as a function of distance from the mine. Elevated values are noted not only in the downwind direction (north-northeast from the mine), but also along nearly all transects. It is suspected that the majority of the LA in tree bark is attributable to historic releases to air during the time the mine was active, although current and on-going releases may also be contributing.

Age Data

Data on tree age generated by tree core analysis are presented in Table 3-14. As seen, for the 12 trees from which a core was collected, the minimum age was 29 years, the maximum was 100 years, and the average was 69 years.

3.4 Forest Soils and Duff

Sampling Stations

Five-point composite samples of forest soil and duff were collected from approximately equally spaced locations around the perimeter of a circle with a radius of about 5 feet, centered on the same tree where the bark sample was collected (see Figure 3-7).

Chemical Analyses

The forest soil samples were divided into two fractions (coarse and fine) by sieving and analytical results were reported as described above for sediment samples analyzed for LA. Duff samples were prepared by high temperature ashing to remove organic matter. The residue was then analyzed for LA by TEM. Results for duff samples are reported as a mass fraction (mass of asbestos in grams per mass of dried duff in grams).

Asbestos Results for Phase I

The results for analyses of asbestos in forest soils are provided in Table 3-15 and are plotted in Figure 3-16. As seen, LA was detected in a number of soil samples located relatively close to the mined area and in the downwind direction, but was not detected at a distance more than about 2 miles from the mined area nor at locations in the upwind directions. Only one sample collected from a location approximately 1/5 mile across gradient downwind from the mine area had levels of LA qualified in Bin C (6% MF_{LA} in the fine fraction and 1.3% MF_{LA} in the coarse fraction).

The full results of the duff samples are not yet available, but preliminary data suggest that LA is detected in duff samples.

4.0 DATA QUALITY OBJECTIVES

4.1 Overview of the DQO Process

Data Quality Objectives (DQOs) define the type, quality, quantity, purpose, and intended uses of data to be collected (EPA, 2006). The design of a study is closely tied to its DQOs, which serve as the basis for important decisions regarding key design features such as the number and location of samples to be collected and the analyses to be performed. In brief, the DQO process typically follows a seven-step procedure, as follows:

1. State the problem that the study is designed to address
2. Identify the decisions to be made with the data obtained
3. Identify the types of data inputs needed to make the decision
4. Define the bounds (in space and time) of the study
5. Define the decision rule which will be used to make decisions
6. Define the acceptable limits on decision errors
7. Optimize the design using information identified in Steps 1-6

Following these seven steps helps ensure that the project plan is carefully thought out and that the data collected will provide sufficient information to support the key decisions which must be made.

4.2 Conceptual Site Models

The conceptual site model (CSM) is a schematic summary of what is known about the nature of source materials at a site, the pathways by which contaminants may migrate through the environment, and the scenarios by which receptors may be exposed to site-related contaminants.

Figure 4-1 presents the CSM for exposure of each general ecological receptor group (fish, benthic invertebrates, terrestrial plants, soil invertebrates, birds, mammals and amphibians) to non-asbestos mining-related contaminants. As seen, each receptor group may be exposed by several different pathways. However, not all pathways are equally likely to be important. In each CSM, pathways are divided into three main categories:

- A solid black circle (●) represents pathways that are believed to be complete, and which may provide an important contribution to the total risk to a receptor group.

- An open circle (O) represents an exposure pathway that is believed to be complete, but which is unlikely to be a major contributor to the total risk to a receptor group, at least in comparison to one or more other pathways that are evaluated.

- An open box represents an exposure pathway that is believed to be incomplete (now and in the future). Thus, this pathway is not assessed.

Figure 4-2 presents the CSM for exposure to asbestos. This CSM is similar to the one for non-asbestos (Figure 4-1), except that information is not generally available to characterize the relative importance of each of the various pathways by which a receptor may be exposed. For this reason, the open circle is only used for direct contact (dermal exposure) of birds and mammals with asbestos. However, it should still be understood that not all of the exposure pathways indicated by a black circle for a receptor are likely to be of equal concern.

The following sections provide a more detailed discussion of the main elements of these CSMs.

Potential Sources of Contamination

The main sources of asbestos contamination at this site are the mine wastes generated by historic vermiculite mining and milling activities. This includes piles of waste rock and waste ore at on-site locations, as well as the coarse tailings pile and the fine tailings impoundment. These wastes may also be sources of metals and other inorganic constituents of the ore. In addition, some chemicals used at the mine site in the processing of vermiculite ore might also be present in on-site wastes, including diesel fuel, alkyl amines, fluorosilicic acid, and various other flocculants, defoamers, frothers and other reagents.

Migration Pathways in the Environment

From the sources, contaminants may be released and transported via airborne emissions, surface water transport or food chain transport.

Airborne Transport. Contaminants may become suspended in air and transported from sources via release mechanisms such as wind, mechanical disturbances and/or erosion. Once airborne, contaminants may move with the air and then settle and become deposited onto surface soils. This pathway is likely to be important for asbestos, but is thought to be of low concern for non-asbestos contaminants.

Surface Transport. Contaminants may be carried in surface water runoff (e.g., from rain or snowmelt) from the mine or other areas where soil is contaminated, and become deposited in soils or sediments at downstream locations. This pathway is equally applicable to both asbestos and non-asbestos contaminants.

Food Chain Transport. Contaminants may be taken up from water, sediment or soil into the tissues of aquatic or terrestrial organisms from water and/or sediment and/or soils and/or prey items into prey items (fish, benthic invertebrate, plants, soil invertebrates, birds, mammals). This is applicable to both asbestos and non-asbestos contaminants.

Potentially Exposed Ecological Receptors

There are a large number of ecological species that are likely to occur in OU3 and that could be exposed to mine-related contaminants. However, it is generally not feasible or necessary to evaluate risks to each species individually. Rather, it is usually appropriate to group receptors with similar behaviors and exposure patterns, and to evaluate the risks to each group.

For aquatic receptors, organisms are grouped into two categories:

- Fish
- Benthic macroinvertebrates

For terrestrial receptors, organisms are grouped into five broad categories:

- Terrestrial Plants
- Soil invertebrates
- Birds
- Mammals
- Amphibians

Exposure Pathways of Primary Concern

Fish. The primary exposure pathway for fish is direct contact with contaminants in surface water. This is applicable to both asbestos and non-asbestos contaminants. Fish may also be exposed to contaminants by ingestion of contaminated prey items, and incidental ingestion of sediment while feeding. Direct contact with sediment may also occur. This is often assumed to be minor compared to the pathways above.

Benthic Invertebrates. Benthic invertebrates may be exposed to contaminants in surface water and/or sediment via ingestion and/or direct contact. Benthic invertebrates may also be exposed to contaminants via ingestion of aquatic prey items that have accumulated contaminants in their tissues. This is applicable to both asbestos and non-asbestos contaminants.

Terrestrial Plants and Soil Invertebrates. Terrestrial plants and soil-dwelling invertebrates (e.g., worms) are exposed mainly by direct contact with contaminants in soil. Exposure of plants may also occur due to deposition of contaminated dust on foliar (leaf) surfaces, but this pathway is generally believed to be small compared to root exposure.

Mammals and Birds. Mammals and birds may be exposed to asbestos and non-asbestos contaminants via ingestion of soils, surface water, sediment and food. Mammals and birds may also be exposed to asbestos by inhalation exposures when feeding or foraging activities result in the disturbance of asbestos-contaminated soils, sediments or other media. Direct contact (i.e.,

dermal exposure) of birds and mammals to soils may occur in some cases, but these exposures are usually considered to be minor in comparison to exposures from ingestion (USEPA, 2003). Likewise, inhalation exposure to non-asbestos contaminants in airborne dusts is possible for all birds and mammals, but this pathway is generally considered to be minor compared to ingestion pathways (USEPA, 2003).

Amphibians. Amphibians (frogs, toads) inhabit both aquatic and terrestrial (mainly riparian) environments with early life stages being primarily aquatic and latter life stages primarily terrestrial. Amphibians in their early aquatic life stages may be exposed to contaminants in surface water via ingestion and direct contact. They may also be exposed to contaminants in sediment via ingestion and direct contact and to contaminants in aquatic prey items via ingestion. In the terrestrial (riparian) environment, amphibians may be exposed to contaminants in soils or sediments via ingestion, inhalation and/or direct contact and also as the result of ingestion of terrestrial prey items.

4.3 Data Quality Objectives

4.3.1 State the Problem

The Phase IIC SAP focuses on aquatic receptors (benthic invertebrates and fish) at OU3. Mining operations at OU3 have resulted in the release of various types of asbestos and non-asbestos to the environment, including surface water, sediment and soils. Several aquatic receptors are likely to be present within OU3 and have the potential to be exposed to asbestos and/or non-asbestos contamination. An assessment of the potential magnitude and frequency of these exposures is needed to assess the risk of adverse effects to aquatic ecological receptors. The problem is complicated by the fact that the data on the toxic effects of asbestos (LA) and some non-asbestos contaminants are not sufficient to allow for a reliable assessment of risks to ecological receptors.

4.3.2 Identify the Decision

Ultimately, the data collected during the OU3 RI is intended to help EPA decide if and what response actions are needed to protect human and/or ecological receptors from unacceptable risks from asbestos and any other mining-related contaminants in surface water and sediment in OU3.

4.3.3 Identify the Types of Data Needed

The available strategies and elements that can be used in the ERA are discussed as part of the Problem Formulation document (USEPA, 2008c). The Phase IIC SAP represents implementation of a subset of elements of the presented strategies. Additional elements may be implemented as described in additional SAPs as they are deemed useful.

