September 26, 2007

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

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

APPROVAL PAGE

This Phase I 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.

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9/26/07
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LIST OF ACRONYMS

AHERA	Asbestos Hazardous Emergency Response Act
BTAG	Biological Technical Assistance Group
BTEX	Benzene, toluene, ethyl benzene, and xylenes
CAR	Corrective Action Request
CCV	Continuing Calibration Verification
CSF	Close Support Facility
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
EMAP	Environmental Monitoring and Assessment Program
EPA	U.S. Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbons
USFWS	U.S. Fish and Wildlife Service
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
HASP	Health and Safety Plan
ICV	Initial Calibration Verification
ID	Identification
IL	Inter-laboratory
ISO	International Organization for Standardization
IS	Internal Standard
LA	Libby Amphibole
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MCL	Maximum Contaminant Level
MDEQ	Montana Department of Environmental Quality
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MTBE	Methyl tert-butyl ether
NVLAP	National Voluntary Laboratory Accreditation Program
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PDF	Portable Document Format
PE	Performance Evaluation
PLM	Polarized Light Microscopy

LIST OF ACRONYMS (cont.)

PLM-VE	Polarized Light Microscopy Visual Area Estimation Method
PPE	Personal Protective Equipment
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 Manger
RS	Recount Same
RSD	Relative Standard Deviation
SAED	Selective Area Electron Diffraction
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SPP	Soil Preparation Plan
TAL	Target Analyte List
TCL	Target Compound List
TEH	Total Extractable Hydrocarbons
TEM	Transmission Electron Microscopy
TWF	Time-Weighting Factor
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound
VPH	Volatile Petroleum Hydrocarbons

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

1.0 PROJECT OVERVIEW

1.1 Purpose of this Document

This document is the Phase I Sampling and Analysis Plan (SAP) for the collection and analysis of samples of environmental media within Operable Unit 3 (OU3) of the Libby Asbestos Superfund Site to support a remedial investigation/feasibility study (RI/FS). OU3 includes the property in and around the former vermiculite mine and 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.

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 the 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 Existing Site Data
Section 4 – Data Quality Objectives
Section 5 – Sampling Program
Section 6 – Laboratory Analysis Requirements
Section 7 – Quality Control
Section 8 – Data Management
Section 9 – Assessment and Oversight
Section 10 – Data Validation and Usability
Section 11 – 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 Marriam 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, and in the evaluation and interpretation of the data.
- NewFields Boulder LLC, working as a subcontractor to SRC, will provide support in sampling and analysis, mapping and other GIS applications, and design and evaluation of the feasibility study.
- Department of Transportation, John A. Volpe National Transportation Systems Center (Volpe) will provide management and coordination of resources for field oversight of sampling activities.
- Camp Dresser & McKee, Inc. (CDM) will provide on-site support and oversight for field sampling activities.

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 MWH Global, Inc. (MWH) and by

Meterological Solutions, Inc (MSI). Individuals responsible for implementation of field sampling activities are listed below:

- MWH Field Supervisor: John D. Garr
- MWH Field Quality Control Officer: Jeremy S. Collyard
- MWH Quality Assurance Officer: Stephanie A. Boehnke
- MSI point of contact: Bill Hauze

EPA Field Oversight Contractor

The on-site point of contact for access to the mine and the coordinator of field oversight activities for OU3 Phase I sampling is Courtney Zamora of Volpe. Oversight of field sampling activities will be provided by CDM staff, under the supervision of Nick Raines.

Sample Preparation and Analysis

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

- All analyses of samples for asbestos will be performed by EMSL Analytical, Inc.
- All analyses of samples for non-asbestos analytes will be performed by Energy Laboratories, Inc. (ELI)
- All samples of soil or soil-like media to be analyzed for non-volatile analytes will be prepared for analysis by EPA's soil preparation facility in Troy, MT.
- All validation and verification activities for asbestos and non-asbestos data will be performed by SRC.

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. She will be responsible for sample tracking, uploading new data, performing error checks to identify inconsistent or missing data, and ensuring that all questionable data are checked and corrected 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.

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. The mine location and preliminary study area boundary of OU3 are shown in Figure 2-1. EPA established the preliminary study area boundary for the purpose of planning and developing the initial scope of the RI/FS for OU3. The preliminary study area boundary includes the former vermiculite mine and the surrounding geographic area that may have been impacted by current and/or historical releases and subsequent migration of hazardous substances and/or pollutants or contaminants from the mine. As noted above, this boundary may be revised based on data about the extent of environmental contamination associated with releases that may have occurred from the mine site.

The terrain in OU3 is mainly mountainous with dense forests and steep slopes. The major mountain ranges in the area are the Cabinets to the southwest and the Parcells to the northeast.

Land ownership in OU3 is shown in Figure 2-2. Kootenai Development Corporation (KDC), a subsidiary of W.R Grace & Co., owns the mine area and the immediately adjacent portion of the off-mine area. The majority of the surrounding land is owned by the United States government and is managed by the Forest Service, with some land parcels owned by the State of Montana and some owned by Plum Creek Timberlands LP for commercial logging. There are numerous smaller parcels adjacent to the Kootenai River. All land parcels within the study area boundaries that are currently residential are excluded from OU3. These current residential properties are included as part of OU4, and as such, investigation and cleanup of these properties is within the scope of OU4.

2.1.1 Climate

Northern Montana has a continental climate characterized by relatively hot summers, cold winters, and low precipitation. Table 2-1 presents climate data collected at the Libby NE Ranger Station, which is located just west of the town of Libby near the Kootenai River. Average summer high temperatures (^{o}F) are in the upper 80s, and low temperatures are in the 40s, while winter highs are in the 30s and lows are in the teens. The western mountain ranges cause Pacific storms to drop much of their moisture before they reach the area, resulting in relatively low precipitation, averaging about 18 inches per year. The most abundant rainfall occurs in late spring/early summer. In the winter months, snowfall averages 54 inches each year and snow cover typically remains on the ground from November through March.

Remedium Group, Inc., a subsidiary of W.R. Grace & Company, installed a meteorological station at the mine in December 2006. Data collected at this station through August 2007

indicate that winds are predominantly to the northeast (Figure 2-3). Local wind patterns and climate conditions may be significantly affected by local topography and ground elevation. Data collection is continuing to assess variability during the summer and fall seasons.

2.1.2 Hydrologic Setting

The mine area is contained completely within the Rainy Creek watershed, which includes Carney Creek and Fleetwood Creek (Figure 2-4). Rainy Creek originates between Blue Mountain and the north fork of Jackson Creek at an elevation of about 5,000 feet, and falls to an elevation of 2,080 feet at the confluence with the Kootenai River approximately 2.5 miles downstream of the Libby Dam and 5.5 miles upstream of the town of Libby (Zinner, 1982). The area drained is approximately 17.8 square miles, including 3.8 and 2.2 square miles associated with Fleetwood Creek and Carney Creek, respectively.

Small springs are reported in the area of the mine (Zinner, 1982) associated with Fleetwood and Carney Creeks. Monitoring performed in the early 1990s observed Carney Creek flows originating from beneath a waste rock pile. Fleetwood Creek flows through a portion of the disturbed area before flowing into the tailings impoundment, which was constructed within the former Rainy Creek channel. Water entering the tailings impoundment (from Rainy and Fleetwood creeks) infiltrates into the tailings and exits via the toe drain at the base of the dam. This flows into a lower pond in the Rainy Creek channel that was constructed to provide a water supply for mining operations. Discharge from this pond mixes with inflow from Carney Creek and flows down Rainy Creek to the Kootenai River, with some seasonal gain in flow, most likely due to groundwater input.

Flows in the Kootenai River are controlled by the Libby Dam, which was constructed in the late-1960s and early-1970s as part of the Columbia River development for flood control, power generation, and recreation. The drainage area above the dam is approximately 9,000 square miles. Daily water outflow plans[1] for October 2006 through August 2007 show lowest discharge flows in March and October at approximately 4,000 cubic feet per second (cfs) and maximum discharge flows in late May/early June at 26,600 cfs.

Table 2-2 presents designated uses for Rainy Creek and the Kootenai River near and downstream of the mine area as classified by the State of Montana Administrative Rules Chapter 30 Water Quality Subchapter 5 (§17.30.609 for the Kootenai River drainage). The State of Montana has established numeric standards for the protection of aquatic life and human health associated with the designated uses. The numeric standards are set forth in the Montana Department of Environmental Quality Circular DEQ-7 – Montana Numeric Water Quality Standards.

[1] Available from http://www.nwd-wc.usace.army.mil/ftppub/project_data/yearly/lib_wy_qr.txt

2.1.3 Hydrogeologic Setting

An investigation of groundwater at the mine performed in the early 1980s (Zinner, 1982) included more than 100 shallow boreholes (less than 200 feet) and two deep holes (900-1,000 feet). The general hydrogeological setting appears to be recharge in the mountains above the mine with some expression of groundwater at the surface as springs near the mine area and recharge to lower Rainy Creek. Regional groundwater flows have not been assessed at this time.

Zinner (1982) identified two types of aquifers in this geologic setting; a layer of altered vermiculite pyroxenite (upper 100 to 200 feet) and the unaltered biotite pyroxenite surrounding the alteration zone. Except where mining has removed the surface material, an overburden layer consisting of reworked glacial deposits blankets most of the area. The overburden is less permeable than the vermiculite pyroxenite and acts as a semi-confining layer, holding groundwater under artesian conditions. Holes drilled in the altered zone produced up to 50 gallons per minute water. This zone appears to be capable of storing and producing considerable quantities of water.

2.1.4 Geologic Setting

The mine is located in a region of the Precambrian Belt Series of northwestern Montana that has been intruded by an alkaline-ultramafic body. The Rainy Creek Igneous Complex comprises the upper portion of this intrusion. Hydrothermal alteration of the biotite pyroxenite intrusion produced the large, high-quality vermiculite deposit. The vermiculite content of the ore varies considerably within the deposit, ranging from 30 to 84%.

A syenite body located southwest of and next to the altered pyroxenite is associated with several syenitic dikes that cut the pyroxenites. Alkaline pegmatites, alkaline granites, and quartz-rich veins also cut the pyroxenites, syenite, and surrounding country rock.

2.1.5 Occurrence and Nature of Asbestos at the Mine

Fibrous and asbestiform amphiboles are present in association with the vermiculite ore. A significant portion of the fibrous amphiboles are located along cross-cutting veins and dikes and in the altered pyroxenite wall rock adjacent to them. The alteration zones, dikes, and veins that range in width from a few millimeters to meters in thickness are found throughout the deposit. Amphibole content in the alteration zones of the deposit is estimated to range between 50 to 75%. Additional alteration minerals include calcite, K-feldspar, vermiculite, talc, titanite, limonite, pyrite, quartz, and albanite.

