ATTACHMENT B
STANDARD OPERATING PROCEDURES AND METHOD MODIFICATIONS

SOP Description	SOP ID
ABS Air Sample Collection	EPA-LIBBY-01 (Rev. 1)
Surface Water Discharge Measurement	OU3 SOP No. 4 (Rev. 0)
Equipment Decontamination	OU3 SOP No. 7 (Rev. 0)
Sample Handling and Shipping	OU3 SOP No. 8 (Rev. 0)
Field Documentation	OU3 SOP No. 9 (Rev. 5)
Investigation-Derived Waste (IDW) Management	OU3 SOP No. 12 (Rev. 0)
Fish Collection [by Electroshock]	SOP FISH-LIBBY (Rev. 0)
Fish Collection by Traps	FISHTRAP-LIBBY-OU3**
Benthic Macroinvertebrate Collection and Processing	BMI-LIBBY-OU3 (Rev. 0)
Small Mammal Collection And Processing	MAMMAL-LIBBY-OU3 (Rev. 0)
Stream Substrate Estimation by Pebble Count	SOP-PEBBLE-OU3**
Overhead Cover Estimation by Densitometer	SOP-COVER-OU3**
Histological Examination of Small Mammals	HISTOPATH-LIBBY-OU3**

***SOP will be prepared by Remedium and submitted to EPA for review and approval.*

Method Modification Description	Modification No.
Analysis of Water Samples for Asbestos by TEM	TEM Mod 1
Analysis of Tissue Samples for Asbestos by TEM	TEM Mod 2
Analysis of Water Samples for Asbestos by PCM	PCM Mod 1

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U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 8

STANDARD OPERATING PROCEDURE (SOP) FOR THE SAMPLING OF ASBESTOS FIBERS IN AIR

Prepared by: for W. Brattin (Author) Date: 3/8/01

Reviewed by: (Project Director) Date: 3/8/01

(Quality Assurance Coordinator) Date: 3/8/01

Approved by: for Paul Peronard (Project Manager) Date: 3/9/01

REVISION LOG

Revision Date	Reason for Revision
02/28/01	--
03/07/01	Further define pump calibration procedures.

PROCEDURAL SECTION

1.0 Scope and Applicability

This Standard Operating Procedure (SOP) provides a standardized method for sampling air to measure the concentration of asbestos fibers. This SOP is applicable to any type of asbestos fiber (amphibole, chrysotile) that may exist in air (either indoor or outdoor), and is applicable to both personal and ambient air (referred as stationary air throughout this SOP) sampling techniques. Filters collected in this way are suitable for examination by a variety of microscopic techniques, including TEM, PCM, and SEM.

2.0 Summary of Method

This SOP is based on air sampling techniques described in EPA SOP 2015, ISO 10312, OSHA Technical Manual, NIOSH 7400 and NIOSH 7402.

Air is drawn through a fine-pore filter in order to trap any suspended particulate matter in the air, including suspended asbestos fibers and other mineralogic materials. The filters are then examined using an appropriate microscopic technique to observe, characterize and quantify the number of asbestos fibers on the filter. The concentration of fibers in air is then calculated by dividing the total number of fibers on the filter by the volume of air drawn through the filter.

3.0 Health and Safety Warnings

Asbestos fibers are hazardous to human health when inhaled. Exposure to excessive levels may increase the risk of lung cancer, mesothelioma, and asbestosis. All personnel engaged in collection of air samples in areas where asbestos fibers may be present must have adequate health and safety training and must wear an appropriate level of personal protective equipment (PPE). Refer to the Health and Safety Plan for further details.

4.0 Cautions

None, refer to Section 3.0.

5.0 Interferences

High levels of dust or other suspended particulates may clog or overload the filter and reduce the ability to observe and characterize asbestos fibers on the filters. Precautions should be taken to avoid any unnecessary sources of dust emissions or use of aerosol sprays. Sampling conditions

(flow rate, sampling time) should be adjusted accordingly to avoid filter overload.