Several types of information are needed to support a decision regarding remedial actions based on ecological risks for the primary pathways of concern. Data needed for the ecological risk assessment for aquatic receptors at OU3 (from the Phase II C SAP) can be divided into four basic categories:

- Hazard Quotients (HQs)
- Site-specific toxicity tests
- Observations of population and community demographics
- In-situ measures of exposure and effects

HQ Approach

It is common to begin by an assessment of risks using the HQ approach. In this approach contaminant concentrations in environmental media (e.g., water, sediment) are compared to respective toxicity reference values. If the HQ results (either those based on maximum exposure or those calculated for each sampling location) suggest that risks are below a level of concern (< 1), then no further evaluation will be needed. If the HQ approach suggests that risks may be occurring, then other lines of evidence will be investigated. Note: this method requires the availability of suitable toxicity reference values (TRVs) for the contaminants of concern. Such TRVs do exist for most non-asbestos analytes, and the HQ approach will be used as the first line of evidence for this group of contaminants.

Site-Specific Toxicity Tests

For ecological receptors, direct measurements of effects on exposed receptors to site media are used to assess risks especially for contaminants for which reliable toxicity values are not available to use in the HQ approach for evaluating measured concentration values. In site-specific toxicity tests, ecological receptors are exposed to site media of known concentrations in order to observe whether the media causes adverse effects on growth, survival, and/or reproduction in laboratory test species. At OU3, site-specific toxicity testing will be completed with site surface waters and sediments. Data from the toxicity test results will be used to establish a reliable site-specific exposure response curve. Using this relationship, it may be possible to identify reference concentrations of contaminants in water or sediment that represent the boundary between acceptable and unacceptable effects on fish and benthic invertebrates. If so, then these reference concentrations may be used in the evaluation of other site waters and sediments that have not been tested using aquatic receptors.

Surface water toxicity testing was addressed in *Phase II Sampling and Analysis Plan for Operable Unit 3 Libby Asbestos Superfund Site Part A: Surface Water and Sediment* (USEPA, 2008a). Sediment toxicity testing is addressed in this Phase IIC SAP.

Population and Community Demographics

Measurements of population and community demographics are made in the field to identify if any receptor population has unusual numbers of individuals (either lower or higher than expected), or whether the diversity (number of different species) or composition of species is different than expected. Other demographics include age structure and the absence or presence of pollution tolerant species. Population and community demographic information will be collected for benthic invertebrates and fish within OU3. These data will be compared to appropriate matched reference areas.

In-Situ Measures of Exposure and Effects

Measurements of *in-situ* exposure and effects are made on receptors collected from the field, seeking to identify if individuals have exposure (tissue) levels, observed lesions and/or deformities that are higher than expected. Asbestos tissue burden levels in selected tissues and the number and severity of gross and microscopic lesions will be measured and compared to matched reference areas. *In-situ* measures of exposures and effects may be examined in fish based on the results of toxicity testing with fish and LA in water completed as part of the *Phase II Sampling and Analysis Plan for Operable Unit 3 Libby Asbestos Superfund Site Part A: Surface Water and Sediment* as well as the results of this Phase IIC SAP.

4.3.4 Define the Bounds of the Study

Spatial Bounds

The primary focus of Part C of the Phase II investigation is the Rainy Creek watershed (including upper and lower Rainy Creek, Fleetwood Creek, and Carney Creek, as well as ponds and impoundments on these streams) and the mining site area.

The spatial bounds of the assessment will also include reference areas identified for comparison of fish populations and benthic invertebrates.

Temporal Bounds

The contamination of sediments and soils is not expected to vary by time. Fish populations and benthic invertebrate communities may vary over time (season and year). The sampling in the SAP samples these populations and communities during only one season in one year (fall of 2008). Sampling during additional seasons and years may be need to understand variability over time which could be needed to support remedial decisions.

Receptor Groups and Exposure Pathways

This Phase IIC SAP is focused on a subset of the possible exposure pathways identified for ecological receptors to asbestos and non-asbestos contamination at Libby OU3. The receptor groups and exposure pathways to be addressed include exposure of benthic invertebrates to contaminants in sediments, and exposure of fish to contaminants in surface water and sediments. Other receptor groups and exposure pathways may be addressed in other SAPs using methods as outlined in the Problem Formulation document (USEPA, 2008c).

4.3.5 Define the Decision Rule

In the baseline ERA, risks to aquatic ecological receptors from a particular chemical in a particular medium will be evaluated using a weight-of-evidence approach, combining the results from up to four possible lines of evidence:

- Calculation of Hazard Quotient (HQ) values based on measured concentration values and available toxicity reference values (TRVs)
- Exposure of test organisms to environmental media samples (surface water and/or sediment) collected from the site to evaluate the magnitude and frequency of any effects on growth, reproduction or survival
- Direct surveys of receptor population and community demographics in comparison to appropriate reference areas
- Direct measurement of receptor exposure and effects in comparison to appropriate reference areas

The weight-of-evidence conclusions will take many factors into account, including the strengths and weaknesses of each line of evidence, and the degree of agreement between the different lines. Thus, no statistical or quantitative decision rule can be stated *a priori*. The following qualitative guidelines will be applied when interpreting risks to each ecological receptor of concern:

- All lines of evidence agree that risk is within an acceptable range. If the calculated HQ does not exceed 1 for acute or chronic toxicity, there are no significant growth, mortality or reproduction effects observed in site-specific toxicity tests (compared to reference and laboratory controls), there are no ecologically relevant differences observed in direct surveys of population and community demographics (compared to reference(s)) and there are no ecologically relevant differences observed in direct measurements of exposure and effects (compared to reference(s)), then remedial actions to protect ecological receptors are not likely to be necessary.

- All lines of evidence agree that there is an unacceptable risk. If the calculated HQ (calculated for each sampling location) exceeds 1 for acute or chronic toxicity, there is

evidence of site-specific toxicity, there is evidence of an adverse impact to population and community structure and function, and there is evidence of in-situ exposure and effects, then alternative response actions to protect ecological receptors will be evaluated in a Feasibility Study.

- The results from each line of evidence are mixed. If the calculated HQs exceed 1 but direct toxicity is not observed then the weight assigned will be in proportion to the confidence in the data for each line of evidence. The ecological decision rule will likely take the form that, if the weight-of-evidence indicates that adverse effects on ecological receptors are occurring, and that these effects are likely to result in a meaningful decrease in the growth, reproduction or survival of local populations compared to what would be expected in the absence of site-related contamination, then alternative response actions to protect ecological receptors will be evaluated in a Feasibility Study.

- The lines of evidence are very limited, weak or absent. If it is not possible to assess possible effects on growth, reproduction or survival of local populations, then the decision rule will be to weigh the potential scope of the problem against the costs and benefits of additional data collection to support one or more lines of evidence and against the costs and benefits of the presumptive remedial action.

4.3.6 Define the Acceptable Limits on Decision Errors

Two types of decision errors are possible when making risk management decisions:

- A false negative decision error occurs when it is decided that risk is acceptable when the true risk is actually above the level of concern
- A false positive decision error occurs when it is decided that risk is not acceptable when the true risk is actually below the level of concern

Of these two types of errors, EPA is primarily concerned with avoiding false negative errors, since an error of this type can leave human or ecological receptors exposed to unacceptable levels of contamination and risk. The EPA usually identifies 5% as the maximum acceptable probability of making a false negative decision.

A false positive decision error does not leave ecological receptors at risk, but is also of concern to EPA because this type of error may result in the expenditure of resources (time, money) that might be better invested elsewhere. For the OU3 RI and risk assessment process, the goal is as follows: if the true level of risk is less than ½ the acceptable risk level, then there should be no more than a 20% chance that the risk will be declared to be unacceptable.

4.3.7 Optimize the Design

Risks to aquatic ecological receptors, including fish and benthic invertebrates will be based on a weight-of-evidence evaluation. Consequently, it is not possible to develop statistical rules that limit the likelihood of false positive or false negative decision errors. Rather, the degree of confidence in the decision is based on the quality of the data available, and the degree to which different lines of evidence yield consistent conclusions. If multiple lines of evidence support the same conclusion, then confidence in the decision is increased. Conversely, if different lines of evidence yield inconsistent conclusions, then confidence in the decision is decreased.

Optimize the Sampling Design for HQs

Application of the HQ approach requires the collection of reliable and representative measurements of the concentration of contaminants as a function of both time and space. This type of data is valuable both to support risk evaluations as well as to identify sources of contaminant releases. The extent of the Phase I sampling is provided as Section 3. Further data on concentration of contaminants in sediments and surface waters is being collected as part of the *Phase II Sampling and Analysis Plan for Operable Unit 3 Libby Asbestos Superfund Site Part A: Surface Water and Sediment* (USEPA, 2008a). As the strength of the HQ approach will be increased by comparison of HQ values from the OU3 site area to reference areas not impacted by releases from the mined area, surface water and sediment analytical data will be collected from two of three identified reference areas.

Aquatic Reference Locations

Three possible aquatic reference locations have been identified for OU3 (Figure 4-3) including one on Noisy Creek (NSY-R1), one on Bobtail Creek (BTC-R1) and one on a tributary to Bobtail Creek (BTT-R1). The upper Bobtail Creek (BTC-R1) location has habitat and stream gradient similar to lower Rainy Creek while the lower Bobtail Creek tributary site (BTT-R1) has habitat similar to Rainy Creek downstream of the tailings impoundment and upstream of the mill pond at TP-TOE2. The Noisy Creek site (NSY-R1) has habitat that is somewhat in between the other two reference locations.

Prior to the sampling of surface water, sediments, benthic invertebrates and fish, two of these reference locations will be selected for sampling based on the results of a field reconnaissance. The field reconnaissance will identify if access to the properties can be made and then upon direct inspection if the sampling locations are comparable matches as expected. Bobtail Creek (BTC-R1) and the Bobtail Creek tributary (BTT-R1) are the preferred sampling locations and will be used unless access to one of these locations cannot be made or the habitat is not similar to OU3 locations. In either of these instances, sampling at Noisy Creek (NSY-R1) will be made.