The U.S. Geological Survey (USGS) performed electron probe micro-analysis and X-ray diffraction analysis of 30 samples obtained from the exposed asbestos veins to identify compositional changes across the veins (Meeker et al. 2003). Results indicate that a variety of

amphiboles exist at this site, including winchite, richterite, tremolite, actinolite, and magnesioriebeckite. The EPA refers to this mixture of amphibole minerals as Libby Amphibole (LA).

2.1.6 Mine Operations and Current Features

Figure 2-5 shows the current mine features and location of historical operations. The mine was operated from 1923 until 1990 and was open pit except for a short period in the early period of operations. The mine area is heavily disturbed by past mining activity and is largely devoid of vegetation. There are a number of areas where mine wastes have been disposed (Figure 2-5), including waste rock dumps (mainly on the south side of the mine), coarse tailings (mainly to the north of the mine), and fine tailings (placed in the tailings impoundment on the west side of the site).

The basics of ore processing did not change over the period of operation, although unit operations were changed as ore quality decreased and technology improved, and in response to concerns over dust generation (Zucker, 2006). In general, rock was removed to allow access to the vermiculite or separated from the vermiculite in the mine pits and dumped over the edge to form waste rock piles (see Figure 2-5). After 1971, ore was processed to separate out vermiculite product by crushing, screening or water floatation, with those operations generally occurring in the mill area (Figure 2-5).

Mining increased dramatically in scale over the first 25 years of mining, with just 100 tons of vermiculite product shipped per year in the 1920s, rising to over 200,000 tons by 1950 (Quivik, 2002). Thereafter, production rates were generally in the range of 150,000 to 250,000 tons per year.

A storage and loading facility along the river at the mouth of Rainy Creek was built in 1949. It included a 600-foot conveyor belt for carrying material across the Kootenai River, and a loading facility along the Great Northern Railroad tracks on the south side of the river.

A new concentrating plant began operations in 1954 in the general milling area (Figure 2-5). This plant was designed to separate the vermiculite from ore that contained less than 35% vermiculite. Continued refinements led to implementation of a wet process, in which a froth flotation process was coupled with shaking tables to separate waste rock from the vermiculite. The dry mill continued to operate. By 1960, the concentration of ore took place along one of two processes (Quivik, 2002). After passing through a two-inch grizzly, ore went to one of five storage bins at the mill. Ore was blended and sent to the primary screens at the mill where water was added. Oversize material was concentrated in jigs and dried in rotary driers. The material was then crushed using hammer mills, and roll crushers before being screened, with finer material further separated using spiral concentrators, dewatered and dried before being screened for product. The process generated two types of waste material; coarse tailings which were

disposed in a pile to the north (Figure 2-5) and fine tailings which appear to have been discharged to Rainy Creek until a tailings impoundment was constructed in 1971.

W.R. Grace & Co.-Conn. (then known as W.R. Grace & Co.) took over mining in 1963. In 1971, they undertook a major expansion to increase capacity and improve the beneficiation process. It was at this time that the tailings impoundment was built to provide for settlement of the fine tailings produced by the new process and to recover water for reuse (Schafer, 1992). The dam was designed and constructed in stages, with a 50 foot high starter dam constructed in 1971, immediately downstream of an older, existing dam. Additional construction phases in 1975, 1977, and 1980 raised the top of the dam to a total height of 135 feet measured from the downstream toe.

Remedium reviewed historic information on mining operations at the site and reported that in a typical year about 5 million tons of rock was mined to generate 220,000 tons of vermiculite product. Primary waste materials were waste rock (3.5 million tons per year) and tailings (1.1 million tons per year), with lesser amounts of oversize rock and screening plant concentrate wastes. As higher quality ores were depleted and lesser quality ores were mined, various reagents were used to facilitate the separation. Reported reagents include #2 Diesel Fuel (typically between 1.2 and 5.4 million pounds per year), Armeen T (Tallow Alkyl Amine; 100,000 to 500,000 pounds per year), fluorosilicic acid (50,000 to 240,000 pounds per year) and lesser quantities of flocculants, defoamers, frothers and other reagents.

2.2 Problem Definition

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 individuals, including workers at the mine and processing facilities (Amandus and Wheeler 1987, McDonald et al. 1986, McDonald et al. 2004), as well as residents of Libby (Peipens et al. 2003).

Starting in 2000, EPA began taking a range of cleanup actions at the site to eliminate sources of LA exposure to residents and workers using CERCLA (or Superfund) authority. In the early stages, efforts were focused mainly on wastes remaining at former vermiculite processing areas (the screening plant, export plant, etc.). As work progressed, attention soon shifted to cleanup of current homes and workplaces in the main residential/commercial areas of Libby, designated by EPA as OU4 of the Libby Asbestos Site. EPA listed the Libby Asbestos Site on the National Priorities List in October 2002.

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. An investigation of the nearby town of Troy, designated as OU7, began in the summer of 2007. Relatively little information has been collected to evaluate contaminant levels and releases

associated with the mine site itself (OU3). However, this area is of potential concern to EPA since the area is used by humans for a variety of recreational activities as well as for logging, and is also habitat to a wide variety of ecological receptors. Contaminants of potential concern in OU3 include not only LA, but any other mining-related contaminants that may have been released to the environment. Therefore, the problem to be addressed is the collection of sufficient information to allow reliable evaluation of risks to humans and ecological receptors from exposure to mining-related releases in OU3 and to support the development and evaluation of remedial alternatives to address unacceptable risks. This will occur over multiple, phased sampling events. The first sampling event (Phase I, as described in this document) is not expected to provide data that will be sufficient to fully characterize the nature and extent of contamination or to support a risk assessment.

3.0 SUMMARY OF EXISTING SITE DATA

Only limited data exist on the nature of source materials at the mine site and on the identity and levels of mining-, processing-, and mine waste disposal- related releases from the mine to surrounding areas in OU3. This section provides a summary of the OU3-specific data that have been located to date.

3.1 Soils and Mine Wastes

As part of site characterization associated with EPA's initial response activities at the Libby Asbestos Site, EPA collected numerous soil samples along roadways within OU3 (EPA 2000a, 2005; CDM 2002, 2003). Figure 3-1 presents the locations of soil samples collected along Rainy Creek road, Highway 37 N, and a forest service road within OU3. In addition to the roadway samples, EPA has also collected surficial soil samples from two logging areas within OU3 (EPA 2000a). Table 3-1 summarizes the asbestos levels measured in these soil samples. As seen, asbestos levels in roadway soils range from non-detect up to 7-8%. Most of the soil samples from logging areas reported asbestos levels less than 1%.

No soils or mine waste data have been identified for non-asbestos contaminants.

3.2 Surface Waters and Sediments

Since 1981, sampling of surface water and sediment has been limited and sporadic. Figures 3-2 and 3-3 present the locations of available surface water and sediment samples, respectively. Zinner (1982), Shafer and Associates (1992-1995), and W.R. Grace (2006) provide historic information on surface water quality from 1981 through 1994. Review of these data indicates the following general conclusions:

- Water is typically pH neutral with total dissolved solids content less than 500 mg/L and low sulfate concentrations; acid mine drainage is not indicated.
- Analyte lists for water were relatively short and in some cases detection limits were too high to allow conclusions about whether metals exceed water quality criteria.
- Concentrations of metals/inorganics in water tend to be highest in the tailings pond toe-drain water and decrease downstream in Rainy Creek, likely as a result of gaining flow from groundwater input. Concentrations of fluoride, zinc, arsenic, phosphate, and Kjeldahl nitrogen may be elevated due to mine sources.
- Asbestos levels in water from Lower Rainy Creek (below the confluence of Carney Creek and Rainy Creek), Carney Creek and in the tailings pond have all been measured above the drinking water Maximum Contaminant Level. Measured values were variable and could be dependent on stream flow rates. Lower Rainy Creek appears to be the primary source of asbestos fibers discharged into the Kootenai River. This may be the

result of old mining practices in which tailings were discharged directly into the Rainy Creek drainage rather than into an impoundment (Shafer, 1993).

- There are no non-asbestos contaminant data for sediments.

More recently (2001-2003), EPA has collected several surface water and sediment samples from Rainy Creek and the tailings pond (EPA 2000a, CDM 2003). Tables 3-2 and 3-3 provide the surface water sample results for asbestos and non-asbestos analytes (e.g., PCBs, pesticides, volatile organic compounds (VOCs), total petroleum hydrocarbons), respectively. Table 3-4 provides the sediment results for asbestos.

As seen, asbestos has been detected in five surface water samples collected from Rainy Creek and the tailings pond, with detected levels ranging from 219 to 9,438 total LA f/mL (Table 3-2). The current MCL for asbestos in water is 7,000 f/mL > 10 um, and one sample from Rainy Creek slightly exceeds this value. Asbestos was also detected in sediment from the upper tailings pond (Table 3-4). Surface water collected in 2001 from the upper and lower ponds along Rainy Creek did not contain any detectable concentrations of metals, total petroleum hydrocarbons, organochlorine pesticides, selected PCB arochlors, or volatile hydrocarbons (Table 3-3).

3.3 Groundwater

Groundwater wells have reportedly been installed at the mine. Historical sampling records refer to various potable water samples that may have been collected from groundwater wells. In addition, a "new well" was drilled in 1986 to a depth of 405 feet. This appears to have been a potable water well. One sample was collected shortly after installation showing near-neutral water, with no exceedences of drinking water Maximum Contaminant Levels for the constituents analyzed (arsenic, barium cadmium, chromium, lead, manganese, mercury, selenium and silver) and possibly slightly elevated levels of nitrate and fluoride.

Well locations were obtained from the Montana Natural Resource Information – Groundwater Information Center web page and from W.R. Grace historical records. Figure 3-4 presents the locations of these groundwater wells.

No asbestos data have been identified for groundwater.

3.4 Tree Bark

Ward et al. (2006) collected tree bark samples from six locations in and around Libby in November 2004. Three of these were located in forested locations within the preliminary OU3

study area. These three stations are shown in Figure 3-5. Samples were analyzed for asbestos by Transmission Electron Microscopy (TEM) using counting methods as specified in the Asbestos Hazardous Emergency Response Act of 1986 (AHERA 1986). For the purposes of reporting analytical results, it was assumed that the surface area of each sample was 2 cm^2. Table 3-5 presents the results. As seen, asbestos loading on these three tree bark samples ranged from 14 million to 260 million f/cm^2, with levels tending to be lowest at Location 3 and highest at Location 1. Lower levels (< 6 million f/cm^2) were reported for the three samples located further from the mine.

No data have been identified for non-asbestos contaminants in tree bark.

3.5 Air

EPA has collected numerous personal and stationary air monitoring samples for analysis of asbestos as part of clean-up activities within OU3. Personal air monitoring data is collected for all clean-up workers to ensure that exposures are not above Occupational Safety and Health Administration (OSHA) levels of concern and to determine the appropriate level of personal protective equipment (PPE) needed during clean-up activities. Table 3-6 summarizes the TEM results for worker personal air monitoring samples collected within OU3 currently in the Libby2 database. As seen, air concentrations of LA vary widely depending upon the types of activities conducted, with detected LA concentrations ranging up to 6.6 structures per cubic centimeter (s/cc) of air.