6.0 Personnel Qualifications

Field personnel engaged in collection of filter cassettes must be trained in the proper use and calibration of the air sampling equipment (as specified in this SOP), as well as proper methods for data recording and sample handling. Additionally, all field personnel must maintain appropriate and current training and/or certifications to meet all federal, state, and local regulations.

7.0 Apparatus and Equipment

Filter Cassettes

All samples will be collected on conductive filter holders consisting of 25-mm diameter, three piece filter cassettes having a 50-mm long electrically conductive extension cowl. The cassette shall be pre-loaded with a mixed cellulose ester (MCE) filter with pore size 0.8 um. Use of the 0.8 um pore size is recommended for all samples so that samples collected using a high volume pump are comparable to samples collected with a low volume pump. The 0.8 um pore size filters are used for samples collected with a low volume pump in order to decrease back-pressure and increase flow rate.

To reduce contamination and to hold the cassette tightly together, seal the crease between the cassette base and the cowl with a shrink band or adhesive tape. If particle deposition on the inside of the cowl is observed, it may be necessary to ground the cowl to reduce static charge. This is done by attaching one end of a length of flexible wire to the plastic cowl with a hose clamp and attaching the other end of the wire to a suitable ground (e.g., a cold water pipe).

Air Pumps

The sampling pump used shall provide a non-fluctuating airflow through the filter and shall maintain the initial flow rate within ± 10% throughout the sampling period.

A variety of different types of air pump may be used, depending on the flow rates that are required to achieve the data quality objectives and desired analytical sensitivity of the project. In general, the pump should be selected to deliver a flow rate that is as high as possible without overloading the filter with dust or fibers. The minimum flow rate is 0.5 L/min, and rates up to 10 L/min may be appropriate in some cases.

For stationary air monitors, a high volume pump that operates on AC power is recommended. For personal air sampling, either a portable high volume AC powered sampler or a low volume

battery-operated pump are acceptable, depending on whether the activities of the individual are impaired by the tethering imposed by the power cord needed for the high volume pump.

Tripod

For stationary air monitors, a tripod or other similar device is required to hold the filter cassette at a specified elevation above the floor. As noted below, this will typically be a height that represents the breathing zone (1.5-2 meters).

Spring Clips

For personal air monitors, the filter cassette is held in place using spring clips or other similar devices.

Rotameter

A rotameter that has been calibrated to a primary calibration source is required to calibrate the air flow rate at the start and the end of each sampling period. Due to its dependency on changes in atmospheric pressure, the rotameter must be calibrated to a primary calibration source at the site location (e.g., City of Libby) prior to sampling and re-calibrated on-site every week. Record calibration and re-calibration to the primary standard in the field logbook.

Primary Calibration Source

A bubble buret or other primary calibration standard may be used to calibrate the rotameter.

Sample Labels

A pre-printed sheet of sample labels (2 identical labels per sample number) is required. One label should be attached to the filter cassette before the sample collection period begins, and the matching label should be attached to the field data sheet that records relevant data on the sample being collected.

Field Log Book

A field log book is required to record relevant information regarding the collection of samples (location, time, unusual conditions or problems, etc.).

Field Data Sheet

A personal air or stationary air monitoring field data sheet (as appropriate) is required to record the relevant sampling information. Refer to the Phase 2 QAPP (EPA, March 2001) for the form.

8.0 Instrument Calibration

External calibration devices such as a bubble buret or a rotometer that have been calibrated to a primary calibration source may be used to calibrate air flow rate prior to air sampling. The flow rate must also be measured by the same method at the end of the sampling period.