In summary, only two of the three reference locations will be sampled. As it is not possible to specifically state which will be sampled until completion of the reconnaissance effort, this SAP lists all three where reference sampling is discussed.

Optimize the Sampling Design for Site-Specific Toxicity Testing

The objective of the toxicity testing is to identify if LA in site sediments is toxic to benthic invertebrate test species. If toxic, a second objective of the toxicity testing is to provide toxicity information for a weight-of-evidence evaluation of risks for aquatic receptors at individual sampling locations in the Rainy Creek watershed. The toxicity testing information along with benthic invertebrate community data and fish population demographics will be used to evaluate risk. A third objective of the toxicity testing is to provide data that may be used to develop a site-specific exposure-response curve for toxicity of asbestos to benthic invertebrates. This is best achieved by testing sediments at regularly-spaced concentration intervals (for LA) ranging from low to high. To achieve this, it is necessary to test sediments within each bin of asbestos contamination (ND, Trace, <1%, and 2 to 3%). In order to understand if other factors may influence sediment toxicity, it is also necessary to test sediments that do not contain asbestos contamination (i.e., reference locations).

Optimize the Sampling Design for Population and Community Demographics

Population and community demographic information will be collected for benthic invertebrates and fish compared to those collected in reference areas. The objective is to identify if any receptor population has unusual numbers of individuals (either lower or higher than expected), or whether the diversity (number of different species) of a particular category of receptors (e.g., benthic organisms, fish) is different than expected.

For benthic invertebrates, the benthic community will be sampled at locations along Fleetwood Creek, Carney Creek, and Rainy Creek that are concurrent with the Phase I and Phase IIA surface water and sediment sampling locations. This will optimize the ability to interpret community metrics versus contaminant concentration. The objective is to identify if metrics are different in comparison with reference areas and if any observed changes could result from contaminant exposures. The specific locations of the reference area(s) in Bobtail Creek, the Bobtail Creek tributary and Noisy Creek will be identified during the site reconnaissance to match as closely as possible the habitat variables present at the aquatic sites being evaluated. Note that, because asbestos contamination may have been transported by air from the mine site area to upstream locations along Rainy Creek, upstream locations may not be an appropriate reference. The methods for benthic invertebrate collections will include those that have been used by the US Forest Service in the Kootenai National Forest. This will optimize comparison of data collected at OU3 with those collected in other streams in the National Forest over a several year period.

For fish, surveys will be performed at selected locations within the Rainy Creek drainage that are concurrent with the Phase I and Phase IIA surface water and sediment sampling locations. Fish species and number (density) are noted and compared to matched reference locations.

5.0 SAMPLING PROGRAM DESIGN

Table 5-1 provides an overview of the data collection activities that will be performed under Phase IIC of the OU3 RI. The following sections provide descriptions of the general experimental design for each of the Phase IIC elements. Specific details with regard to sampling method requirements, laboratory testing requirements and analytical methods are provided in subsequent sections.

5.1 Site-Specific Sediment Toxicity Testing Methods and Procedures

Figure 5-1 provides a conceptual flow diagram for the sediment toxicity testing. The testing strategy involves two steps. Part 1 involves testing the two sediment samples with the two highest measured levels of LA. Part 2 is contingent on the results of Part 1.

5.1.1 Testing: Part 1

Twp sediment samples with the two highest LA concentrations measured in either the Phase I sampling or Phase IIA sampling will be tested. Sediments for testing will be collected as a composite of grab samples. Two laboratory test organisms will be exposed (the amphipod *Hyalella azteca* and midge *Chironomus tentans*). Sediment samples will be tested for toxicity using the amphipod *Hyalella azteca* in a 42 day test for measuring the effects of sediment associated contaminants on survival, growth and reproduction (EPA Test Method 100.4; USEPA, 2000). Sediment samples will also be tested for toxicity to the midge *Chironomus tentans* using the life-cycle test for measuring effects on survival, growth and reproduction (EPA Test Method 100.5; USEPA, 2000).

5.1.2 Testing: Part 2

If toxicity is observed in any of the Part 1 toxicity tests, then further testing of sediment samples collected as part of this Phase IIC SAP will be completed. If toxicity is observed to only one species, then that species and test will be used in the Part 2 testing. If toxicity is observed to both species then both species and tests may be used in the Part 2 testing.

5.1.3 Sediment Samples Identified for Testing

Part 1

The Part 1 sediment toxicity testing will include two sampling locations in the Rainy Creek drainage where the two highest concentrations of LA were measured in either the Phase I or Phase IIA sampling. In this SAP, it was not possible to identify the two locations as the Phase IIA sampling data were not available. The locations selected will not include any of the pond locations or seep locations. Testing will also be completed at one of the three reference areas

(BTT-R1, BTC-R1 or NSY-R1). Selection of the reference location will be based on the field reconnaissance.

Part 2

The objective of the toxicity testing is to identify if LA in sediments is toxic to benthic invertebrates. If toxicity is established in Part 1, then Part 2 testing will be implemented. A total of ten sampling locations in the Rainy Creek drainage were selected for the Part 2 sediment toxicity testing. The locations selected include eight in the Rainy Creek drainage (URC-1A, URC-2, LRC-2, LRC-3, LRC-5, CC-1, FC-2 and TP-TOE2) and two of three possible reference locations (BTT-R1, BTC-R1 and/or NSY-R1).

The toxicity testing results will provide direct toxicity information for a weight-of-evidence evaluation of risks for aquatic receptors at individual sampling locations in the Rainy Creek watershed. The toxicity testing results along with benthic invertebrate community data and fish population demographics will be used to evaluate risk. Toxicity testing results may also provide data that can be used to develop a site-specific exposure-response curve for the toxicity of LA to benthic invertebrates. This is best achieved by testing sediments at regularly-spaced concentration intervals ranging from low to high. To achieve this it is necessary to test sediments within a range of asbestos contamination (ND, Trace, <1%, 2%, 3% and 4%). The following table summarizes the sampling locations that will be tested versus level of asbestos in sediment based on the Phase I results:

Level of Asbestos in Sediment	**Locations identified for toxicity testing**
Asbestos content unknown	BTT-R1* BTC-R1* NSY-R1* URC-1A
ND	None
Trace	FC-2
<1%	URC-2 LRC-2 LRC-5
2%	LRC-3
3%	TP-TOE2
4%	CC-1
*Two of three reference locations will be tested.	

Sediments will be tested within all bins of asbestos contamination with the exception of the non-detect (ND). However, it is expected that the reference samples to be tested will fall within the ND bin. Sediments samples for testing in Part 2 will be collected from all locations with toxicity testing of the samples contingent upon the results of Part 1.

5.2 Population and Community Demographic Observations

5.2.1 Benthic Invertebrates

Benthic invertebrates will be collected at 9 stream locations (Table 5-2) including two in upper Rainy Creek (URC-1A and URC-2), four in lower Rainy Creek (LRC-1, LRC-2, LRC-3, and LRC-5), one location downstream of the tailings impoundment (TP-TOE2) and two at reference locations (BTT-R1, BTC-R1, and/or NSY-R1). At each location, two samples of the benthic invertebrate will be collected using two different protocols. One samples will be collected according to an established EPA *Rapid Bioassessment Protocol* (RBP) (USEPA, 1999) and one sample will be collected in the same manner as that conducted by the US Forest Service (i.e., Surber). For each sampling location, a number of alternative metrics of benthic community status will be calculated and combined to yield a Biological Condition Score. A number of alternative measures of habitat quality will also be measured to yield a Habitat Quality Score (a comparison of the Biological Condition Score to the Habitat Quality Score provides information on the likely contribution of non-habitat factors (e.g., chemical pollution) on the benthic community). The scores and individual metrics will be examined to identify if the community is impacted relative to reference and if there are any apparent trends in condition with asbestos and/or non-asbestos contaminant concentrations.

5.2.2 Fish

Fish will be collected at 9 stream locations (Table 5-2) including two in upper Rainy Creek (URC-1A and URC-2), four in lower Rainy Creek (LRC-1, LRC-2, LRC-3, and LRC-5), one location downstream of the tailings impoundment (TP-TOE2) and two at reference locations (BTT-R1, BTC-R1, and/or NSY-R1). For each sampling location, the following information will be recorded:

- The species identified
- The number of individual fish
- The size class structure of the fish collected by weight and length
- The ratio of males to females (if sex can be determined)
- The frequency of any identified external abnormalities

These results will be compared to those collected from the reference areas.

5.3 Surface Water and Sediment Samples for Chemical Analyses

Surface Water

Surface water samples will be collected at two of three reference locations and analyzed for water quality parameters, asbestos, TAL metals and selected organic analytes. The specific parameters are specified in Section 9.0.

Sediment

All sediment samples used in the toxicity tests will be analyzed for grain size, total organic carbon (TOC), asbestos and TAL metals. The reference samples will be analyzed for the same parameters plus additional parameters as specified in Section 9.0.

6.0 SAMPLING METHOD REQUIREMENTS

All sampling of environmental media within OU3 described in this SAP will be performed by personnel who are properly trained in the field collection methods summarized in the OU3 Standard Operating Procedures (SOPs) provided in Attachment B and the Phase IIC experimental sampling design details presented below. The field sampling teams will follow procedures in the Health and Safety Plan (HASP) prepared by Parametrix for the OU3 investigation.

6.1 Surface Water Sampling Methods and Procedures

Surface waters will be collected from two of three reference locations (BTT-R1, BTC-R1 and/or NSY-R1) for analyses of asbestos and non-asbestos parameters (specified in Section 9.0). The sampling procedures for collection of surface water grab samples are presented in OU3 SOP No. 3. To minimize the potential effect of time variability, all samples will be collected on the same day. All samples will be grab samples, collected by pumping directly from the source into laboratory collection containers using a peristaltic pump. Samples will be collected from representative flowing water (usually the mid-channel).