Most of the stationary air monitoring samples within OU3 were collected along roadways within the mine area, Rainy Creek road, and Highway 37 N. Table 3-7 summarizes the TEM results for stationary air monitoring samples collected within OU3. As seen, between 30-50% of all stationary air samples collected prior to 2002 were detect for LA, with detected LA concentrations ranging up to 0.2 s/cc.

No data have been identified for non-asbestos contaminants in air.

3.6 Biota

No samples of biota from OU3 have been analyzed for asbestos or other mining-related contaminants.

The U.S. Forest Service (USFS) has acquired biological data for Rainy Creek and other streams and rivers in the area. EPA has not yet reviewed these data, but it is expected that these data will be valuable in planning data collection efforts to support the aquatic risk assessment for OU3.

EPA's Environmental Monitoring and Assessment Program (EMAP) has collected aquatic community data at a station on the Kootenai River about one mile downstream of the confluence with Rainy Creek. This location was sampled in August 2002. Forty-four species of aquatic invertebrates (Table 3-8) and eleven species of fish (Table 3-9) were collected from this location.

The Montana Natural Heritage Program reports that there are 92 Species of Concern (plants and animals) in Lincoln County. The list includes species that are at-risk or potentially at-risk due to rarity, restricted distribution, habitat loss, and/or other factors. The list includes species that have a special designation by federal organizations or land management agencies, including the Bureau of Land Management (Special Status and Watch species), the U.S. Forest Service (Sensitive and Watch species), and the U.S. Fish and Wildlife Service (USFWS) (Threatened, Endangered and Candidate species). The USFWS in Helena, Montana identified six federally listed rare, endangered and threatened species in the vicinity of the Mine area. These include the Canada lynx, bull trout, gray wolf, grizzly bear, bald eagle, and white sturgeon.

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 chemical 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

One of the first steps in planning data collection to support an RI in the Superfund program is development of a Conceptual Site Model (CSM). The 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 (both human and ecological) may be exposed to site-related contaminants. When information is sufficient, the CSM may also indicate which of the exposure scenarios for each receptor are likely to be the most significant, and which (if any) are likely to be sufficiently minor that detailed evaluation is not needed. The CSM is therefore helpful in identifying environmental media that may require sampling in order to evaluate exposure and risk from site-related releases.

For OU3, it is convenient to divide the CSM into four parts:

- Exposure of humans to asbestos
- Exposure of humans to other (non-asbestos) chemicals
- Exposure of ecological receptors to asbestos
- Exposure of ecological receptors to other (non-asbestos) chemicals

Figures 4-1 to 4-2 present initial CSMs for human exposures at the site. It is important to note that these initial CSMs are based on the limited information currently available, and it is expected they will be revised and improved as additional information is acquired.

Each CSM identifies a number of exposure pathways that may be occurring, now or in the future. However, not all pathways are equally likely to be important. In each CSM, pathways are divided into four 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. These are the pathways for which data will be acquired so that meaningful estimates of exposure and risk can be derived.
- An open circle (O) represents an exposure pathway that is or might be complete, but which is unlikely to be a major contributor to the total risk to a receptor, at least in comparison to one or more other pathways that are evaluated. Data collection to support assessment of this type of pathway is not considered necessary.
- A question mark (?) represents an exposure pathway that is or might be complete, but data available at present are not adequate to decide if the pathway is or is not a major contributor to the total risk to the receptor.
- An open box represents an exposure pathway that is believed to be incomplete (now and in the future). Thus, this pathway is not assessed.

4.2.1 Human Exposure to Asbestos

Figure 4-1 presents an initial CSM for human exposure to asbestos that summarizes EPA's current understanding of the environmental media that are likely to be contaminated by past and ongoing releases of asbestos from the mine and pathways by which humans might be exposed, now or in the future. The CSM for asbestos focuses on pathways of inhalation exposures, because the inhalation pathway is generally considered to be of much greater risk than oral or dermal pathways. A range of different human receptors may be exposed, including:

- *Recreational visitors in the forested area* – This receptor population includes children and adults who engage in activities such as camping, hiking, dirt bike riding, ATV riding, hunting, etc. Exposures of primary concern for asbestos include inhalation of ambient air and inhalation of air in the vicinity of soil or roadway disturbances or the burning of wood derived from potentially contaminated trees. Inhalation exposures due to cutting/sawing of potentially contaminated trees is not evaluated for this type of recreational visitor because it is anticipated that this exposure scenario would be addressed in the wood cutter receptor population (see below).

- *Wood cutters in the forested area* – This receptor population includes adult area residents who engage in sawing and hauling wood for personal use, as well as adult workers who

are employed in commercial logging operations. Exposures of potential concern for asbestos include inhalation of ambient air and inhalation of air in the vicinity of soil disturbances and tree cutting/sawing activities.

- *Recreational visitors along streams and rivers (e.g., Rainy Creek, Kootenai River)* – This receptor population includes adults and children who hike, fish, wade/swim or explore site drainages, including Fleetwood Creek, Carney Creek, and Rainy Creek, and reaches of the Kootenai River that may be impacted by site releases. Exposures of potential concern for asbestos include inhalation of ambient air and inhalation of air in the vicinity of disturbed soil or dried sediments.

- *Fire fighters in the forested area* – This population includes adults who may respond to forest fires in the area of the site. Exposures of potential concern for asbestos include inhalation of ambient air and inhalation of air in the vicinity of soil disturbances, tree cutting/sawing activities, or the burning of potentially contaminated trees.

- *Trespasser or "rockhound" in the mined area* – This population includes children and adults who trespass on the area that has been disturbed by past mining activities. In this document, this is referred to as the "mined area". Exposures of potential concern for asbestos include inhalation of ambient air and inhalation of air in the vicinity of soil and solid waste (e.g., tailings, ore) disturbances.

Note that the CSM for OU3 does not include residential exposure scenarios. This is because any properties geographically within OU3 that are currently residential will be evaluated as part of OU4, and, based on information currently available to EPA, future residential development is not reasonably anticipated in other areas of OU3.

4.2.2 Human Exposure to Other Chemicals

Figure 4-2 presents an analogous CSM for human exposure to non-asbestos chemicals from the site. This might include a range of different types of contaminants, potentially including metals and metalloids released from ore and waste rock, as well as foaming agents, petroleum products, herbicides, pesticides, and PCBs that may have been used or released during site operations. As seen, the receptor populations of interest are the same as identified above for asbestos. However, the exposure pathways of potential concern include not only inhalation, but also ingestion and dermal contact with contaminated site media (soil, surface water, sediment, etc.).

4.2.3 Exposure of Ecological Receptors to Asbestos and Non-Asbestos Contaminants

A wide range of ecological receptors may be exposed to site-related contaminants. This may include a number of species of aquatic and semi-aquatic receptors (fish, benthic invertebrates, amphibians) in and along Rainy Creek, a variety of birds and mammals that feed and/or breed in

the forested area around the mine, as well as plants and soil invertebrates in and around the mined area. Environmental media that may be impacted by mine-related contaminants include soil, surface water, sediment, air, and biotic food web items.

At present, conceptual site models have not been finalized for exposure of ecological receptors to asbestos or non-asbestos contaminants. These site models will be developed by EPA with input and advice from the Biological Technical Assistance Group (BTAG), and these site models will be used to develop appropriate data collection efforts in Phase II.

4.3 Phased Sampling Approach

Collection of data needed to assess all of the media and exposure pathways indicated in the CSMs and to support baseline human health and ecological risk assessments is expected to occur in two or more Phases. Phase I sampling and analysis, planned for the fall of 2007, is intended to provide initial information on the nature and extent of asbestos and non-asbestos contamination, to identify contaminants of potential concern to be investigated in the remedial investigation, and to establish a study area boundary for Phase II of the remedial investigation. Phase I is not expected to provide data that will be sufficient to fully characterize the nature and extent of contamination or to support a risk assessment. Rather, the results of Phase I are intended to provide sufficient information that a more detailed and extensive sampling effort (Phase II) may be planned for implementation in the summer of 2008. Additional Phases may be planned and executed as deemed necessary by EPA.

4.4. General Data Quality Objectives for Phase I Sampling

This section presents a general overview of the data quality objectives of the Phase I sampling effort. Details specific to the sampling of each environmental medium are presented in Section 4.5.

4.4.1 State the Problem

Evaluation of the nature and extent of environmental contamination and assessment of risks to humans and ecological receptors requires reliable and representative data on the concentrations of mining-, processing-, and mine waste disposal-related contaminants in a range of environmental media (soil, surface water, sediment, groundwater, biota, air, etc.), as well as data on the status of ecological communities at the site. At present, some data on contaminant levels and ecological communities are available, but the data are too limited to support reliable assessment of nature and extent of contamination or of human or ecological risks. Therefore, additional data collection is needed. These data will be collected during the remedial investigation for OU3. Phase I is the first part of this data collection effort.

4.4.2 Identify the Decisions

Ultimately, EPA must decide if and where response actions are needed in OU3 to protect human and/or ecological receptors from unacceptable risks from asbestos and any other mining-related contaminants. As noted above, it is not expected that data collected during the Phase I investigation will be sufficient to support these risk management decisions. Rather, the data collected during Phase I is intended to provide preliminary information to address the following questions:

- What will be the study area for Phase II of the remedial investigation of OU3?
- What contaminants and what media will be investigated in Phase II of the remedial investigation of OU3? Which (if any) can be excluded?
- Of the various types of contamination within the mine area, which are likely to be the most important sources of release to other media?

Data collected during Phase I will provide a basis for the design of the Phase II sampling effort. This includes key information on source areas, transport pathways, contaminants of potential concern, and extent of contamination.

4.4.3 Identify the Types of Data Needed

<u>Contaminant Concentration Data</u>

One type of data that is needed to evaluate risks from contaminant release is the concentration of contaminants in various site media. Based on the initial CSMs presented above and an understanding of the available environmental data sets (as presented in Section 3), it is expected that concentration data on asbestos and/or non-asbestos contaminants may ultimately be needed for the following:

- Ambient Air
- Air in the vicinity of surface soil, roadway, sediment, and solid waste material disturbances
- Tree bark, and air in the vicinity of tree bark disturbances
- Surface water
- Bulk sediment
- Groundwater
- Surface soil
- Mine waste
- Aquatic and terrestrial food items (e.g., fish, invertebrates, plants, birds, small mammals)

However, it is not considered feasible (given the study temporal bounds) or necessary to collect initial data for all of these media during the Phase I investigation. Media that will be sampled for contaminant levels during Phase I include:

- Ambient Air
- Surface water
- Bulk sediment
- Surface soil
- Tree bark
- Mine waste
- Groundwater

Target analytes in these media may include LA, metals and metalloids, and potentially other chemicals that may have been used at and released from the site (e.g., foaming agents, petroleum products, herbicides, pesticides, PCBs, etc.).