8.1 Calibrating a Rotameter with an Electronic Calibrator (DryCal)

- See manufacturer's manual for operational instructions.
- To set up the calibration train, attach one end of the tygon tubing to the outlet plug of the rotameter; attach the other end of the tubing to the inlet plug on the pump. Another piece of tubing is attached from the inlet plug of the rotameter to the outlet plug on the DryCal.
- Rest or firmly stabilize the rotameter so that it is vertical (± 6°).
- Attach an isolating load with a pressure drop of about 10 to 20 inches of water column in series with a stable pump (a filter cassette of same lot number as will be used for field samples works well for this).
- Turn the DryCal and sampling pump on.
- Turn the flow adjust screw (or knob) on the pump until the desired flow rate is attained.
- Record the DryCal flow rate reading and the corresponding rotameter reading in the field logbook. The rotameter should be able to work within the desired flow range.
- Perform the calibration three times until the desired flow rate of ± 5% is attained. Once at the sampling location, a secondary calibrator (e.g., rotameter) may be used to calibrate sampling pumps.

8.2 Calibrating an Air Pump with a Rotameter

A rotameter can be used provided it has been precalibrated to a primary calibration source at the site location (e.g., City of Libby). Three separate constant flow calibration readings should be obtained both before sampling and after sampling. The mean value of these flow rate measurements shall be used to calculate the total air volume sampled.

Turn on the sampling pump and run for 5 minutes before performing calibration.

- Remove the end plugs on the filter cassette. A cassette, representative of the lot planned for use in air sampling, must be used.
- To set up the calibration train, attach one end of the tygon tubing to the cassette base; attach the other end of the tubing to the inlet plug on the pump. Another piece of tubing is attached from the cassette cap to the rotameter.

- Rest or firmly stabilize the flow meter so that it is vertical (± 6°).
- Turn the flow adjust screw (or knob) on the sampling pump until the center of the float ball on the rotameter meets the flow rate value specified in the project plan.

9.0 Sample Collection

Apply one of the pre-printed adhesive labels to the filter cassette and apply the other to the field data sheet for the sample.

Secure the filter cassette in the appropriate sampling location. For a fixed air monitor, this will generally be at a height that represents the breathing zone of the potentially exposed population (e.g., 1.5- 2 meters above the floor). For personal air monitoring, the cassette will typically be placed on the lapel just below the face of the individual being monitored. For personal air sampling for Scenarios 2 and 3 [Refer to Phase 2 QAPP (EPA March 2001)] , secure the cassette on the lapel of the dominant hand of the worker. The distance from the nose/mouth of the person to the cassette should be about 10 cm. Secure the cassette on the collar or lapel using spring clips or other similar devices. In all cases, orient the cassette so the open face of the cowel is pointing downward to avoid any particles entering the filter by precipitation. Remove the protective cap over the open face of the cowel and turn on the calibrated pump. Record the starting time, the initial flow rate, and all other relevant sample data on the field data sheet for the sample. Store covers and end plugs in a clean area (e.g., a closed bag or box) during the sampling period.

For sampling events lasting longer than 2 hours, in-field pump checks should be performed approximately every 2 hours. These periodic checks should include the following activities:

- Observe the sampling apparatus (filter cassette, pump, tripod, etc.) to determine whether it's been disturbed.

- Check the pump to ensure it is working properly and the flow rate is stable at the prescribed flow rate.

- Inspect the filter for overloading and particle deposition. Inspect the filter using a small flashlight. Look for particle adhesion or deposition on the side of the cassette and check the filter surface for accumulation of visible dust or smoke particles. If particle deposition on the inside of the cowl is observed, it may be necessary to ground the cowl to reduce static charge.

After the specified sampling period has elapsed, measure the ending flow rate and ending clock time on the data sheet. Turn off the pump and remove the cassette from the pump. Attach and secure a sample seal around each sample cassette in such a way as to assure that the end cap and

base plug cannot be removed without destroying the seal. Tape the ends of the seal together since the seal is not long enough to be wrapped end-to-end. Initial and date the seal.