Both filtered and unfiltered samples will be collected directly from the water bodies into sample bottles. At each station, the unfiltered sample will be collected before the filtered sample (or any other activities) to minimize the potential disruption of the sediment and resuspension of LA. For the filtered samples, water from the source water body will be pumped through a 0.45 µm in-line, high-capacity filter using either a battery-operated peristaltic pump or hand-held manual pump. The in-line filter will be purged with approximately 200 mL of sample water before the laboratory container is filled. A new (0.45 µm) in-line filter and tubing will be used for each site to collect water for analyses of "dissolved" constituent concentrations. The filter will then be removed, and the sample for unfiltered metals and other water quality parameters will be collected.

6.2 Surface Water Field Measurements and Flow Monitoring

At the same locations where grab samples of surface water are collected, in-stream measurements of temperature, pH, specific conductance, dissolved oxygen (DO), and turbidity will also be taken using portable field meters. Field parameter measurement and calibration protocols will be performed according to manufacturer's specifications and OU3 SOP No. 10. These measurements will be recorded on field sampling forms.

At locations where flowing water is present, stream discharge will always be measured following the collection of surface water and sediment samples. The stream flow will be measured and recorded in accord with OU3 SOP No. 4. In brief, discharge will be measured using one of three portable methods, as dictated by flow or channel characteristics. Depending on the channel

characteristics and flow, an area-velocity method, a portable flume, a volumetric method, or some combination of these methods, will be used to obtain the stream discharge measurements. Field personnel responsible for stream-discharge measurements must have prior experience using the methods and equipment described in OU3 SOP No. 4.

In cases where water depth is greater than 0.3 feet or the channel cross section is wide, flow generally will be measured using the area-velocity method of stream-flow gauging as described in the *National Handbook of Recommended Methods for Water Data Acquisition* (USGS 1977), and explained in detail in OU3 SOP No. 4. Using this method, the stream cross section is divided into a series of subsections where the average depth, average velocity, and width for the subsections are measured.

A portable cutthroat flume will be used to measure flow when low discharge and/or channel geometry preclude the use of a velocity meter. The flume will have a throat width adjustable from 2 to 8 inches, which can be used to measure flows from approximately 0.01 to 2.2 ft^3/sec. All water will be routed through the leveled flume, to the extent practicable, after which the height (to the nearest 0.01 foot), throat width, and leakage estimate as a percentage (if any) will be recorded. Discharge will be calculated using these data and an equation that is specific to the flume size.

6.3 Sediment Sampling Methods and Procedures

Sediments will be collected from a total of twelve sampling locations. Three sediment samples (two in the Rainy Creek drainage and one reference) will be collected for the Part 1 sediment toxicity testing. The two locations with the highest LA concentrations will be identified based on the results of asbestos analyses from both Phase 1 and Phase IIA (Section 5.1.1). The reference location will be selected based on the results of the field reconnaissance.

Ten sediment samples will be collected for the Part 2 sediment toxicity testing including two in upper Rainy Creek (URC-1A and URC-2), three in lower Rainy Creek (LRC-2, LRC-3, and LRC-5), one location downstream of the tailings impoundment (TP-TOE2), one in Fleetwood Creek (FC-2), one in Carney Creek (CC-1) and two at reference locations (BTT-R1, BTC-R1, and/or NSY-R1; Figure 5-2). Sediments collected will be analyzed for a range of non-asbestos and asbestos parameters as specified in Section 9.0.

At each sampling location, sediment will be collected in accord with OU3 SOP No. 5. In brief, a single sediment sample will be collected from each station. Each sample will consist of a grab sample collected from low-energy (i.e., depositional) portions of the stream channel that are inundated by creek water at the time of sampling (i.e., locations of sediment deposition to channel). Each grab sample will be collected using the “direct sampling” method and compositing instructions included in OU3 SOP No. 5. The mass of sediment collected may be estimated by visual assessment of sediment volume.

All sampling and field measurement equipment that is used at more than one sample station must be decontaminated following each use. Appropriate equipment decontamination procedures are provided in OU3 SOP No. 7.

6.4 Benthic Invertebrate Sampling Methods and Procedures

Benthic invertebrate samples will be collected from 9 stream locations (Table 5-2) including two in upper Rainy Creek (URC-1A and URC-2), four in lower Rainy Creek (LRC-1, LRC-2, LRC-3, and LRC-5), one location downstream of the tailings impoundment (TP-TOE2) and two at reference locations (BTT-R1, BTC-R1, and/or NSY-R1; Figure 5-2). Samples will be collected according to the procedures in SOP-BMI-LIBBY-OU3 (Appendix B). As described previously, a number of alternative metrics of benthic community status will be calculated for each sampling station and combined to yield a Biological Condition Score. A number of alternative measures of habitat quality will also be measured to yield a Habitat Quality Score. The scores and individual metrics will be examined to identify if the community is impacted relative to reference and if there are any apparent trends in condition in relation to asbestos concentrations as well as responses observed in the sediment toxicity testing.

The US Forest Service (Vinson, 2007) has collected benthic invertebrates from several locations in the Kootenai National Forest (Figure 6-1) over a several year period (1998-2006). Benthic invertebrates were collected from riffle habitats using a Surber net with a 250 µm mesh net. Three samples were collected at each site and composited to form a single sample with an area of 0.279 square meters per sample. At Libby OU3, benthic invertebrates will be collected at each sampling station in the same manner as that conducted by the US Forest Service according to the procedures in OU3 SOP-BMI-LIBBY-OU3 (Appendix B). The results will be compared to the US Forest Station data in the area of the Libby OU3.

6.5 Fish Sampling Methods and Procedures

Fish will be collected and identified from 9 stream locations (Table 5-2) including two in upper Rainy Creek (URC-1A and URC-2), four in lower Rainy Creek (LRC-1, LRC-2, LRC-3, and LRC-5), one location downstream of the tailings impoundment (TP-TOE2) and two at reference locations (BTT-R1, BTC-R1, and/or NSY-R1; Figure 5-2). Fish will be collected according to the procedures specified in SOP-FISH-OU3 (Appendix B).

7.0 LABORATORY TESTING REQUIREMENTS

The following subsections describe the laboratory testing requirements for samples collected under the SAP. Laboratory testing requirements include those for sediment toxicity testing and the identification and enumeration of benthic invertebrates.

7.1 Sediment Toxicity Testing Methods and Procedures

Sediment samples will be tested for toxicity using a standard EPA protocol (EPA Test Method 100.4; USEPA, 2000) with the amphipod *Hyalella azteca* in a 42 day test for measuring the effects of sediment associated contaminants on survival, growth and reproduction.

Sediment samples will also be tested for toxicity to the midge *Chironomus tentans* using a standard EPA protocol for a life-cycle test measuring effects on survival, growth and reproduction (EPA Test Method 100.5; USEPA, 2000).

7.2 Benthic Macroinvertebrate Identification

Benthic invertebrate samples collected as described in Section 6.4 will be submitted to a qualified laboratory for identification and enumeration of species. The procedures for processing samples and identification are detailed in SOP-BMI-LIBBY-OU3. The laboratory will be responsible for preparation of voucher specimens.

8.0 SAMPLE DOCUMENTATION

8.1 Field Documentation

Field documentation procedures are described in OU3 SOP No. 9. Field documentation associated with field sampling will also contain information of sufficient detail to fully describe:

- sample depth
- sampling method, and
- associated field measurements, including stream discharge if measured, and field measurement methods.

Field measurement values are generally reported directly in the units of final use in the field notebook and data sheets without need for additional calculations (e.g., pH, temperature, and conductivity measurements). The field data will be reviewed daily by the field supervisor to identify anomalous data and transcriptional and/or computational errors. Corrective actions will be initiated as appropriate; these actions may consist of re-measuring a particular parameter, collecting a new sample, or other applicable corrective action measures.

8.2 Sample Handling Instructions

8.2.1 Sample Containers

All sample containers used for sample collection and analysis for this project will be prepared according to the procedures contained in the EPA document, *Specifications and Guidance for Obtaining Contaminant-Free Sample Containers,* dated December 1992. This document specifies the acceptable types of containers, the specific cleaning procedures to be used before samples are collected, and requirements relevant to the containers and cleaning procedures. The analytical laboratories will supply all sample containers utilized for this investigation, both for asbestos and non-asbestos analyses. If field personnel observe any cracked or dirty containers, or if the appropriate preservative is missing in the sample bottles, those containers will be discarded and the laboratory will be notified of the problem to prevent its re-occurrence.

Tables 8-1 and 8-2 identify the types of sample containers needed to support the Phase IIC surface water and sediment sample collection, respectively.

8.2.2 Sample Preservation and Storage

Tables 8-1 and 8-2 describe the sample preservation and storage requirements for aqueous and solid media, respectively. Samples will be preserved using appropriate preservatives in order to prevent or minimize chemical changes that could occur during transit and storage. Solid samples (soil and sediment) typically do not require preservation other than temperature control during storage and transfer to the laboratory.

8.2.3 Sample Holding Times

A holding time is defined as the allowable time between sample collection and analysis and/or extraction recommended to ensure accuracy and representativeness of analysis results, based on the nature of the analyte of interest and chemical stability factors. The holding time is calculated from the date and time of sample collection to the time of sample preparation and/or analysis. Sample holding times are established to minimize chemical changes in a sample prior to analysis and/or extraction. Samples will be shipped to the laboratory as soon as possible after collection or processing. There are currently no EPA guidelines for holding times for solid samples analyzed for metals/metalloids and most other inorganic constituents, but a six-month holding time is recommended. There is no holding time requirement for asbestos.

Tables 8-1 and 8-2 define the method-specific analytical holding times for aqueous and solid media, respectively.