Another type of data that was considered for collection during Phase I was sampling of biota to obtain preliminary information on the types of aquatic and terrestrial organisms present at the site, initial testing of sediments and surface water for toxicity to aquatic receptors, and measurement of biomarkers of exposure to asbestos (asbestos tissue burden) in aquatic and terrestrial receptors. However, it was decided that this type of sampling activity will likely be more effective if it is deferred until the data from Phase I become available, and after a BTAG has been formed to assist in problem formulation and sampling design.

4.4.4. Define the Bounds of the Study

Spatial Bounds

The spatial bounds of OU3 are not yet established, and will ultimately be defined by the RI for OU3. For the purposes of the Phase I investigation, the areas that will be investigated include:

- The mined area, including various areas of mine waste disposal, will be investigated to characterize the nature of the source materials and current releases into ambient air.
- An area about 4-8 miles from the mined area will be investigated to provide an initial characterization of the spatial pattern of past and present airborne asbestos deposition.
- Rainy Creek, Fleetwood Creek, and Carney Creek and Rainy Creek Road will be investigated to characterize releases that occurred by transport down the drainage from the site, either in Rainy Creek itself or by spillage of mine materials hauled by truck along Rainy Creek Road.

Temporal Bounds

Because the level of mining-related contaminants in some environmental media (e.g., air, water) may tend to vary over time, it may ultimately be necessary during Phase II and subsequent investigations to collect multiple samples over time in order to fully characterize the variability and average concentration values. However, this is not an objective of the Phase I investigation. Rather, Phase I is intended to provide information on conditions within OU3 at the time of sampling (fall of 2007).

4.4.5. Define the Decision Rule

As noted above, the data from Phase I sampling are not expected to be used for risk management decision-making, but primarily to provide information needed to develop a well-planned Phase II SAP.

In particular, one of the goals of the Phase I effort is to establish a geographic boundary that will guide the Phase II investigation. Although it is not possible to precisely define the decision rule for setting this boundary until the data are available, it is expected that the basic form of the decision rule will be that the boundary for the Phase II study area will be somewhat beyond the location where there is evidence that impacts from mine-related releases significantly decrease or can no longer be observed. It is expected that the decision will be based primarily on an evaluation of soil and tree bark data using statistical tests to evaluate spatial patterns and trends.

4.4.6. Define the Acceptable Limits on Decision Errors

Because the data from Phase I sampling are not intended to support risk management decision-making, no quantitative bounds on the probability of false negative or false positive decision errors are needed at this time.

4.4.7. Optimize the Design

The sampling design for Phase I has been developed to provide an initial characterization of the nature and extent of mining-related releases to the environment. The data from Phase I will then be used to optimize the design of the Phase II investigation, planned for the summer of 2008.

4.5 Medium-Specific Data Quality Objectives

The following sections describe specific data collection objectives for the data needs identified in Section 4.4.3. Each of these sections includes a general statement of the problem, an explanation of how the data are intended to be used, and identifies the specific types of data that will address the existing data need. The objectives described herein are all specific to the Phase I sampling and analysis activities.

4.5.1 Mine Waste Materials from Mined Area and Road Bed Materials

Large volumes of waste rock and tailings are present at various locations across the mined areas. Mine wastes may have also been used to construct roads within and around active mining areas. There is no information available to identify potentially hazardous constituents in those materials. Further, there is only limited information about the levels of asbestos associated with the different types of mine wastes present at various locations across the mined area (i.e., waste piles, mine pits, impoundments, etc.). Therefore, the objective of the mine waste sampling activities in Phase I is to collect samples from representative types of mine waste and soils in the mined area in order to identify environmental contaminants associated with mine wastes and develop a list of source areas of potential concern.

4.5.2 Surface Waters and Sediment

At various times in the past, surface water samples were collected and analyzed for a limited list of chemical parameters. Most of the surface water quality data for non-asbestos contaminants was collected in the mid-1990s, so current surface water quality conditions are not known.

The objective of collecting additional surface water data during Phase I is to obtain a preliminary characterization of the nature and extent of surface water contamination related to historical mining, milling/processing, and mine-waste disposal operations. This objective will be addressed by collection of surface water samples at locations upstream and downstream of the mine in the stream drainages disturbed by past mining activities. In addition, the Phase I investigation will also include a visual survey to identify the locations of any springs where groundwater discharge is present and any seeps emanating from mine waste disposal areas. If springs or seeps with running water are identified during Phase I, a sample of water and sediment will be collected at each of those locations.

Only a few sediment samples have been collected from lower Rainy Creek. Additional sediment data will be collected during Phase I to provide a preliminary characterization of the nature and extent of sediment contamination related to historical mining, ore processing and milling, and mine-waste disposal operations. This objective will be met by collecting sediment at the same upstream and downstream creek locations where surface water samples are collected, as well as from any seeps or springs identified during the visual survey.

4.5.3 Groundwater

Although groundwater wells have been installed at the mine in the past, there are insufficient data available to characterize groundwater flow direction, contaminant transport to groundwater, and potential groundwater transport pathways to surface waters. A well survey will be conducted and groundwater samples will be collected during Phase I to obtain preliminary

information that will help assess the potential for groundwater contamination resulting from historical mining, milling/processing, and mine-waste disposal operations.

The locations of the potential water wells identified in records available from W.R. Grace and the State of Montana (Figure 3-4) have not been verified, and neither the condition nor status of any existing wells is known. Phase I groundwater data collection will begin with locating existing groundwater wells and assessing the usability of those wells for collection of water-level measurements and groundwater samples. If there are usable groundwater wells within the KDC-owned property, samples will be collected from each usable well for analysis of asbestos and non-asbestos contaminants. Water level elevations will also be measured in any usable groundwater wells and flows will be measured or estimated at springs and seeps to provide preliminary information that may improve understanding of the local groundwater flow units and directions of groundwater flow. The findings of the spring/seep survey and sampling will also provide additional information on groundwater within OU3.

4.5.4 Surface Soil and Tree Bark in Forested Areas Around the Mine

The objective of sampling surface soil and tree bark at various locations in the forest surrounding the mine is to determine if the extent of releases of airborne asbestos from the mine can be identified by examining the spatial pattern of asbestos in soil and/or tree bark. In order for the data to be maximally useful, it is necessary that the samples provide good spatial coverage of the area around the mine, and that sufficient samples be collected to allow recognition of spatial patterns that may be present. Because soil samples can only be analyzed for asbestos semi-quantitatively, it is unknown whether or not the soil samples will provide a clear basis for spatial pattern assessment. However, it is expected that tree-bark samples can be evaluated for asbestos quantitatively, and therefore it is important that these samples be analyzed with an analytical sensitivity that is sufficient to provide reliable estimates of concentration (e.g., ± 30%). If levels of asbestos in soil and/or tree bark are highest close to the mine and tend to decrease as a function of distance away from the mine, then appropriate statistical methods will be used to determine the approximate location where the mining-related increase can no longer be observed. If this approach is successful, the locations where mining-related contamination ceases to be observable will provide the basis for defining the Phase II study area.

4.5.5 Ambient Air

The purpose of sampling ambient air for asbestos is to obtain data on the level of releases occurring from the mine area to adjacent downwind areas under current site conditions. Because wind speed and direction are variable, characterization of releases to ambient air will require placement of a number of stationary air monitors around the mined area, along with data from the existing meteorological station at the mine site. Because the input needed for risk assessment purposes is an average concentration of asbestos in ambient air, samples should be collected at multiple time intervals of 5-days each. In this way, sample results from the Phase I program,

although only intended to be screening level, may in the future be combined with results from subsequent phases of the OU3 RI to support risk assessment calculations.

5.0 SAMPLING PROGRAM

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 A and the Phase I experimental sampling design details presented below. A Health and Safety Plan (HASP) for the field sampling team will be provided by the field sampling contractor and will be reviewed by EPA and the Montana Department of Environmental Quality (MDEQ) prior to commencement of any field sampling activities.

Table 5-1 summarizes all of the samples of each medium at each sampling location that are scheduled for collection at as part of the Phase I program. The following sections discuss the rationale and intended purpose of each of these samples.

5.1 Mine Wastes and Soils from the Mined Area

5.1.1 Experimental Design

Table 5-2 identifies locations where samples of mine wastes and surface soil will be collected. These locations are shown in Figure 5-1. Samples will be collected from:

- each of the principal mine waste materials that have been identified to date: mine waste rock, impounded tailings, and coarse tailings;
- soils in the former mill area; and
- materials used for construction of unpaved sections of Rainy Creek Road.

Mine Waste and Surface Soil

The mine waste/soil samples will be grab samples collected at specified location. Each sample will be collected from an area 3 feet *x* 3 feet, and the sample will consist of finer grained materials (< ¼ inch) from the top 6 inches. Additional characterization of mine waste rock and soil in the mined area will take place during subsequent phases of the RI.

Tailing Sampling

Each tailing samples will be a composite of eight sub-samples. Each sub-sample will be collected from the top 12 inches of tailings materials. The tailings at the surface of disposal areas are the most recently disposed yet longest exposed to weathering effects. For this reason, they may not be representative of all tailings disposed at the site. Additional sampling and analysis at depth will be conducted during Phase II to characterize older materials that are now buried under the more recent mine wastes.

Roadway Sampling

Roadway materials will be collected at specified locations from unpaved areas along the access road to the mine. Each roadway sample will be a single grab sample collected from the top 6 inches. For the purposes Phase I, three sampling locations are sufficient for general characterization of roadway materials. However, additional sampling and analysis of Rainy Creek roadway materials may be necessary during Phase II to assess spatial variability of those materials. The need for and scope of any additional sampling will be determined as part of the detailed DQO process for Phase II.

Analysis

All samples will be analyzed for asbestos and CERCLA target analyte list (TAL) metals/metalloids. Mine waste rock, tailings, soil from the former mill area and roadway materials will also be analyzed for petroleum hydrocarbons (refer to Table 5-2 for sample descriptions), and the three samples of Rainy Creek roadway materials will also be analyzed for PCBs. The use of oil for dust control on mine roads was reported and PCB oils were present at the mine in the past. Samples collected from the fine tailings impoundment (refer to Table 5-2) will be analyzed for a broader suite of potential contaminants. Details on the specific analyses that will be performed are discussed in Section 6.

5.1.2 Sampling Methods and Procedures

Mine tailings, waste rock, and soil sampling procedures will be consistent with procedures summarized below and described in detail in the OU3 SOPs for soil sampling (OU3 SOPs Nos. 1 and 2).