10. Sample Handling and Preservation

Package the cassettes so they will not rattle during shipment nor be exposed to static electricity. Place custody seals, dated and marked with the packager's signature, onto the shipping container. Do not ship samples in polystyrene peanuts, vermiculite, paper shreds, or excelsior. Tape sample cassettes to sheet bubbles and place in a container that will cushion the samples in such a manner that they will not rattle. For additional shipping requirements, see the project plan.

Ship the sealed cassette to the analytical laboratory under proper chain of custody procedures. No preservation of the cassette is required.

QUALITY CONTROL and QUALITY ASSURANCE

Pre-Project Filter ("Lot") Blanks

Before samples are collected, two cassettes from each filter lot of 100 cassettes should be randomly selected and submitted for analysis. The lot blanks will be analyzed for asbestos fibers by the same method as will be used for field samples. The entire batch of cassettes should be rejected if any asbestos fiber is detected on any filter.

Field Blanks

Blank samples are used to determine if any contamination has occurred during sample handling. Prepare two blanks (from the sample lot used for field sampling) for the first 1 to 20 samples. For sets containing greater than 20 samples, prepare blanks as 10% of the samples. Filter blanks should be taken to a sampling location and prepared there. Remove the caps on the filter cassette and hold the cassette open for about 30 seconds. Close and seal the cassette as described in Section 9. Store blanks for shipment with the sample cassettes.

REFERENCES

NIOSH 7400

NIOSH 7402

ISO 10312

OSHA Technical Manual

EPA SOP 2015

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Libby Superfund Site Operable Unit 3 Standard Operating Procedure

Date: September 26, 2007 OU3 SOP 4 (Rev. 0)

Title: SURFACE WATER DISCHARGE MEASURMENT

APPROVALS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Remedial Project Manager		9/26/07
SOP Author		9/26/07

Revision Number	Date	Reason for Revision
0	09/26/2007	--

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the protocol for collecting discharge measurements in streams and ditches. Discharge is defined as the volume rate of flow of water, including any substances suspended or dissolved in the water. Discharge will be expressed in cubic feet per second (cfs) or gallons per minute (gpm). This SOP provides a method for describing a current and three methods for measuring discharge: 1) volumetric method, 2) area-velocity method, and 3) flume method. Note that the protocol for collection of surface water samples is included in Libby OU3 SOP-3, Surface Water Sampling.

The procedures presented herein are intended to be general in nature and are applicable when referenced in a monitoring or field sampling plan. As the work progresses, and if warranted, appropriate revisions may be made when approved in writing by the Project Manager. All discharge measurements must be performed following health and safety protocols described in the health and safety plan.

2.0 HEALTH AND SAFETY WARNING

All personnel engaged in surface water discharge measurements must follow health and safety protocols described in the health and safety plan. Asbestos fibers are thin and long fibers so small that they cannot be seen by the naked eye. Asbestos fibers are easily inhaled when disturbed and when embedded in the lung tissue can cause health problems. Significant exposure to asbestos increases the risk of lung cancer, mesothelioma, asbestosis (non-cancerous lung disease), and other respiratory diseases (ATSDR 2006).

3.0 DEFINITIONS

Discharge: The volume of water transported in a certain amount of time through a cross-section of a stream. Discharge is expressed in cfs or gpm.

4.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often additional personnel may be involved. Project team member information shall be included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

Project Manager: Selects site-specific sampling methods, sample locations, and constituents to be analyzed with input from other key project staff.

Quality Control Manager: Overall management and responsibility for quality assurance and quality control (QA/QC). Selects QA/QC procedures for the sampling and analytical methods, performs project audits, and ensures that data quality objectives are fulfilled.

Field Team Leader (FTL) and/or Field Geologist, Hydrogeologist, or Engineer: Implements the sampling program, supervises other sampling personnel, and ensures compliance with SOPs and QA/QC requirements. Prepares daily logs of field activities.

Sampling Technician (or other designated personnel): Assists the FTL, geologist, hydrogeologist, or engineer in the implementation of tasks. Performs the actual sample collection, packaging, and documentation (e.g., sample label and log sheet, chain-of-custody record, etc).