8.2.4 Sample Archival and Final Disposition

Unused samples and containers of environmental media will be maintained in storage at the laboratory for a minimum of 90 days following completion of the analysis, unless otherwise directed by EPA. Except as noted below, after 90 days or approval from EPA for disposal if less than 90 days, the laboratory will be responsible for proper disposal of any remaining samples, sample containers, shipping containers, and packing materials in accordance with sound environmental practice, based on the sample analytical results. The laboratory will maintain proper records of waste disposal methods, and will have disposal company contracts on file for inspection.

Materials that shall not be disposed of but held in archive include:

- Unanalyzed portions of filters and grids that have been prepared for asbestos analysis. These shall be held in archive at the asbestos analytical laboratory.
- The archive portion and three fine-ground aliquots of sediment samples.

All data generated during the analysis of project samples must be stored by the laboratory for a period of ten years. Revised copies of the applicable SOPs and QAPPs must also be maintained and available should the data be required.

8.3 Sample Documentation and Identification

Data regarding each surface water and sediment sample collected will be documented in accord with OU3 SOP No. 9 using Libby-specific field sample data sheets (FSDS). Any special circumstances that influence sample collection or result in deviations from sampling SOPs will be documented in a field log book.

At the time of collection, each sample will be labeled with a unique 5-digit sequential identification (ID) number. The sample ID for all samples collected as part of Phase II (including both Phase IIA and IIB) sampling activities will have a prefix of "P2" (e.g., P2-12345). Information on whether the sample is representative of a field sample or a field-based quality control (QC) sample (e.g., field blank, field split) will be documented on the FSDS, but this information will not be included on the chain-of-custody to make certain that the sample type is unknown to the analytical laboratory.

Each field sampling team will maintain a field log book. The log book shall record all potentially relevant information on sampling activities and conditions that are not otherwise captured on the FSDS forms. Examples of the type of information to be captured in the filed log include:

- Names of team members
- Current and previous weather conditions
- Field sketches
- Physical description of the location relative to permanent landmarks
- Number and type of samples collected
- Any special circumstances that influenced sample collection

As necessary for sample collection and location documentation, photographs will be taken using a digital camera. GPS coordinates will be recorded for all sampling locations on the FSDS form in accord with OU3 SOP No. 11. A stake or pole identifying the sampling station will be placed at or near the sampling station for future identification of the location. Any investigation derived waste (IDW) will be handled according to OU3 SOP No. 12.

8.4 Sample Chain of Custody and Shipment

Field sample custody and documentation will follow the requirements described in OU3 SOP No. 9. Sample packaging and shipping will follow the requirements described in OU3 SOP No. 8.

A chain-of-custody form specific to the Phase II OU3 sampling shall accompany every shipment of samples to the analytical laboratory. The purposes of the chain-of-custody form are: a) to establish the documentation necessary to trace possession from the time of collection to final disposal, and b) to identify the type of analysis requested. All corrections to the chain-of-custody record will be initialed and dated by the person making the corrections. Each chain-of-custody form will include signatures of the appropriate individuals indicated on the form. The originals will accompany the samples to the laboratory and copies documenting each custody change will be recorded and kept on file. One copy of the chain-of-custody will be kept by field personnel.

All required paper work, including sample container labels, chain-of-custody forms, custody seals and shipping forms will be fully completed in ink (or printed from a computer) prior to shipping of the samples to the laboratory. Shipping to the appropriate laboratory from the field or sample storage will occur through overnight delivery.

All samples that may require special handling by laboratory personnel to prevent potential exposure to LA or other hazardous substances will be clearly labeled.

Upon receipt, the samples will be given to the laboratory sample custodian. The shipping containers will be opened and the contents inspected. Chain-of custody forms will be reviewed for completeness and samples will be logged and assigned a unique laboratory sample number. Any discrepancies or abnormalities in samples will be noted and the Laboratory Manger and the EPA Remedial Project Manager will be promptly notified.

Chain-of-custody will be maintained until final disposition of the samples by the laboratory and acceptance of analytical results.

9.0 LABORATORY ANALYSIS REQUIREMENTS

9.1 Analytical Methods for Asbestos

All laboratories that analyze samples of surface water or sediment for asbestos as part of this project must participate in and have satisfied the certification requirements in the last two proficiency examinations from the National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program (NVLAP). Laboratories must also have demonstrated proficiency by successful analysis of Libby-specific performance evaluation samples and/or standard reference materials, and must participate in the on-going laboratory training program developed by the Libby laboratory team.

Surface Water

Preparation

Surface water samples will be submitted for asbestos analysis using transmission electron microscopy (TEM). For each sample, an aliquot of surface water will be filtered through a 47 mm mixed cellulose acetate (MCE) filter with pore size of 0.2 um, using a backing filter with pore size of 5 um. Initially, a series of three filters will be prepared by applying aliquot volumes of 100 mL, 50 mL, and 25 mL. The analyst will select the filter from the dilution series yielding the largest possible application volume which does not violate the criteria for an overloaded sample (> 20 structures per grid opening). If examination of the 25 mL aliquot is deemed overloaded, the laboratory may proceed to prepare a 10 ml aliquot dilution. Based on preliminary observation of the 10 ml filter, if it appears that this filter remains overloaded, 10 ml of the remaining volume will be diluted to 100 ml. From this secondary dilution, a second series of filters will be prepared using 50 ml, 25 ml, and 10 ml (corresponding to 5 ml, 2.5 ml, and 1 ml of the original suspension). The analyst will select the filter from the dilution series yielding the largest possible application volume which does not violate the criteria for an overloaded sample. A total of 5 grids will be prepared from the selected filter in accordance with the preparation techniques specified in the International Organization for Standardization (ISO) 10312 method (ISO 1995).

Analysis

Samples will be analyzed in accordance with ISO 10312 (ISO 1995) counting protocols, with all applicable Libby site-specific laboratory modifications, including the most recent versions of modifications LB-000016, LB-000019, LB-000028, LB-000029, LB-000030, and LB-000066 (as provided in Attachment C). All amphibole structures (including not only LA but all other amphibole asbestos types as well) that have appropriate Selective Area Electron Diffraction (SAED) patterns and Energy Dispersive X-Ray Analysis (EDXA) spectra, and having length ≥

0.5 um and an aspect ratio (length:width) ≥ 3:1, will be recorded on the most recent version of the Libby site-specific laboratory bench sheets and electronic data deliverable (EDD) spreadsheets ("TEM Water EDD.xls"). Data recording for chrysotile, if observed, is not required.

The target analytical sensitivity for asbestos in water is 50,000 f/L (0.05 million fibers per liter, abbreviated as MFL). The human health MCL for asbestos in drinking water is 7,000,000 f/L and is based on fibers longer than 10 um in length. Upon review of available ecological toxicity data in the literature, it appears that effects thresholds range from about 10,000-1,000,000 f/L for aquatic receptors and wildlife. Therefore, a target analytical sensitivity of 50,000 f/L should be adequate to provide screening level risk estimates for humans and most ecological receptors of interest. Based on an effective filter area (EFA) of 1295 mm^2 and a grid opening (GO) area of 0.013 mm^2, this sensitivity can be achieved by filtering 100 mL of water and counting about 20 GOs, assuming that filter overloading does not occur.

Stopping rules for these analyses are as follows:

1. Calculate the number of GOs needed to achieve the target sensitivity.
2. If the target sensitivity can be achieved by counting 50 or fewer GOs, count until the target sensitivity is achieved, or until 50 LA structures are observed. If 50 LA structures are observed, finish counting the GO containing the 50th structure, then stop.
3. If the target sensitivity requires more than 50 GOs, count until the area examined[†] is at least 0.65 mm^2 or until 50 LA structures are observed. If 50 LA structures are observed, finish counting the GO containing the 50th structure, then stop.

Sediment

Preparation

All sediment samples collected for asbestos analysis will be transmitted to the CDM soil preparation laboratory at 2714 Walnut Street, Denver, Colorado. Samples will be prepared in accordance with ISSI-LIBBY-01 Revision 10. In brief, the raw sediment sample is dried and then split into two aliquots. One aliquot is placed into archive, and the other aliquot is sieved into coarse (> ¼ inch) and fine fractions. The fine fraction is ground to reduce particles to a diameter of 250 um or less and this fine-ground portion is split into 4 aliquots.

Analysis

Each sediment sample will be analyzed for LA in accordance with Libby site-specific SOPs. The coarse fraction (if any) will be examined using stereomicroscopy, and any particles of LA will be removed and weighed in accordance with SRC-LIBBY-01 Revision 2. Mass fraction

[†] Area Examined (mm^2) = GO area (mm^2) · GOs counted. If GO area is 0.013 mm^2, this is equal to 50 GOs.

estimates for the coarse fraction will be recorded on the most recent version of the Libby site-specific laboratory EDD spreadsheet ("SRC-LIBBY-01 Data sheet and EDD.xls").

One of the fine ground fraction aliquots will be analyzed by polarized light microscopy (PLM) using the visual area estimation method (PLM-VE) in accordance with SRC-LIBBY-03 Revision 2. Mass fraction estimates and optical property details will be recorded on the most recent version of the Libby site-specific laboratory EDD spreadsheet ("PLM (VE & PC) Data Sheet and EDD.xls").

9.2 Analytical Methods for Other (Non-Asbestos) Analytes

This section describes the laboratory analysis methods selected to provide non-asbestos chemical data to support the Phase IIC data quality objectives. Methods employed are derived from the following sources:

- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods* (EPA, 1986)
- *Methods for Chemical Analysis of Water and Wastes* (EPA, 1994b)
- Montana Department of Environmental Quality method specifications for petroleum hydrocarbons (MDEQ, 2003)

Detailed calibration procedures and quality control practices associated with each referenced method are described later in Section 10.