The mine waste rock, soil, and roadway samples will be grab samples collected by directly sampling from the surface using a stainless steel or plastic scoop or trowel or with the assistance of a manual core sampler or hand auger, as described in OU3 SOP Nos. 1 and 2. Each roadway sample will be a single grab sample collected from the surface to a depth of 6 inches. When sampling roadbed materials, sampling efforts should focus on the road margin areas where the materials are less compacted.

Grab samples will be collected by digging or coring into the surface to the target sample collection depth (i.e., either 6 inches or 12 inches, as specified herein). Each grab sample will be placed into one or more appropriate containers as may be required for the specified analyses. The field sampler will ensure that each container contains material that is representative of the full depth of the sample required by the SAP.

Mine tailings samples will each be composites of eight sub-samples. A simple, unbiased, systematic sampling design will be used to collect the sub-samples for each composite.

- For the fine-tailings impoundment, two composite samples will be collected along two transect lines. One transect will cross the length of the impoundment footprint and one will cross the width. At each transect, eight discrete sub-samples will be collected along the transect to comprise a single composite sample. Discrete sample locations will be spaced at regular distance intervals along the transect line (i.e., spacing equivalent to approximately 1/7th the transect length).
- For the coarse tailings disposal area, four composite samples will be collected along four transect lines: one "high-elevation," two "mid-elevation," and one "low-elevation." The four transects will cross the width of the disposal area at four distinct surface elevations. At each transect, eight discrete sub-samples will be collected along the transect to comprise a single composite sample.

Attachment C illustrates the transect composite sampling approach for the mine tailings stations. The locations of each transect will be selected in the field based on site conditions. Areas of the fine-tailings impoundment inundated by water at the time of sampling may be avoided.

At each discrete sub-sampling site, tailings will be collected from the surface to a depth of 12 inches. Once eight sub-samples have been collected and combined into one bag, the solids will be homogenized in accordance with OU3 SOP Nos. 1 and 2. The mine wastes collected for metals analyses (and other inorganic parameters) will be submitted to the laboratory with requests to air dry and then homogenize the sample by passing the dry solids through a 2 mm mesh screen. The solids collected for volatile petroleum hydrocarbon (VPH) analysis will be handled and contained in accordance with OU3 SOP No. 2 and MDEQ specifications for VPH sample collection, which require methanol preservation of VPH samples. Methanol will be added to sample vials at the time of sample collection, as described in detail in the MDEQ-referenced analytical method for VPH (MADEP-VPH-04-1.1).

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

5.2 Surface Waters and Sediments

5.2.1 Experimental Design

Figure 5-2 identifies the locations where samples of surface water and sediment will be collected (station identifiers are summarized in Table 5-3). Surface water and sediment samples will be collected at locations on:

- Tailings impoundment and its toe drains
- Mill Pond

- Rainy Creek, Fleetwood Creek, and Carney Creek upstream of the mine-disturbed areas
- Fleetwood Creek and Carney Creek downstream of mine-disturbed areas
- Lower Rainy Creek below the Mill Pond and below Carney Creek
- Seeps, springs, or other water features on or near the mined area

The location of these sampling locations were established during site reconnaissance visits by CDM. GPS coordinates are provided in Attachment E.

All surface water samples will be analyzed for asbestos, metals/metalloids, petroleum hydrocarbons, anions, and other water quality parameters. In addition, a broad suite of analyses will be performed for samples collected at two locations: the tailings impoundment toe drain and Lower Rainy Creek downstream of the confluence with Carney Creek. These locations were selected because they appear to have the best potential of characterizing releases from the mine. The additional analyses for surface water include PCBs, pesticides, herbicides, gross alpha/gross beta, volatile and semi-volatile organic compounds, and cyanide. These analyses will provide a more comprehensive screen for potential contaminants associated with mine wastes and process chemicals used during mine operations. Water quality data for springs will provide information on shallow groundwater quality. Seep water will provide information on whether contaminants are being released from mine waste piles and disposal areas. These data, along with any groundwater sampling data, will allow for identification of mine-related contaminants and possibly an initial assessment of transport pathways.

All sediment samples will be analyzed for asbestos, metals/metalloids, and petroleum hydrocarbons, and total organic carbon. Sediments from lower Rainy Creek and the tailings impoundment toe drain will also be analyzed for PCBs to assess the potential effects of use of oil for dust control along the adjacent road. Sediment collected from stations along lower Rainy Creek will also be analyzed for pesticides, herbicides, volatile and semi-volatile organic compounds, and cyanide.

These data will provide an initial indication of whether site-related contaminants are present in sediments, and if they are causing observable toxicity to benthic organisms. Details on the specific analyses that will be performed for surface water and sediment are discussed in Section 6.

5.2.2 Surface Water Sampling Methods and Procedures

The surface water sampling procedures are presented in OU3 SOP No. 3. Stream water samples generally will be collected from downstream to upstream locations, to minimize the effect of sampling activities on the samples collected. To minimize the potential effect of time variability, all samples from a single stream drainage (i.e., Rainy Creek) 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. For the filtered samples (to be analyzed for metals only), 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.

The method for collection of water at springs, seeps, and ponds will be the same as above, except in locations of very shallow water. In such locations, water can be collected from a depression created to increase the depth of water and allow for sampling using a pump and tubing, as described in OU3 SOP No. 3.

5.2.3 Sediment Sampling Methods and Procedures

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 homogeneous mixture, or composite, of five grab samples 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). The five grab samples will be collected over a reach that is within 100 feet upstream or 100 feet downstream of the specified station. 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. If the mass of sediment from the inundated areas is not sufficient for the analyses that are required (refer to Section 5.7 below), sediment will be collected from within the active high-flow channel, but no sediments will be collected from over-bank areas. After homogenization, the composite sample may be split to fill appropriate containers for the analyses requested.

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.

5.2.4 Field Data Measurements

Temperature, pH, specific conductance, dissolved oxygen (DO), and turbidity will be measured, in-stream using portable field meters and recorded on sampling forms. Field parameters will be measured using individual or multiple probe electronic meters. Field parameter measurement

and calibration protocols will be performed according to manufacturer's specifications and OU3 SOP No. 10.

At locations where flowing water is present, the stream discharge will also 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 cfs. 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.

In cases where flows are too small or stream gradients are too great to be measured using the area-velocity method or a cutthroat flume, measurements will be made volumetrically using a calibrated collection container and a stopwatch. Stream flow will be routed through a PVC pipe and the time to fill a collection container to a known volume will be measured. A minimum of five trials will be executed for each volumetric measurement, and discharge will be taken as an average of the five trials. An estimate of any leakage around the routing pipe will be recorded.

5.2.5 Field Documentation

Field documentation procedures are described in Section 5.8 and OU3 SOP No. 9. Field documentation associated with surface water and sediment sampling will also contain information of sufficient detail to fully describe:

- sample depth (sediment),
- 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.

5.3 Groundwater

5.3.1 Experimental Design

A field survey to locate wells within the mine area property owned by KDC will be performed by MWH. EPA will review the survey results and, in a separate directive, will identify all wells that are appropriate for collection of groundwater samples.

At each location, sampling personnel will photograph and record a brief description of the well location in relation to permanent landmarks. Water levels will be measured and groundwater samples collected for chemical analyses. Groundwater samples will be analyzed for asbestos, TAL metals/metalloids, major ions, gross alpha/gross beta, and cyanide. Details on the specific analyses that will be performed for groundwater are discussed in Section 6.

5.3.2 Sampling Methods and Procedures

OU3 SOP Nos. 6 and 13 provide detailed procedures for groundwater sample collection, including the procedures for measuring water levels and purging wells prior to sampling. Water level will be measured before the well is purged, and groundwater samples will be collected after purging is complete.

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

5.3.3 Field Data Measurements

Measurements of pH, specific conductance, turbidity, dissolved oxygen, and temperature will be made in the field using individual or multiple probe electronic meters. Field parameter measurement and calibration protocols will be performed according to equipment manufacturer’s specifications and OU3 SOP No. 10.

Well-depth and depth-to-water measurements will be made in accordance with OU3 SOP No. 13 at each well where such measurements are possible.

5.3.4 Field Documentation

Field documentation procedures are described in Section 5.8 and OU3 SOP No. 9. Field documentation associated with groundwater sampling will also contain information of sufficient detail to fully describe:

- well condition,
- total depth of well,
- depth to water,
- volume of water purged,
- final depth to water after sampling, and
- associated field measurements 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.

5.4 Surface Soil and Tree Bark in Forested Areas Around the Mine

5.4.1 Experimental Design

In order to provide data that will facilitate spatial pattern analysis, samples of surface soil and tree bark will be collected along a number of transects that radiate away from the mine, with special emphasis on the predominant downwind direction (northeast). Table 5-4 summarizes the transects that will be sampled. Figure 5-3 shows the approximate sampling locations for surface soil and tree bark collection. Actual sampling locations may be adjusted in the field based on local features. To the extent possible, the precise sampling location should prefer generally open areas that are not likely to have been substantially shielded from airborne deposition of asbestos by local features.

5.4.2 Sampling Methods and Procedures

<u>Surface Soil</u>

Soil samples will be collected from approximately equally spaced locations around the perimeter of a circle with a radius of about 5 feet, centered on the tree where the bark sample will be

collected. Soil samples will be collected in accordance with OU3 SOP No. 1. All samples will be representative of surficial soils (about 0-2 inches in depth). All of the five grab samples will be placed into a single sample bag to create a composite. In order to ensure that sufficient sample is available for potential future investigations, the mass of the composite sample must be no less than 500 grams.

At most locations it is expected that there will some amount of organic debris (pine needles, grass, tree bark, other vegetation) overlying the surficial soil. In the absence of data, it is not known if this organic debris layer could contain a significant fraction of the historically deposited asbestos fibers at that location. In order to evaluate this possibility, at each of the five soil sub-sampling locations, the organic debris will be collected and placed into a separate sample bag to create a single 5-point composite sample for the station. Initially, a subset of these samples will be analyzed for asbestos (expressed as mass of LA per gram of organic debris) by TEM. If the amount of asbestos in this fraction is found to be significant compared to the amount in the soil, then all of the organic debris samples will be analyzed and the sum of the levels in soil and organic debris will be used to characterize the level of contamination at the station.

Tree Bark

Tree bark samples will be collected in accord with SOP TREE-LIBBY-OU3. In brief, bark samples will be collected from Douglas fir trees that are 8-10 inches in diameter. This is important because the amount of asbestos deposition in/on bark is likely to be related to the age of the tree, and collection of bark from trees 8-10 inches in diameter ensures that the tree was present during the time of mining operations. The age of the tree will be confirmed by collection and tree-ring analysis of a tree core for about 10% of the trees, as described in the SOP. If multiple trees of appropriate type and size are present at the sampling location, preference should be given to trees with rough bark over trees with smoother bark, since it is expected that rough bark will tend to capture and retain airborne asbestos fibers more efficiently that trees with smooth bark. All bark samples will be collected from the side of the tree facing toward the mine site, from a height of about 4-5 feet above ground. Samples submitted for analysis will be prepared in a way such that that the projected surface area is known and constant for all samples (e.g., a circular sample of diameter 2 inches). This will enable asbestos concentrations to be reported as structures per unit surface area of bark (s/cm^2).