5.0 DISCHARGE MEASUREMENT PROCEDURES

5.1 Background

The methods and procedures described in this SOP were developed from these sources:

- Rantz, S.E. et al., 1982. *Measurement and Computation of Streamflow: Volume 1, Measurement of Stage and Discharge*, U.S. Geological Survey Water Supply Paper 2175. U.S. Government Printing Office, Washington, D.C.

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

- U.S. Environmental Protection Agency, 1986. *Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual*. Environmental Services Division, Region IV, Athens, GA.

The selection of an appropriate method for discharge measurement depends on the flow conditions. In some conditions, the flow measurement methods described here may be impossible to implement (e.g., extreme high-flow conditions). If flow conditions cannot be measured at a specific location, then field personnel will attempt to measure flow at a point upstream or downstream of the sample site. The field personnel will also note the conditions that inhibited more accurate measurement at the designated measurement location. All samples should be collected prior to performing the discharge measurements.

5.2 Qualitative Current Description

In cases where a discharge measurement is not required but a description of the direction and relative rate of flow is useful, qualitative measurements are made. Qualitative measurement of current is made by using a strip of soft tape or cloth attached to the end of a pole. The strip will indicate the presence of water flow and direction of flow at the location and depth. The diameter of the pole should be sufficiently small to prevent directional error.

5.3 Discharge Measurement

Quantitative measurements may be made using a current meter, a volumetric method, or flume method. The selection of discharge measurement method depends on streamflow rate and/or specific channel characteristics. For pipes, drain system outfalls and cases where flows are too small or stream gradients are too high, the volumetric method is appropriate. In cases where water depth is greater than 0.3 feet or the channel cross section is wide, discharge should be measured using the

area-velocity method. Where flows are below the practical limit that can be measured with the area-velocity method, the flume method is best. Where the total discharge is conveyed through two channels or differing types, a combination of these methods may be appropriate.

5.3.1 Volumetric Method

The volumetric method is a simple and accurate method for measuring flow from small discharges such as gravity flow discharged from pipe outlets, and is particularly useful for the measurement of small flows. This method involves observing the time required to fill or partly fill a calibrated container to a known volume. Alternatively, in the case of measuring discharge remotely in a sump or standpipe setting, the volumetric method may be performed by capturing flow in a container for a set period of time, no less than 10 seconds. This volume of water is then measured and discharge is determined.

Field personnel will observe and use judgment in approximating the flow volume and will select an appropriately sized volumetric container to use the volumetric method of flow measurement. Equipment required to make this measurement is a calibrated container and a stopwatch. Calibrated containers of varying sizes include: 5-gallon bucket, 2-liter graduated cylinder, 1-liter graduated cylinder, 1-liter bucket, etc. The incremental volume of a 5-gallon bucket can be determined by adding known volumes of water and recording the depth after each addition.

To measure flow, a technician will measure the time required to fill a volumetric container. The technician will time flow into the container for a minimum of 10 seconds. Five consecutive measurements will be made and noted, and the results will be averaged to determine the discharge. If remote measurement is necessary, a container will be attached to an extension rod. The technician will time flow for a minimum of 10 seconds. The volume of water will then be poured into a calibrated container, measured, and recorded. Five such measurements will be made, noted, and the results averaged to determine the discharge.
Calculations will be performed as follows:

- Record each of the five measurements in terms of gallons per second or milliliters per second, depending on the volumetric container.
- If one of the five measurements is 50 percent or more different from the other measurements, then this value will not be used. Instead, five additional measurements will be taken and, provided that none of these measurements differs by greater than 50 percent from the other measurements, these values will be used.
- Average the five values.
- Leakage around the discharge pipe, if any, will also be estimated and noted.
- Convert the averaged value to cfs as follows:
  - to convert ml/s to cfs, multiply by 3.53 x 10-5
  - to convert gal/s to cfs, multiply by 0.134
- Record discharge in cfs.