The laboratories performing chemical analyses will be required to follow procedures for each referenced method in accordance with the method protocols in the original source documents. All method-specific quality control measures, such as external and internal standard calibration procedures, instrument performance verifications, and quantitation using method of standard additions, specified within any referenced EPA method number will be performed.

Non-asbestos analyses required for surface water and sediment samples are listed in Tables 9-1 and 9-2, respectively. Analytes included under each method for surface water and sediment are identified in Tables 3-1 and 3-5, respectively.

9.3 Instrument Calibration and Frequency

All laboratory instruments used in the analysis of samples generated during this project must be calibrated by the laboratory in accordance with the requirements of the instrument manufacturer and the requirements specified in the relevant analytical method. Calibration records will be kept in logbooks for all instruments. It is the responsibility of the Laboratory Quality Assurance (QA) Officer to assure that calibration data is properly logged in the logbooks for each analysis.

9.4 Laboratory Custody Procedures and Documentation

The laboratories will implement the following procedures:

- A sample custodian will be designated.
- Upon receipt at the laboratory, each sample shipment will be inspected to assess the condition of the shipping container and the individual samples.
- Enclosed chain-of-custody records will be cross-referenced with all the samples in the shipment. These records will be signed by the sample custodian and placed in the project file.
- Sample storage will be secured (in the appropriate environment, i.e., refrigerated, dry, etc.), sample storage records and intra-laboratory sample custody records will be maintained, and sample disposal and disposal date will be properly documented.
- Internal chain-of-custody procedures will be followed by assigning a unique laboratory number to each sample on receipt; this number identifies the sample through all further handling;
- Internal logbooks and records will maintain the chain-of-custody throughout sample preparation and analysis, and data reporting will be kept in the project files.
- The original chain-of-custody record will be returned to the Project QA Officer with the resulting data report from the laboratory.

It is the laboratory's responsibility to maintain internal logbooks and records throughout sample preparation, analysis, and data reporting.

9.5 Laboratory Health and Safety

All laboratories analyzing samples from OU3 must be properly trained in the safe handling, storage and disposal of samples that may contain LA and other potentially hazardous materials.

9.6 Documentation and Records

Data reports will be submitted to the Project Manager and include a case narrative that briefly describes the number of samples, the analyses, and any analytical difficulties or QA/QC issues associated with the submitted samples. The data report will also include signed chain-of-custody (COC) forms, analytical data summary report pages, and a summary of laboratory QC sample results and raw data, where applicable. Raw data are to consist of instrument preparation and calibration logs, instrument printouts of field sample results, laboratory QC sample results, calibration and maintenance records, COC check in and tracking, raw data count sheets, spectra, micrographic photos, and diffraction patterns.

9.7 Data Deliverables

Asbestos data generated during this project will be entered into Libby-specific EDD spreadsheets by appropriately trained data entry staff. The data to be captured will include all relevant field information regarding each environmental sample collected, as well as the analytical results provided by the laboratory. Analytical results will include the structure-specific data for all TEM analyses and optical properties data for all PLM analyses. All data entry will be reviewed and validated for accuracy by the laboratory data entry manager or appointed delegate.

Non-asbestos data generated for this project will be transmitted via an EDD spreadsheet. The specific structure and format of this spreadsheet will be specified by the project data manager and will be provided to the laboratory for data submittal. All data entry will be reviewed and validated for accuracy by the laboratory data entry manager or appointed delegate.

All asbestos and non-asbestos EDDs will be submitted to EPA technical contractors (SRC) electronically. Whenever possible, data files should be transmitted by e-mail to the following address:

LibbyOU3@syrres.com

When files are too large to transmit by e-mail, they should be provided on compact disk to the following address:

Lynn Woodbury
Syracuse Research Corporation
999 18th Street, Suite 1975
Denver CO 80202

All original data records (both hard copy and electronic) will be cataloged and stored in their original form until otherwise directed by the EPA Remedial Project Manager. At the termination of Phase IIC, all original data records will be provided to the EPA Remedial Project Manager for incorporation into the OU3 project files.

10.0 QUALITY CONTROL

Quality Control (QC) is a component of the QAPP, and consists of the collection of data that allow a quantitative evaluation of the accuracy and precision of the field data collected during the project. QC samples that will be collected during this project include both field-based and laboratory-based QC samples.

10.1 Field-Based Quality Control Samples

Field-based QC samples are those samples which are prepared in the field and submitted to the laboratory in a blind fashion. That is, the laboratory is not aware the sample is a QC sample, and should treat the sample in the same way as a field sample. In general, there are three types of field QC sample: blanks, field splits/duplicates, and performance evaluation (PE) samples. Table 10-1 summarizes the types and frequency of field QC samples which will be collected during Phase IIC.

10.1.1 Blanks

Field Blanks

A field blank is a sample of the same medium as field samples, but which does not contain any contaminant. Field blanks are collected for water samples, but not for sediment.

A field blank for water shall be prepared by placing an appropriate volume of analyte-free reagent water (e.g., ASTM Type II) into a sample collection container. Field blanks for water will be collected at a rate of at least 10% (1 field blank per 10 field samples, or 1 per sample batch, whichever is greater).

Equipment Rinsate Blanks

Equipment rinsate blanks determine if decontamination procedures of field equipment are adequate to prevent cross-contamination of samples during sample collection. An equipment rinsate blank is prepared by rinsing decontaminated field equipment with analyte-free reagent water. Equipment rinsate blanks will be collected at a rate of 1 per sampling team per day. If field equipment is not re-used between sampling locations (i.e., dedicated equipment is used or equipment is disposable and decontamination is not necessary), equipment rinsate blanks will not be collected.

10.1.2 Field Duplicates

A field duplicate is a field sample that is collected at the same place and time as an original field sample. However, because of potential variation in field duplicate samples (even those from similar locations, especially for media such as sediment), it is not appropriate to assume that field duplicate pairs must necessarily have the same or similar concentration values. Rather, field duplicates help to evaluate variability due to small-scale media heterogeneity, along with analytical precision.

Table 10-1 summarizes the frequency that field duplicates will be collected for each media. In general, field splits/duplicates will be prepared at a rate of approximately 10% (1 field duplicate per 10 field samples). The specific stations at which field splits/duplicates will be collected will be determined in the field based on sampling conditions.

10.1.3 Performance Evaluation (PE) Samples

Performance Evaluation (PE) samples are samples of a matrix that contain a known and certified level of a contaminant. The results of PE sample analysis help evaluate analytical accuracy. PE samples for water and soil are available through the EPA Quality Assurance Technical Support (QATS) program. A total of 2 soil PE samples and 2 water PE samples containing a range of inorganic and organic analytes will be analyzed.

PE samples for LA in soil are available from USGS. These PE samples were prepared by mixing uncontaminated soil samples from Libby with known amounts of LA collected from the mine, so the true mass fraction of LA is known. A total of 2 PE samples representing a range of LA levels will be added to the sediment sample preparation and analysis train in random order at the time of sediment sample preparation by the preparation laboratory.

10.2 Laboratory-Based Quality Control Samples for Asbestos Analysis by TEM

The QC requirements for TEM analyses of air samples at the Libby site are patterned after the requirements set forth by NVLAP. There are three types of laboratory-based QC analyses that are performed for TEM. Each of these is described in more detail below.

Lab Blank - This is an analysis of a TEM grid that is prepared from a new, unused filter by the laboratory and is analyzed using the same procedure as used for field samples.

Recounts - A recount is an analysis where TEM grid openings are re-examined after the initial examination. The type of recount depends upon who is performing the re-examination. A *Recount Same* (RS) describes a re-examination by the same microscopist who performed the initial examination. A *Recount Different* (RD) describes a re-examination by a different microscopist within the same laboratory than who performed

the initial examination. An *Interlab* (IL) describes a re-examination by a different microscopist from a different laboratory.

Repreparation - A repreparation is an analysis of a TEM grid that is prepared from a new aliquot of the same field sample as was used to prepare the original grid. Typically, this is done within the same lab as did the original analysis, but a different lab may also prepare grids from a new piece of filter.

As described the most recent Libby-specific Laboratory Modification #29 (LB-000029), laboratory blanks will be performed at a frequency of 4%, recounts will be performed at a frequency of 5%, and repreparations will be performed at a frequency of 1%. Laboratory QC samples will be selected and analyzed in accord with LB-000029, except that the minimum frequencies will apply to each individual media specifically collected at OU3 as summarized in Table 10-2.

10.3 Laboratory-Based Quality Control Samples for Asbestos Analysis by PLM

10.3.1 Preparation Laboratory QC Samples

Sediment preparation QC samples are collected to ensure proper sample handling and decontamination of sediment preparation equipment. Preparation QC samples are assigned unique field identifiers and are submitted blind to the analytical laboratory along with the field samples. Thus, the analytical laboratories cannot distinguish field samples from preparation QC samples. Two types of preparation QC samples are included for PLM analysis. Each of these is described in more detail below.

Preparation Blank – A preparation blank consists of asbestos-free quartz sand which is processed with each batch of field samples. A batch of samples is defined as a group of samples that have been prepared together for analysis at the same time (approximately 125). Preparation blanks determine if cross-contamination is occurring during sample preparation processing (i.e., drying, sieving, grinding, and splitting). The target number of preparation blanks is 1 per batch. All preparation blanks shall be PLM-VE Bin A (non-detect). If a preparation blank is ranked as a detect, the procedures for equipment decontamination between samples will be revised and revised as needed.

Preparation Splits – Preparation splits are prepared by dividing a sample into two parts after drying but prior to sieving and grinding. One preparation duplicate is included for every 20 field samples prepared. Because preparation splits may be authentically different due to within-sample heterogeneity, there are no acceptance criteria for preparation splits. Comparison of the results for preparation splits with the paired original field samples helps to evaluate the variability that arises during the preparation and analysis steps.