5.5 Ambient Air

5.5.1 Experimental Design

The basic sampling design for ambient air consists of two concentric rings of stationary air monitors placed around the mine. The first ring is close to the boundary of the disturbed area, and the second ring is close to the perimeter of the property owned by KDC. Figure 5-4 shows

the locations for the ambient air monitors (station identifiers are summarized in Table 5-5). GPS coordinates are provided in Attachment E. Each sample will be collected over a period of 5 days, with samples being collected once per week for a period of four weeks.

5.5.2 Sampling Methods and Procedures

Ambient air samples will be collected and equipment calibrated in accordance with SOP AMB-LIBBY-OU3. Because the objective of the sampling effort is to estimate long-term average concentration values, all ambient air samples should be collected using low-flow (2 L/min) stationary air monitors over an extended period of time (e.g., 5 days), as available technology permits. In no event shall a sample be collected at a flow rate lower than 0.92 L/min, since the linear flow velocity would fall below 4 cm/sec, which is the minimum velocity specified by ISO 10312.

Samples will be collected using 25-mm diameter, 0.8 µm pore size MCE filter cassettes. This filter type has been used at Libby because it allows for the collection of samples without excessive backpressure. All samples will be collected at a height approximately 6 feet above ground level.

Equipment shelters will be used to house the sampling pumps. The use of these shelters will protect the sampling equipment from adverse weather conditions that would otherwise interfere with the collection of long-term samples.

Sample collection will begin on a predetermined day of the week. Monitors will be checked daily to ensure the pump flow rate is within method requirements.

5.6 Sample Handling Instructions

5.6.1 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 QA/QC requirements relevant to the containers and cleaning procedures. The analytical laboratories will supply all sample containers utilized for this investigation. 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 5-6 and 5-7 identify the appropriate sample containers for the analysis methods used in Phase I for solid and aqueous media, respectively.

5.6.2 Sample Preservation and Storage

Tables 5-6 and 5-7 describe the sample preservation and storage requirements for solid and aqueous 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. The exception is solid samples collected for analyses of volatile organic compounds, including VPH and TCL VOCs. Soil and sediment samples collected for analysis of VPH and TCL VOCs will be preserved in the field with methanol based on EPA SW-846 method 5035.

5.6.3 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 not holding time requirement for asbestos.

Tables 5-6 and 5-7 define method-specific analytical holding times for solid and aqueous media, respectively.

5.6.4 Sample Archival and Final Disposition

Unused samples and containers will be maintained in storage at the laboratory for a minimum of 90 days following completion of the analysis, unless otherwise directed by EPA. After 90 days or approval from EPA for disposal, 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.

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.

5.7 Sample Documentation and Identification

Data regarding each 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 I sampling activities will have a prefix of "P1" (e.g., P1-12345). 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

For soil samples, the field log book should also include a description of the visual appearance of the surface materials, including particle sizes, moisture content, color, mineralogy (if readily apparent), lithology, and any visual indications of contamination.

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. A stake or pole identifying the sampling station will be placed at or near the sampling station for future identification of the location.

5.8 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 I 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 Project Manager or the appropriate delegate will be promptly notified.

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

6.0 LABORATORY ANALYSIS REQUIREMENTS

6.1 Analytical Methods for Asbestos in Abiotic Media

All laboratories that analyze samples of abiotic media 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.

6.1.1 Ambient Air

All air samples collected during Phase I sampling will be submitted for asbestos analysis using transmission electron microscopy (TEM) in accord with the International Organization for Standardization (ISO) 10312 method (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, LB-000053, and LB-000066 (see Attachment D). All amphibole structures (including not only LA but all other asbestos types as well) that have appropriate Selective Area Electron Diffraction (SAED) patterns and Energy Dispersive X-Ray Analysis (EDXA) spectra, and having length greater than or equal to 0.5 um and an aspect ratio (length:width) ≥ 3:1, will be recorded on the Libby site-specific laboratory bench sheets and electronic data deliverable (EDD) spreadsheets. Data recording for chrysotile, if observed, is not required.

The level of analytical sensitivity needed for ambient air samples depends on the level of human exposure that is anticipated in the vicinity of the mine site. For initial planning purposes, it is conservatively assumed that the maximally exposed individual would be a present near the site about 8 hours per day for about 150 days per year, for a total of 25 years out of a lifetime. This corresponds to a time-weighting factor (TWF) of (8/24)·(150/365)·(25/70) = 0.049. Based on an assumed target risk of 1E-05 (1/10th the level that is normally considered to be the maximum acceptable total risk to a receptor), the target analytical sensitivity is calculated as follows:

$$\begin{aligned}\text{Target Sensitivity} &= \text{Target Risk} / (\text{TWF} \cdot \text{Unit Risk}) \\ &= 1\text{E-05} / (0.049 \cdot 0.23) \\ &\approx 0.001 \text{ f/cc}\end{aligned}$$

Assuming that typical sample volumes for ambient air samples will be about 5,000-10,000 L and indirect preparations are not necessary, it is expected that an analytical sensitivity of 0.001 f/cc can be achieved by counting about 5-10 TEM grid openings (GOs).

Stopping rules for these analyses are as follows:

1. Calculate the number of GOs needed to achieve the target sensitivity.
2. If this value is larger than 50 GOs, contact EPA for direction. If the target sensitivity can be achieved by counting 50 or fewer GOs, count until the target sensitivity is achieved.
3. If more than 50 LA structures are detected during analysis of a sample, counting may end after the GO containing the 50th structure is completed. This results in a Poisson uncertainty interval of < 30%.

6.1.2 Soil and Sediment

Sample Preparation

All soil and sediment samples collected for asbestos analysis will be transmitted to the soil preparation laboratory in Troy, Montana. Samples will be prepared in accordance with ISSI-LIBBY-01 Revision 8. In brief, prior to sample preparation, the raw soil sample will be split into two aliquots. One aliquot will be placed into archive. The other aliquot will be dried, mixed, and sieved into coarse (> ¼ inch) and fine fractions. The fine fraction will be ground to reduce particles to a diameter of 250 um or less and separated into 4 aliquots.

Sample Analysis

Soil and sediment samples will be analyzed for asbestos by polarized light microscopy (PLM) in accordance with Libby site-specific SOPs. The coarse fraction soil aliquot (if any) will be examined using stereomicroscopy, and any particles of asbestos (confirmed by PLM) will be removed and weighed in accordance with SRC-LIBBY-01 Revision 2. One of the fine ground fraction aliquots will be analyzed by PLM visual area estimation method (PLM-VE) using Libby-specific reference materials in accordance with SRC-LIBBY-03 Revision 2. Results from the PLM-VE method are semi-quantitative, with an estimated detection limit for LA of about 0.2% or slightly less. Mass fraction estimates and optical property details will be recorded on the Libby site-specific laboratory bench sheets and EDD spreadsheets.

6.1.3 Organic Debris from Forest Floor

Organic debris from the forest floor will be analyzed in accord with SOP DEBRIS-LIBBY-OU3. In brief, the sample will be prepared by ashing, and the residue will be prepared for examination by TEM. The mass of each LA particle will be estimated from its dimensions, and the results will be expressed in terms of mass of LA per unit weight of organic debris. This will allow the results to be combined with the corresponding soil sample, analyzed by PLM-VE.

6.1.4 Tree Bark

Tree bark samples will be analyzed for asbestos using a method similar to that developed by Ward et al. (2006), as detailed in SOP TREE-LIBBY-OU3. In brief, tree bark samples will be prepared for analysis by drying to stable mass at 80 °C, followed by ashing in a muffle furnace at 450 °C. Residue from the ashing step will be resuspended in water and deposited on a 385 mm^2 MCE filter for analysis by TEM using ISO-10312 counting protocols, as modified by all applicable Libby site-specific laboratory modifications, including project specific modifications LB-000016, LB-000019, LB-000028, LB-000029, LB-000030, LB-000053, and LB-000066 (see Attachment D). All amphibole structures that have appropriate SAED patterns and EDXA spectra, and having length greater than or equal to 0.5 um and an aspect ratio (length:width) ≥ 3:1, will be recorded on the Libby site-specific laboratory bench sheets and EDD spreadsheets. Chrysotile particles, if observed, need not be recorded.

Based on data reported by Ward et al. (2006), it appears that amphibole levels in tree bark away from the mine range between 250,000 to 5,800,000 f/cm^2. In order to maximize the ability to see a spatial pattern in tree bark samples, it is important to establish an analytical goal sufficiently low so results are not truncated by the occurrence of non-detects at stations remote from the mine. Based on this, the target analytical sensitivity for tree bark samples is set at 10,000 f/cm^2. Assuming that at least 1/10 of the sample can be applied to the filer without overloading, This value may be achieved or exceeded by ashing of samples with a projected area of about 20 cm^2 and counting 5-10 GOs. Note that this target sensitivity is intended only to facilitate an evaluation of spatial pattern, and is not risk-based.

Stopping rules for these analyses are as follows:

1. Calculate the number of GOs needed to achieve the target sensitivity.
2. If this value is larger than 50 GOs, contact EPA for direction. If the target sensitivity can be achieved by counting 50 or fewer GOs, count until the target sensitivity is achieved.
3. If more than 50 LA structures are detected during analysis of a sample, counting may end after the GO containing the 50th structure is completed. This results in a Poisson uncertainty interval of < 30%.

6.1.5 Water

Surface water and groundwater samples will be analyzed for asbestos by TEM using Modified EPA Method 100.2 (EPA 1994a) in accord with the modified counting procedures described in Libby Laboratory Modification #20 (LB-000020 in Attachment D). In brief, all amphibole structures that have appropriate SAED patterns and EDXA spectra, and having length greater than or equal to 0.5 um and an aspect ratio (length:width) ≥ 3:1, will be recorded on the Libby site-specific laboratory bench sheets and EDD spreadsheets. Chrysotile structures, if detected, need not be recorded.

The target analytical sensitivity specified in the method is 200,000 f/L (200 f/mL). The human health maximum contaminant level (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. This sensitivity can be achieved by filtering 100 mL of water and counting about 10 GOs. Sensitivity may be increased as needed by filtering larger volumes of water, assuming overloading of the filter 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 this value is larger than 50 GOs, contact EPA for direction. If the target sensitivity can be achieved by counting 50 or fewer GOs, count until the target sensitivity is achieved.
3. If more than 50 LA structures are detected during analysis of a sample, counting may end after the GO containing the 50th structure is completed. This results in a Poisson uncertainty interval of < 30%.

6.2 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 I data quality objectives. Detailed calibration procedures and quality control practices associated with each referenced method are described later in Section 7.