5.3.2 Velocity-Area Method

The vertical axis current meter may be used to perform velocity-area method discharge measurements. Common types of vertical axis current meters are the Price meter, type AA, and the Marsh-McBirney. A current meter is an instrument used to measure the velocity of flowing water. Operation of the Price Meter, type AA, is based on the proportionality between the velocity of the water and the resulting angular velocity of the meter rotor. By placing a current meter at a point in a stream and counting the number of revolutions of the rotor during a measured interval of time, the velocity of water at that point is determined. The number of revolutions of the rotor is obtained by an electrical circuit through the contact chamber. Contact points in the chamber are designed to complete an electrical circuit at selected frequencies of revolution. The electrical impulse produces an audible click in a headphone. The intervals during which meter revolutions are counted are timed with a stopwatch. The Marsh-McBirney uses electromagnetic induction to determine the velocity of water. As water flows over a sensor it changes the voltage within the sensor. The changing voltage is processed by the instrument which presents the output as a linear measurement of velocity.

A Price pygmy meter may be used in shallow depths and low-velocity waters. The pygmy meter is scaled two-fifths as large as the type AA meter. The pygmy meter makes one contact (click) per revolution and the type AA meter can make one click per revolution or one click per five revolutions. The Marsh-McBirney type meter can be used at any depth greater than 0.15 feet.

The current meter measures velocity at a point. The velocity-area method requires measurement of the mean velocity in selected subsections of the stream cross-section. By dividing the stream width into subsections, discharge becomes the total of discharges measured in each subsection. Velocity (V) is measured at each subsection, and discharge becomes the sum of the products of each velocity point and the cross-sectional area of each subsection:

$$Q = \sum(A_i * V_i)$$

where: Q = Streamflow in cfs,
A = Area of stream subsection in square feet, and
V = velocity in feet per second.

A cross section is defined by the depths at vertical points (i = 1, 2, 3, ...n) where the average velocity is measured.

In general, the person(s) measuring discharge should strive to measure no more than 5 percent of the flow in any one subsection. However, for small streams this is often impossible. Therefore, the person(s) should divide the channel cross-section into as many subsections as possible and make two complete discharge measurements using different sections for each. Subsections do not need to be identical in width. Velocities near banks are generally lower than velocities near the center of streams; therefore, these subsections may be wider than subsections near the center. Subsections will also be more closely spaced if a stream has an unusually deep portion in the cross-section.
Typically, velocities will be measured by current meter for a 40- to 70-second period. It is recognized that 40 to 70 seconds is not long enough to ensure the accuracy of a single-point observation of velocity. However, because pulsations caused by turbulent and eddying effects are random and because velocity observations during a discharge measurement are made at several

verticals, there is little likelihood that the pulsations will bias the total measure discharge of a stream.

To make an area-velocity discharge measurement, the following conditions are required:

1. The stream must be channelized or contain relatively straight sections upstream of the measurement location.

2. Depth must be greater than 0.2 foot across most of the cross-section being measured.

The ideal channel cross-section is trapezoidal in shape, completely smooth in boundary materials, and possesses a uniform velocity distribution. Such an ideal condition is rarely observed. Therefore, minor modifications to the stream channels will be used to optimize measurement conditions. These modifications may include removal of aquatic vegetation, ice, and moving small stones that impact velocity upstream or downstream of the cross-section. However, no modifications should be made while measurements are being taken.

If flow conditions permit, current meter measurements will be made by wading. The type AA or pygmy meter and the Marsh-McBirney are used for wading measurements. The table below lists the type of meter and velocity method to be used for wading measurements at various depths. The persons(s) should stand at arm's length to the side of the meter.