10.3.2 Analytical Laboratory QC Samples

As part of PLM-VE analysis, laboratory duplicate analyses will be prepared at a frequency of 15% (3 per 20 analyses). A *laboratory duplicate* is a re-preparation of a soil sample slide by a different analyst than who performed the initial analysis. Laboratory duplicates are performed to evaluate potential analytical differences between analysts. The selection of samples for laboratory duplicate analysis will be performed by SRC based on the results of the original analyses. Selections will be made to include samples from all solid media and, to the extent possible, will include samples from each PLM-VE bin (Bin A, Bin B1, Bin B2, and Bin C).

Each sample selected for laboratory duplicate analysis will also be submitted for interlab analysis. An *interlab* (IL) is a re-analysis of a soil sample based on a second fine ground aliquot (e.g., FG2) that is examined by an analyst from a different laboratory than who performed the initial analysis. The identity of the laboratory to perform the analysis on the interlab samples will be specified by EPA. The acceptance criterion for laboratory duplicate and interlab analyses is that no more than 10% of all samples shall be strongly discordant (assigned different PLM-VE bins). If the discordance rate is greater than 10%, laboratory procedures for sample examination and bin-assignment shall be reviewed and staff re-trained, as needed.

10.4 Laboratory-Based Quality Control Samples for Non-Asbestos Analyses

The following subsections describe laboratory-based quality control measures used to assess and document the quality of analytical results for non-asbestos parameters. Laboratory QC sample analysis frequencies and control limits used by contracted laboratories will be in accordance with referenced analytical method protocols, and the QC analyses and results will be documented and reported to EPA by the selected laboratory.

Table 10-3 summarizes all laboratory quality control measures, control limits, and corrective actions for this project, by analysis method. All laboratory QC data will be reported with results of associated sample analyses to allow for comparison of QC results to the QC criteria specified for this project.

10.4.1 Method Blank

Method blanks are designed to measure laboratory-introduced contamination of environmental samples. Method blanks verify that method interferences caused by airborne contaminants, solvents, reagents, glassware, or other sample processing hardware are known and minimized. The blank will be ASTM Type II water (or equivalent) for water samples. The method/reagent blank is processed through all procedures, materials, and lab-ware used for sample preparation and analysis.

The frequency for method blank preparation and analysis is a minimum of one per twenty field samples or per analytical batch, whichever is most frequent. An analytical batch is defined as samples which are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch are to be of similar composition or matrix.

Acceptance criteria and corrective action for out-of-control method blanks are provided in Table 10-3.

10.4.2 Laboratory Control Samples

Laboratory control samples (LCSs) are designed to check the accuracy of the analytical procedure by measuring a known concentration of an analyte of interest. LCS samples are prepared by spiking clean, laboratory-simulated matrices (reagent-free water or purified solid matrix) with representative analytes at known concentrations that are approximately 10 times greater than the method's quantitation limits. These spiked samples are then subjected to the same preparation and analytical procedures as associated environmental samples. A LCS will be analyzed with every analytical batch, and the measured concentrations will be compared to the known, or spiked, concentrations of the LCS to compute a percent recovery value.

LCSs will be analyzed at a minimum frequency of one per every 20 samples or one per analytical batch of no more than 20 samples. Control limits for laboratory control samples are listed on Table 10-3. Failure of the LCS to meet recovery criteria requires corrective action before any further analyses can continue.

For some methods, a duplicate of the LCS is also analyzed with each analytical batch and the difference between the LCS and the LCS Duplicate (LCSD) indicates the precision of laboratory sample preparation and analysis methods at a known concentration level. Control limits for precision measured by the RPD of LCS/LCSD results are listed in Table 10-3. When LCSD samples are analyzed, the minimum frequency of analysis is one per every 20 samples.

10.4.3 Matrix Spikes/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) samples are designed to evaluate the effect of the sample matrix on analytical data, by measuring precision and accuracy from a known concentration of a target analyte that has been added to a particular sample matrix. MS/MSD samples are prepared by spiking environmental field samples with a standard solution containing known concentrations of representative target analytes. The MS/MSD sample pair is prepared from three volumes of an environmental sample. Two portions of the sample (the MS and the MSD) are spiked with the standard solution. The remaining volume is not spiked. The spiked samples are analyzed, and the percent recovery (PR) and relative percent difference (RPD)

between the results of the MS analysis and the MSD analysis are calculated. The unaltered sample volume is analyzed as an ordinary environmental sample.

Sampling personnel will identify for the laboratory which samples are to be used for MS/MSD preparation. Field blanks and field duplicates are not used as MS/MSDs. Typically, additional sample volume will be required to prepare the MS and MSD, especially for analyses of water samples for organic compounds. MS/MSDs will be analyzed at a minimum frequency of one per every 20 samples.

Background and interferences that have an effect on the actual sample analyte will have a similar effect on the spike. The calculated percent recovery of the matrix spike is considered to be a measure of the relative accuracy of the total analytical method, i.e., sample preparation and analysis. The matrix spike is also a measure of the effect of the sample matrix on the ability of the methodology to detect specific analytes. Acceptance criteria and corrective action procedures for out-of-control matrix spike results are listed in Table 10-3.

10.4.4 Surrogate Spike Analyses

Surrogate spike analyses are used to determine the efficiency of target analyte recovery during sample preparation and analysis. A surrogate spike is prepared by adding a known amount of surrogate compound to an environmental sample before extraction. The surrogate compound is selected to exhibit an analytical response that is similar to the response displayed by a target compound during sample analysis. The accuracy of the analytical method is measured using the calculated percent recovery of the spiking compound. Poor reproducibility and percent recovery during surrogate spike analyses may indicate sample matrix effects.

Surrogate compounds are not added to inorganic analyses; however, surrogates are required for most organic analyses. Both environmental and QC samples are spiked with surrogate compounds. Surrogate spike recoveries are acceptable if the results of a surrogate spike fall within the control limits established by laboratory QC protocol. Acceptance criteria and corrective action procedures for out-of-control surrogate spike results are listed in Table 10-3.

Frequencies for surrogate spike analyses will be consistent with the referenced method protocols.

10.4.5 Internal Standards

Internal Standards (ISs) are compounds of known concentrations used to quantitate the concentrations of target detections in field and QC samples. ISs are added to all samples after sample extraction or preparation. Because of this, ISs provide for the accurate quantitation of target detections by allowing for the effects of sample loss through extraction, purging, and/or matrix effects. ISs are used for any method requiring an IS calibration. Corrective action is

required when ISs are out of control. Acceptance criteria and corrective action procedures for out-of-control internal standard spike results are listed in Table 10-3.

10.4.6 Instrument Calibration and Frequency

Analytical instruments will be calibrated in accordance with the referenced analytical methods. All target analytes that are reported to EPA will be present in the initial and continuing calibrations, and these calibrations must meet the acceptance criteria specified in referenced methods. Records of standard preparation and instrument calibration will be maintained by the contract laboratory. Records will unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards will be traceable to standard materials.

Analyte concentrations are determined with either calibration curves (linear regression) or response factors (RFs). All correlation coefficients for linear regression calibration curves or relative standard deviation (RSD) of RFs to determine linearity must meet the acceptability criteria specified within the method. For GC/MS methods, the average RF from the initial five-point calibration will be used to determine analyte concentrations. The continuing calibration curve will not be used to update the RFs from the initial five-point calibration. GC/MS methods also will meet all instrument performance and/or tuning criteria as specified by the methods.

Initial Calibration Verification

Initial calibration curves must be verified using a standard made from a source independent of the one used to make the initial calibration standards. All target compounds must be included within the initial calibration verification (ICV), typically at a concentration around the midpoint of the calibration curve. Control limits and corrective action procedures for out-of-control initial calibration verification results are listed in Table 10-3.

Continuing Calibration and Verification

Initial calibration curves must be verified daily prior to sample analysis. All target compounds must be included, typically at a concentration around the midpoint of the calibration curve. Continuing calibration verifications (CCVs) are check samples required at frequencies specified in each analytical method, typically at the beginning and end of each analytical sequence and after every ten samples analyzed (as specified in each analytical method). Control limits and corrective action procedures for out-of-control CCV results are listed Table 10-3.

Calibration procedures for a specific laboratory instrument will consist of initial calibration (3- or 5-points), initial calibration verification (ICV) and continuing calibration verification (CCV). Calibration protocols included in method references, including calibration frequencies, conditions, and acceptance criteria, will be followed.

10.5 Quality Assurance Objectives For Measurement Data

This section identifies specific objectives for precision, accuracy, representativeness, completeness, and comparability of measurement data collected to support the Phase II data quality objectives.

10.5.1 Precision

Precision is defined as the agreement between a set of replicate measurements without assumption or knowledge of the true value. Agreement is expressed as either the relative percent difference (RPD) for duplicate measurements, or the range and standard deviation for larger numbers of replicates. Precision will be assessed through the calculation of the relative percent difference (RPD) for two replicate samples. RPD is calculated according to the following formula:

$$RPD = \frac{(S - D)}{(S + D)/2} \cdot 100$$

where: S = Original sample value
D = Duplicate sample value

Field precision is assessed through the collection and measurement of field duplicates. The variability between field duplicates reflect the combined variation in concentration between nearby samples and the variation due to measurement error. Because the variability between field duplicates is random and may be either small or large, no quantitative requirement for the agreement of field duplicates is established for this project.

Precision in the laboratory is assessed through calculation of RPDs for duplicate analyses or relative standard deviations (RSDs) for three or more replicate analyses of the same sample. Results from sediment duplicate samples are expected to be more variable than results from duplicate water samples due to the physical and chemical heterogeneity of the solid matrices. Based on this, an RPD of 50% for sediment field duplicate samples and 25% for water field duplicates will be used as advisory limits for analytes detected in both the original sample and its field duplicate at concentrations greater than 5 times the reported quantitation limit.