Tables 6-1 through 6-6 identify the non-asbestos chemical analyses that will be performed for each type of environmental sample. Analytical methods referred to on Tables 6-1 through 6-6 originate 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 DEQ method specifications for petroleum hydrocarbons (MDEQ, 2003)

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.

6.2.1 Mine Waste and Road Bed Materials

Because mine waste and road bed materials are likely to be coarse grained and physically and chemically heterogeneous, some additional preparation of those sample types will be conducted prior to analysis for metals/metalloids. As noted previously, the mine waste and roadbed samples will be collected into three separate sample containers; one for asbestos analysis, one for analyses of metals and other inorganic parameters, and one for organic compound analyses. The sample split submitted for metals analyses will be air dried and then sieved prior to laboratory analysis in order to thoroughly homogenize the sample. The fraction of solids less than 2 mm in diameter will be used for laboratory analysis.

Mine waste rock, mine tailings, mine soils, and road bed materials will be analyzed for the parameters listed in Table 6-1. The samples collected at eight locations described as “outcrop” bedrock (refer to Table 5-2) will be analyzed for metals/metalloids and other inorganic parameters, but they will not be analyzed for petroleum hydrocarbons or PCBs.

All of the analytical methods identified in Table 6-1, with the exception of petroleum hydrocarbon methods, are standard test methods used by EPA for evaluating solid waste (SW-846 Methods). Table 6-1 also lists the detection and quantitation limits for each analyte, and compares these to appropriate human and ecological analytical goals (see Attachment B). As seen, these methods are expected to have adequate detection limits for both ecological receptors and humans.

VPH and EPH will be analyzed in accordance with the methods specified by the MDEQ for use in their Risk-Based Corrective Action program for petroleum hydrocarbon releases. MDEQ references the method developed by the Massachusetts Department of Environmental Protection "Method for the Determination of Extractable Petroleum Hydrocarbons" (MDEP-EPH/VPH-98-1), for analyses of petroleum hydrocarbons. This method provides quantitative analyses of hydrocarbon compounds within specified carbon-number ranges. The VPH method provides quantitative results for the gasoline compounds methyl tert-butyl ether (MTBE), benzene, toluene, ethyl benzene and xylenes (BTEX), and naphthalene, and the EPH method can provide quantitative concentration data for heavier compounds and groups of compounds, including diesel #1, diesel #2, fuel oils #2 through #6, waste oil, jet fuel/kerosene, mineral and dielectric oils, and crude oil. MDEQ identifies risk-based screening levels for total extractable hydrocarbons (TEH) to identify sites or locations where additional investigations of petroleum hydrocarbon releases are warranted. The OU3 Phase I samples will be analyzed for VPH (MTBE, BTEX, naphthalene) and total EPH. If the total EPH concentration is greater than 50 mg/kg, the sample will be analyzed for the following specific EPH compounds:

- Diesel #1
- Diesel #2
- #3-#6 Fuel Oils
- Waste Oil
- Jet Fuel/Kerosene
- Mineral/Dielectric Oils
- Heavier Wastes
- Crude Oil

- Other Oils

Two samples collected from the tailings impoundment (MW-4 and MW-5) will also be analyzed for a broad suite of other potential contaminants listed on Table 6-5.

6.2.1 Surface Water, Springs and Seeps

Water samples will be analyzed using methods from:

- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods* (EPA, 1986)
- *Methods for Chemical Analysis of Water and Wastes* (EPA, 1994b)
- Montana DEQ method specifications for risk-based evaluation of petroleum hydrocarbon releases (MDEQ, 2003)

Surface water samples, including any spring and/or seep water samples, will be analyzed for the parameters listed in Table 6-2. The analytical methods identified in Tables 6-2 and 6-4 were selected to provide quantitative results at or below recommended water quality criteria (see Attachment B).

The Phase I samples will be analyzed for VPH and total EPH. If the total EPH concentration is greater than 300 ug/L in a water sample, the sample will be analyzed for the following specific EPH compounds:

- Diesel #1
- Diesel #2
- #3-#6 Fuel Oils
- Waste Oil
- Jet Fuel/Kerosene
- Mineral/Dielectric Oils
- Heavier Wastes
- Crude Oil
- Other Oils

Two surface water samples will also be analyzed for the additional parameters listed in Table 6-4. Those two samples will be collected from the tailings impoundment toe drain (TP-TOE1) and lower Rainy Creek below Carney Creek (LRC-2).

6.2.2 Sediment

Sediment samples will be analyzed using methods from:

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)

Sediment samples will be analyzed for the parameters listed in Table 6-3. Table 6-3 also identifies the detection limits of the methods for each analyte, and compares these to the target detection limits for human and ecological receptors (see Attachment B). As seen, for some organic chemicals, the method detection limit is above the benthic invertebrate toxicity benchmark. This is not considered unacceptable for Phase I because these toxicity benchmarks have high uncertainty and are likely to be conservative. Lower detection limits for some analytes in sediment may be called for in Phase II investigations, as needed.

The Phase I samples will be analyzed for VPH and total EPH. If the total EPH concentration is greater than 50 mg/kg, the sample will be analyzed for the specific EPH compounds identified above in Section 6.2.1.

Sediment samples collected from lower Rainy Creek (LRC-1 through LRC-6) will also be analyzed for organo-phosphorus pesticides, chlorinated herbicides, and PCBs. The sediment samples collected from the tailings impoundment toe drain area, at TP-Toe2 as shown on Figure 5-2, and lower Rainy Creek at LRC-2 will be analyzed for the broader suite of potential contaminants listed on Table 6-5.

6.2.4 Groundwater

Groundwater samples will be analyzed using methods from:

- *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)

Groundwater samples will be analyzed for the parameters listed in Table 6-6. The analytical methods identified in Table 6-6 were selected to provide quantitative results at or below state/federal drinking water standards and tap water RBCs for residents (see Attachment B).

The Phase I samples will be analyzed for VPH and total EPH. If the total EPH concentration is greater than 300 ug/L in a water sample, the sample will be analyzed for the specific EPH compounds identified above in Section 6.2.2.

6.3 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.

6.4 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.

6.5 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.

6.6 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.

6.7 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 Project Manager. At the termination of Phase I, all original data records will be provided to the EPA Project Manager for incorporation into the OU3 project files.

7.0 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.

7.1 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 7-1 summarizes the types and frequency of field QC samples which will be collected during Phase I.

7.1.1 Blanks

Lot Blanks for Air Samples

Before any air cassettes may be used for asbestos sampling, the lot must be determined to be asbestos free. This will be accomplished by sending 5 blanks per lot for TEM analysis using ISO 10312 counting protocols as modified by Libby-specific laboratory modifications, including project specific modifications LB-000016, LB-000019, LB-000028, LB-000029, LB-000030, LB-000053, and LB-000066 (see Attachment D). Once the lot is confirmed to be asbestos free, that lot may be placed into use for sampling.

There are no lot blanks associated with any other sampled media.

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 normally collected for air and water samples, but not for soil or sediment.

A field blank for air shall be prepared by removing the sampling cassette from the box, opening the cassette to the air in the area where the investigative samples will be taken, then closing the cassette and packaging for shipment and analysis. Field blanks for air will be collected at a rate of 1 per day that ambient air sampling is occurring. Initially, a set of 8 field blanks (two selected at random from each of the four sampling periods) will be analyzed by counting a number of grid openings that is approximately equal to the number of grid openings that are analyzed for field

samples. It is expected that, if filter overloading is not encountered, this will be about 5-10 grid openings. If contamination is detected on any of these field blanks, then the entire set of all field blanks will be analyzed.

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).

Trip Blanks

The trip blank is used to indicate potential contamination by VOCs during sample shipping and handling. A trip blank consists of analyte-free laboratory reagent water which accompanies the empty sample bottles to the field and is placed in each cooler containing samples scheduled for VOC analysis. The trip blank is not opened until analysis in the laboratory with the corresponding site samples.

During Phase I sampling, one trip blank per cooler will be prepared to accompany aqueous samples when they are shipped to the laboratory for VOC analysis. One trip blank per cooler will also be prepared to accompany solid samples shipped for analysis of EPH and VPH.

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.

7.1.2 Field Splits/Duplicates

A field split is a sample that is prepared by thoroughly homogenizing a field sample, dividing the homogenized sample into two parts, and analyzing each independently. A comparison of field split samples is a measure of the precision of the sample preparation and analysis methods.

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 soil, waste rock, tree bark, sediment, etc.), 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 7-1 summarizes the frequency that field splits and duplicates will be collected for each media. In general, field splits/duplicates will be prepared at a rate of approximately 10% (1 field split/replicate per 10 field samples). The exception will be solid media samples collected within the mined area. There are four types of solid media that will be collected within the mined area – mine waste, roadway materials, coarse tailings, and fine tailings. Within the mined area, 1 field duplicate will be collected for each type of solid media. The specific stations at which field splits/duplicates will be collected will be determined in the field based on sampling conditions.

7.1.3 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 in soil are available through the EPA Quality Assurance Technical Support (QATS) program. A total of 4 water PE samples and 3 soil PE samples containing a range of inorganic and organic analytes will be added in random order to the field samples by the field collection teams.

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 4 PE samples representing a range of LA levels will be added in random order to the field soil samples at the time of soil sample preparation.

7.2 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 in Attachment D), lab 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%. LB-000029 summarizes the project-specific acceptance criteria for TEM QC analyses for all participating laboratories.

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

7.3.1 Preparation Laboratory QC Samples

Soil Preparation QC samples are collected to ensure proper sample handling and decontamination of soil 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.

7.3.2 Analytical Laboratory QC Samples

As part of PLM-VE analysis, laboratory duplicate analyses will be prepared at a frequency of 10% (1 per 10 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 acceptance criterion for laboratory duplicate analyses is that no more than 10% of all samples shall be 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.

7.4 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 7-2 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.

7.4.1 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 7-2.

7.4.2 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 7-2. 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 7-2. When LCSD samples are analyzed, the minimum frequency of analysis is one per every 20 samples.

7.4.3 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 7-2.

7.4.4 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 7-2.

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

7.4.5 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 7-2.

7.4.6 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 7-2.

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 7-2.

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.

7.5 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 I data quality objectives.

7.5.1 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 mine waste, soil, and 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 RPDs of 50% for mine waste, soil, sediment field duplicate samples and RPDs of 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.

7.5.2 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 of Phase I 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.

7.5.3 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 Phase I sampling activities are designed to provide data that are representative of conditions at specific locations and times of sample collection.

7.5.4 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.

7.5.5 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 Phase I 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 Phase I will be comparable to laboratory data collected for future 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.

8.0 DATA MANAGEMENT

8.1 Data Applications

All data generated as part of the Phase I 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.

As needed, EPA staff and designated contractors will develop tabular and graphical data summaries, perform statistical analyses, and generate maps using commercially-available applications such as Microsoft® Access and Excel and ArcGIS®.