Velocity Measurement Point Selection

Stream Depth (ft)	Type of Meter	Velocity Measuring Point(s) (Fraction of Depth)
2.5 or more	Type AA/Marsh-McBirney	0.2 and 0.8
1.5 - 2.5	Optional/Marsh-McBirney	0.6
0.3 - 1.5	Optional/Marsh-McBirney	0.6
< 0.3	Pygmy	0.5

Some departure from these specifications will be permitted. A Marsh-McBirney meter is appropriate for all depths deeper than 0.15 feet. Do not switch from one meter to another in the middle of a discharge measurement.

Under open channel laminar flow conditions, the effect of fluid contact with the bed of a stream channel and the air is a vertical distribution of velocities. Consistent with this velocity distribution, actual observation and mathematical theory has demonstrated that a single measurement of velocity taken at 0.6-depth or the average of two point velocities taken at 0.2 and 0.8 of the depth below the surface accurately results in mean velocity in the vertical (U.S.G.S. Water-Supply Paper 2175, 133-134 pp).

If the stream is generally less than 2.5 feet deep, the six-tenths (0.6) method will be used. If the stream is generally greater than 2.5 feet, the two- and eight-tenths (0.2 and 0.8) method, also known as the two-point method, will be used. A complete discussion concerning how to set the wading rod to place the current meter at proper depths is contained in Section 2.3.5, Field Procedures.

In the 0.6-depth method, an observation of velocity made in the vertical at 0.6 of the depth below the surface is used as the mean velocity in the vertical. In the two-point method of measuring velocities, observations are made in each vertical at 0.2 and 0.8 of the depth below the surface. The average of the two observations is taken as the mean velocity in the vertical.

A depth of 1.25 feet will accommodate the 0.6-depth method without causing the meter to be set closer than 0.5 feet from the stream bed; if the meter is set any closer to the stream bed, it will under-register the velocity. If the technician is at a measurement section that has only a few verticals shallower than 1.25 feet, the technician should use the type AA or Marsh-McBirney meter rather than the pygmy meter.

Mechanical vertical axis current meters do not register velocities accurately when placed close to a vertical wall. A Price meter held close to a right-bank vertical wall will under-register because the slower water velocity near the wall strikes the effective (concave) face of the cups. The converse is true at a left-bank vertical wall. (The terms "left bank" and "right bank" designate direction from the center of a stream for an observer facing downstream.) The Price meter also under-registers when positioned close to the water surface or close to the streambed.

5.3.2.1 Equipment And Techniques

Current meters, timers, depth and width measuring devices, and a means of counting meter revolutions are needed for measurement of discharge. The equipment includes:

- Field notebook, indelible marker
- Global Positioning System (GPS) unit;
- Digital Camera;
- Top-setting wading rod and current meter;
- Width-measuring devices, either engineer's tape or tagline;
- Digital counter or headset and stopwatch;
- Current meter rating tables;
- Stakes for width-measuring devices; and
- Calculator.

Top-Setting Wading Rod. The depth-measuring device that will be used is the wading rod. The current meter is attached to the wading rod. The top-setting wading rod has a 2-inch hexagonal main rod for measuring depth and a d-inch diameter round rod for setting the position of the current meter.

Current Meter. Vertical axis current meter, Marsh-McBirney, type AA meter, or pygmy meter.

Engineer's Tape or Tagline. Tape measures or premarked taglines are used for stream width measurements. Orientation normal to the flow patterns of the stream and elimination of most of the sag, through support or tension, are recommended for improved accuracy.

Digital Revolution Counter or Headset. The digital revolution counter attaches to an electronic connection at the top of the wading rod. The digital display shows the number of seconds of elapsed time. The person(s) stops the counter after 40 or more seconds, and the counter automatically displays the velocity.

If the digital counters are unavailable, the headset will be used as a means for determining the number of revolutions. A headset attaches to an electronic connection at the upper end of the wading rod. The person(s) wears this headset to listen to the audible clicking sounds produced by current meter revolutions. The number of rotations are counted and timed. Velocities as a function of time are listed on a current meter rating chart provided by the manufacturer, which is kept in the current-meter carrying case. When using the Marsh-McBirney meter a revolution counter or a headset will not be needed. This type of meter computes velocity directly. A velocity reading should be taken only after a suitable time has passed allowing the readings to stabilize.