Differences greater than these advisory limits will be noted for data users through the data validation process.

10.5.2 Accuracy

Accuracy is a measure of the agreement between a measurement and the "true" value. The accuracy of a measurement may be affected by errors introduced by field contamination, sample preparation and handling, and sample analysis. The accuracy of an analytical method is generally assessed by analyses of samples with known concentration levels, including field calibration standards (for field based measurements), laboratory control samples, MS/MSD samples, and PE samples.

The accuracy required for data usability depends on a number of factors. In general, good accuracy is most important for samples whose concentration values are close to the level of concern, and a somewhat lesser level of accuracy may be acceptable for samples whose concentrations are either well below or well above a level of concern. Based on this, the goal is to achieve an analytical accuracy of ±25% for analytes that are within a factor of 10 of initial estimates of the level of concern, and ±50% for samples either 10-fold above or 10-fold below initial estimates of the level of concern.

10.5.3 Representativeness

Representativeness is the degree to which data accurately and precisely represent characteristics of a population, parameter variations at a sampling point, or an environmental condition. Representativeness of field measurements is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the SAP and SOPs are followed. The sampling activities in this plan are designed to provide data that are representative of conditions at specific locations and times of sample collection.

10.5.4 Completeness

Data are considered complete when a prescribed percentage of the total intended measurements and samples are obtained. Analytical completeness is defined as the percentage of valid analytical results requested.

Field completeness is a measure of the amount of valid measurement data collected for the project. The target completeness objective for field measurements collected for this sampling program is 95 percent or more.

Laboratory completeness is a measure of the amount of valid laboratory-measurement data obtained for the project. For this sampling program, a minimum of 90% percent of the planned collection of individual samples for quantification must be obtained to achieve a satisfactory level of data completeness.

10.5.5 Comparability

Data are comparable if collection techniques, measurement procedures, methods, and reporting units are equivalent for the samples within a sample set. These criteria allow comparison of data from different sources. Comparable data will be obtained by specifying standard units for physical measurements and standard procedures for sample collection, processing, and analysis.

The criteria for field comparability will be to ensure and document that the sampling designs are properly implemented and the sampling procedures are consistently followed for the duration of the data collection program. Each sampling task will utilize standardized procedures for sample collection and field measurements, as specified in Section 5 of this plan.

The criteria for laboratory data comparability will be to ensure that the laboratory results generated during this phase of investigation will be comparable to laboratory data collected for all other environmental investigations at OU3 and comparable to the asbestos data already collected by EPA in the vicinity of OU3. This goal will be achieved through utilization of standard EPA Test Methods and site-specific asbestos analysis methods for sample analyses and adherence to quality assurance/quality control and analytical procedures specified for the OU3 RI.

11.0 DATA MANAGEMENT

11.1 Data Applications

All data generated as part of the Phase IIC sampling event will be maintained in an OU3-specific Microsoft Access® database. This will be a relational database with tables designed to store information on station location, sample collection details, preparation and analysis details, and analytical results. Results will include asbestos data (including detailed structure attributes for TEM analyses and optical properties for PLM analyses) and non-asbestos chemical data (e.g., metals.

11.2 Roles and Responsibilities for Data Flow

11.2.1 Field Personnel

W.R. Grace contractors will perform all Phase IIC sample collection in accordance with the project-specific sampling plan and SOPs presented above. In the field, sample details will be documented on hard copy media-specific FSDS forms and in field log books. COC information will be documented on hard copy forms. FSDS and COC information will be manually entered into a field-specific[‡] OU3 database using electronic data entry forms. Use of electronic data entry forms ensures the accuracy of data entry and helps maintain data integrity. For example, data entry forms utilize drop-down menus and check boxes whenever possible. These features allow the data entry personnel to select from a set of standard inputs, thereby preventing duplication and transcription errors and limiting the number of available selections (e.g., media types). In addition, entry into a database allows for the incorporation of data entry checks. For example, the database will allow a unique sample ID to only be entered once, thus ensuring that duplicate records cannot be created.

Entry of FSDS forms and COC information will be completed weekly, or more frequently as conditions permit. Copies of all FSDS forms, COC forms, and field log books will be scanned and posted in portable document format (PDF) to a project-specific file transfer protocol (FTP) site weekly. This FTP site will have controlled access (i.e., user name and password are required) to ensure data access is limited to appropriate project-related personnel. File names for scanned FSDS forms, COC forms, and field log books will include the sample date in the format YYYYMMDD to facilitate document organization (e.g., FSDS_20070831.pdf). Electronic copies of all digital photographs will also be posted weekly to the project-specific FTP site. File names for digital photographs will include the station identifier, the sample date, and photograph identifier (e.g., ST-1_20070831_12459.tif).

[‡] The field-specific OU3 database is a simplified version of the master OU3 database. This simplified database includes only the station and sample recording and tracking tables, as well as the FSDS and COC data entry forms.

After FSDS data entry is completed, a copy of the field-specific OU3 database will be posted by the field data manager to the project-specific FTP weekly, or more frequently as conditions permit. The field-specific OU3 database posted to the FTP site will include the post date in the file name (e.g., FieldOU3DB_20070831.mdb).

11.2.2 Laboratory Personnel

Each of the laboratories performing asbestos analyses for the Phase IIC sampling event are required to utilize all applicable Libby-specific Microsoft® Excel spreadsheets for asbestos data recording and electronic submittals. Upon completion of the appropriate analyses, EDDs will be transmitted via email to a designated email distribution list within the appropriate turn around time. Hard copies of all analytical laboratory data packages will be scanned and posted as a PDF to the project-specific FTP site. File names for scanned analytical laboratory data packages will include the laboratory name and the job number to facilitate document organization (e.g., LabX_12365-A.pdf).

11.2.3 Database Administrators

Day-to-day operations of the master OU3 database will be under the control of EPA contractors. The primary database administrator will be responsible for sample tracking, uploading new data, performing error checks, and making any necessary data corrections. New records will be added to the master OU3 database within an appropriate time period of FSDS and/or EDD receipt.

Incremental backups of the master OU3 database will be performed daily Monday through Thursday, and a full backup will be performed each Friday. The full backup tapes will be stored off-site for 30 days. After 30 days, the tape will be placed back into the tape library to be overwritten by another full backup.

11.3 Data Storage

All original data records (both hard copy and electronic) will be cataloged and stored in their original form until otherwise directed by the EPA Remedial Project Manager. At the termination of this project, all original data records will be provided to the EPA Remedial Project Manager for incorporation into the site project files.

12.0 ASSESSMENT AND OVERSIGHT

Assessments and oversight reports to management are necessary to ensure that procedures are followed as required and that deviations from procedures are documented. These reports also serve to keep management current on field activities. Assessment, oversight reports, and response actions are discussed below.

12.1 Assessments

12.1.1 Field Oversight

All individuals who collect samples during field activities will be provided a copy of this SAP and will be required to participate in a pre-sampling readiness review meeting to ensure that methods and procedures called for in this SAP and associated SOPs are understood and that all necessary equipment is on hand. EPA may perform random and unannounced field audits of field sampling collection activities, as may be deemed necessary.

12.1.2 Laboratory Oversight

All laboratories selected for analysis of samples for asbestos will be part of the Libby analytical team. These laboratories have all demonstrated experience and expertise in analysis of LA in environmental media, and all are part of an on-going site-specific quality assurance program designed to ensure accuracy and consistency between laboratories. These laboratories are audited by EPA and NVLAP on a regular basis. Additional laboratory audits may be conducted upon request from the EPA, as may be needed.

12.2 Response Actions

If any inconsistencies or errors in field or laboratory methods and procedures are identified, response actions will be implemented on a case-by-case basis to correct quality problems. All response actions will be documented in a memo to the EPA RPM for OU3 at the following address:

Bonita Lavelle
U.S. EPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129
E-mail: lavelle.bonita@epa.gov

Any problems that cannot be corrected quickly through routine procedures may require implementation of a corrective action request (CAR) form.

12.3 Reports to Management

Field and analytical staff will promptly communicate any difficulties or problems in implementation of the SAP to EPA, and may recommend changes as needed. If any revisions to this SAP are needed, the EPA RPM will approve these revisions before implementation by field or analytical staff.

13.0 DATA VALIDATION AND USABILITY

13.1 Data Validation and Verification Requirements

Data validation, review, and verifications must be performed on sample results before distribution to the public for review.

Validation of Non-Asbestos Data

For non-asbestos analytical data, data validation will be performed in accord with the most current versions of EPA's National Functional Guidelines. In brief, the validation process consists of examining the sample data package(s) in order to determine if the data comply with the requirements specified in the National Functional Guidelines. The validator may examine, as appropriate, the reported results, QC summaries, case narratives, COC information, raw data, initial and continuing instrument calibration, and other reported information to evaluate the accuracy and completeness of the data package. During this process, the validator will determine if analytical methodologies were followed and QC requirements were met. The validator may recalculate selected analytical results to verify the accuracy of the reported information, as appropriate, and will assign qualifiers to the data as needed.

Verification of Asbestos Data

For asbestos analytical data, data verification includes checking that all required data have been entered on the laboratory bench sheets and field sample data sheets, and that results have been transferred correctly to the EDD. Some of the data verification checks are performed as a function of built-in quality control checks in the Libby-specific data entry spreadsheets. Additional verifications of field and analytical results will be performed manually by independent review of the bench sheets and FSDS. The initial frequency of manual review will be 10% of all samples. This initial rate may be revised either upward or downward depending on the frequency and nature of errors that are identified by the verification process.

13.2 Reconciliation with Data Quality Objectives

Once all samples have been collected and the analytical data have been reported and validated, the data will be reviewed by data users to determine if DQOs were achieved. A report of the data quality evaluation will be posted on the Libby OU3 site web page, when completed.

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