8.2 Roles and Responsibilities for Data Flow

8.2.1 Field Personnel

W.R. Grace contractors will perform all Phase I 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 (see Section 5.8). COC information will be documented on hard copy forms (see Section 5.9). FSDS and COC information will be manually entered into a field-specific[2] 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

[2] The field-specific OU3 database would be a simplified version of the master OU3 database. This simplified database will include only the station and sample recording and tracking tables, as well as the FSDS and COC data entry forms.

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).

After FSDS data entry is completed, a copy of the field-specific OU3 database will be posted 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).

8.2.2 Laboratory Personnel

Each of the laboratories performing analyses for the Phase I sampling event are required to utilize all applicable Libby-specific Microsoft® Excel spreadsheets for data recording and electronic submittals (see Section 6.7). 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).

8.2.3 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.

Each Friday, a copy of the master OU3 database will be posted to a project-specific FTP site to allow timely access to results by data users. The master OU3 database posted to the FTP site will include the post date in the file name (e.g., MasterOU3DB_20070831.mdb).

8.3 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 Project Manager. At the termination of this project, all original data records will be provided to the Project Manager for incorporation into the site project files.

9.0 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.

9.1 Assessments

9.1.1 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.

9.1.2 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.

9.2 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.

9.3 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.

10.0 DATA VALIDATION AND USABILITY

10.1 Data Validation and Verification Requirements

Data validation consists of examining the sample data package(s) against pre-determined standardized requirements. 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 determine the accuracy and completeness of the data package. During this process, the validator will verify that the analytical methodologies were followed and QC requirements were met. The validator may recalculate selected analytical results to verify the accuracy of the reported information. Analytical results will then be qualified as necessary.

Data verification includes checking that results have been transferred correctly from laboratory data printouts to the laboratory report and 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 at a frequency of 10%. This initial rate may be revised as samples are analyzed and results evaluated. Data validation, review, and verifications must be performed on sample results before distribution to the public for review.

10.2 Reconciliation with Data Quality Objectives

Once all samples have been collected and analytical data has been generated, data will be evaluated to determine if DQOs were achieved. The Phase I data summary report will include a qualitative and quantitative review of all QC samples and all deviations from sampling and analysis plans described in this report, along with conclusions regarding the reliability of the data for their intended use.

11.0 REFERENCES

Asbestos Hazardous Emergency Response Act (AHERA). 1986. Title 20, Chapter 52, Sec. 4011. Public Law 99-519.

Amandus HE, Wheeler R. 1987. The Morbidity and Mortality of Vermiculite Miners and Millers Exposed to Tremolite-Actinolite: Part II. Mortality. Am. J. Ind. Med. 11:15-26.

Camp Dresser & McKee, Inc. (CDM). 2002. Final Sampling and Analysis Plan for the Remedial Investigation of Contaminant Screening Study (CSS), Libby Asbestos Site, Operable Unit 4. April 2002.

Camp Dresser & McKee, Inc. (CDM). 2003. Final Sampling and Analysis Plan, Remedial Investigation, Libby Asbestos Site OU4. May 2003.

Camp Dresser & McKee, Inc. (CDM). 2007. Site-Wide Quality Assurance Project Plan, Libby, Montana Asbestos Project. *Final Report Date Pending TAU Review*.

International Organization for Standardization. 1995. Ambient Air – Determination of asbestos fibres – Direct-transfer transmission electron microscopy method. ISO 10312:1995(E).

McDonald JC, Harris J, Armstrong B. 2004. Mortality in a cohort of vermiculite miners exposed to fibrous Amphibole in Libby, Montana. Occup. Environ. Med. 61:363-366.

McDonald JC, McDonald AD, Armstrong B, Sebastien P. 1986. Cohort study of mortality of vermiculite miners exposed to tremolite. Brit. J. Ind. Med. 43:436-444.

Montana Department of Environmental Quality (MDEQ). 2003. Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases, October 2003. http://www.deq.state.mt.us/rem/hwc/rbca/NewRBCA11-2003/Tier1Guidance10-03.pdf

Meeker GP, Bern AM, Brownfield IK, Lowers HA, Sutley SJ, Hoeffen TM, Vance JS. 2003. The Composition and Morphology of Amphiboles from the Rainy Creek Complex, Near Libby, Montana. American Mineralogist 88:1955-1969.

Peipins LA, Lewin M, Campolucci S, Lybarger JA, Miller A, Middleton D, et al. 2003. Radiographic abnormalities and exposure to asbestos-contaminated vermiculite in the community of Libby, Montana, USA. Environ. Health Perspect. 111:1753-1759.

Quivik L.F., 2002. Expert Report. United States v. W.R. Grace Civil Action No.90-11-2-07106/2. July 29, 2002.

Schafer and Associates, 1992a. Engineering Analysis of Flood Routing Alternatives for the W.R. Grace Vermiculite Tailings Impoundment. March 1992.

Shafer and Associates, 1992b. W.R. Grace Vermiculite Mine Closure Water Quality Data Report No. 1. November 1991. March 4, 1992.

Shafer and Associates, 1992c. W.R. Grace Vermiculite Mine Closure Water Quality Data Report No. 2. March 1991. May 6, 1992.

Shafer and Associates, 1992d. W.R. Grace Vermiculite Mine Closure Water Quality Data Report No. 3. July 1992. November 6, 1992.

Shafer and Associates, 1993. W.R. Grace Vermiculite Mine Closure Water Quality Data Report No. 4. October 1992. January 13, 1993.

Shafer and Associates, 1994. W.R. Grace Vermiculite Mine Closure Water Quality Data Report No. 5. October 1993. January 27, 1994.

Shafer and Associates, 1995. W.R. Grace Vermiculite Mine Closure Water Quality Data Report No. 6. September 1994. February 3, 1995.

U.S. Environmental Protection Agency (EPA). 1986. Test Methods for Evaluating Solid Waste Physical/Chemical Methods and Updates I, II, IIA, IIB, III, IIIA and IIIB, EPA SW-846. http://www.epa.gov/epaoswer/hazwaste/test/main.htm

U.S. Environmental Protection Agency (EPA). 1994a. Method 100.2: Determination of Asbestos Structures Over 10 um in Length in Drinking Water. U.S. Environmental Protection Agency, Office of Research and Development. June 1994.

U.S. Environmental Protection Agency (EPA). 1994b. Methods for the Determination of Metals in Environmental Samples, Supplement 1. EPA/600/R-94/111. May 1994.

U.S. Environmental Protection Agency (EPA). 2000a. Sampling and Quality Assurance Project Plan, Revision 1 for Libby, Montana, Environmental Monitoring for Asbestos, Baseline Monitoring for Source Area and Residential Exposure to Tremolite-Actinolite Asbestos fibers. January 2000.

U.S. Environmental Protection Agency (EPA). 2000b. Methods for Measuring Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates – Second Edition. U.S. Environmental Protection Agency, Office of Research and Development. EPA 600/R-99/064. March 2000.

U.S. Environmental Protection Agency (EPA). 2001. EPA Requirements for Quality Assurance Project Plans. EPA QA/R-5. U.S. Environmental Protection Agency, Office of Environmental Information. EPA/240/B-01/003. March 2001.

U.S. Environmental Protection Agency (EPA). 2005. Supplemental Remedial Investigation Quality Assurance Project Plan (SQAPP) for Libby, Montana. June 24, 2005.

U.S. Environmental Protection Agency (EPA). 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process – EPA QA/G4. U.S. Environmental Protection Agency, Office of Environmental Information. EPA/240/B-06/001. February 2006.

U.S. Environmental Protection Agency (EPA). 2007. Sediment Toxicity Identification Evaluation (TIE) – Phases I, II, and III Guidance Document. U.S. Environmental Protection Agency, National Health and Environmental Effects Research laboratory (NHEERL). EPA/600/R-xx/xxx. Draft – June 2007.

U.S. Geological Survey (USGS). 1977. National Handbook of Recommended Methods for Water-Data Acquisition. Office of Water Data Coordination, U.S. Geological Survey, Department of the Interior, Reston, VA.

Ward TJ, T Spear, J Hart, C Noonan, A Holian, M Getman, and JS Webber. 2006. Trees as reservoirs for amphibole fibers in Libby, Montana. Science of the Total Environment 367: 460–465.

W.R. Grace, 2006. Letter from Robert R. Marriam, Remedium, to Bonnie Lavelle, EPA dated August 2006.

Zinner E,R. 1982. Geohydrology of the Rainy Creek Igneous Complex Near Libby Montana. Masters Thesis Univeristy of Reno, Nevada. June 1982.

Zucker, G. 2006. Expert Report Prepared for W.R. Grace Company. Provided by Robert Marriam, Remedium correspondence to Bonita Lavelle, EPA, October 24, 2006.

ATTACHMENT A

STANDARD OPERATING PROCEDURES

SOP Description	SOP ID
Soil Sampling for Analyses of Non-Volatile Constituents	No. 1 (Rev. 0)
Soil Sampling for Volatile Organic Compounds	No. 2 (Rev. 0)
Surface Water Sampling	No. 3 (Rev. 0)
Surface Water Discharge Measurement	No. 4 (Rev. 0)
Sediment Sampling for Chemical Analysis	No. 5 (Rev. 0)
Groundwater Sampling for Chemical Analysis	No. 6 (Rev. 0)
Equipment Decontamination	No. 7 (Rev. 0)
Sample Handling and Shipping	No. 8 (Rev. 0)
Field Documentation	No. 9 (Rev. 1)
Field Equipment Calibration	No. 10 (Rev. 0)
GPS Data Collection	No. 11 (Rev. 0)
Investigation Derived Waste (IDW) Management	No. 12 (Rev. 0)
Groundwater Elevation Measurements	No. 13 (Rev. 0)
Collection of Outdoor Ambient Air Samples	AMB-LIBBY-OU3 (Rev. 0)
Sampling, Preparation, and Analysis of Tree Bark for Asbestos	TREE-LIBBY-OU3 (Rev. 0)
Preparation and Analysis of Organic Debris for Asbestos	DEBRIS-LIBBY-OU3 (Rev. 0)
Soil Sample Preparation	ISSI-LIBBY-01 (Rev. 8)
Qualitative Estimation of Asbestos in Coarse Soil by Visual Examination Using Stereomicroscopy and Polarized Light Microscopy (PLM)	SRC-LIBBY-01 (Rev. 2)
Analysis of Asbestos Fibers in Soil By Polarized Light Microscopy (PLM)	SRC-LIBBY-03 (Rev. 2)

ATTACHMENT B

ECOLOGICAL BENCHMARKS AND HUMAN HEALTH RISK-BASED CONCENTRATIONS

ATTACHMENT C

TRANSECT COMPOSITE SAMPLING APPROACH EXAMPLE

ATTACHMENT D

LIBBY LABORATORY MODIFICATIONS FOR TEM ANALYSES

ATTACHMENT E

GPS COORDINATES FOR TARGET SAMPLING LOCATIONS