Stopwatch. A stopwatch is used to measure time during which velocity is measured at each point in the cross-section.

5.3.2.2 Maintenance And Calibration

Prior to and following the use of the current meter, spin tests will be conducted to ensure that the unit performs acceptably. The spin test will be performed in an enclosed area, such as in the cab or in the enclosed rear of the trunk, to prevent wind interference. The test is to be performed prior to attaching the current meter to the wading rod. While holding the meter steady in an area sheltered

from breezes, the technicians will spin the rotor and then press the start button on the stopwatch. The technician will observe the meter until the rotor ceases to spin.

The duration of the spin for the pygmy meter will be more than 40 seconds, and for the Price AA meter, it will be more than 90 seconds. If the meter fails to meet the time-of-spin criteria, the meter will be cleaned and oiled before use. If the meter continues to spin well beyond these time limits, the record will indicate that the meter spun for 40+ seconds in the case of the pygmy meter, or for 90+ seconds in the case of the Price AA meter.

The Marsh-McBirney will have a zero check performed on the sensor to ensure accurate readings are obtained. First clean the sensor. Then place the sensor in a five gallon bucket of water. Keep it at least three inches away from the sides and bottom of the bucket. To make sure the water is not moving, wait 10 to 15 minutes after you have positioned the sensor and before taking any zero readings. If needed follow the manufactures recommendations to zero adjust the sensor.

To ensure reliable observations of velocity, it is necessary that the current meter be kept in good condition. Before and after each discharge measurement, the meter cups or vanes, pivot and bearing, and shaft will be examined for damage, wear, or faulty alignment. During measurements, the meter will be observed periodically when it is out of the water to be sure that the rotor spins freely and/or the sensor is free of debris.

Meters will be cleaned and oiled daily when in use. If measurements are made in sediment-laden water, the meter will be cleaned immediately after each measurement. After oiling, wipe away any excess oil and spin the rotor to ensure that it operates freely. If the rotor stops abruptly, the cause of the trouble will be determined and corrected before using the meter. The Marsh-McBirney should not be oiled in any way.

In addition to meter maintenance, the entire unit consisting of current meter, wading rod, and digital counter or headset will be checked before departure to the field each day as follows:

- Attach the current meter and digital counter/headset to the wading rod.
- Check the digital counter by ensuring that the readout is visible when the unit is turned on.
- If a headset is being used:
    - Spin the current meter to ensure that audible clicks occur.
    - If audible clicks do not occur, the following steps should be taken:
    - Check that electronic connections are tight.
    - Check that the cat's whisker lightly contacts the upper part of the shaft.
    - Spin again. If audible clicks still do not occur, check that the battery in the headset is properly aligned. Replace the battery, if necessary.

5.3.2.3 Procedures

Upon arrival at the site, the field technicians will evaluate the flow conditions to determine which measurement method is appropriate. Based on flow conditions, the Price AA meter, the pygmy meter, or the Marsh-McBirney meter will be selected to perform an area-velocity measurement.

At each measurement point (or section) across the stream cross-section, depth is measured prior to measurement of velocity. Place the wading rod about 0.5 feet downstream from the tagline. Place the wading rod in the stream so the base plate rests on the streambed. The depth of water is read from the graduated main rod. The main rod is graduated into 0.1-foot increments. These increments are indicated by a single score in the metal. Half-foot increments are marked by two scores in the metal, and each foot is marked by three scores in the metal. A vernier scale on the upper handle of the rod corresponds to 0.1-foot increments, and has 1 through 9 in raised numbers next to raised marks. A sliding, adjustable rod, known as the setting rod, to which the meter is attached, has single scored marks that are aligned with values on the vernier scale.

In high-velocity areas, it is recommended that depth be read as the value between depth on the upstream side of the rod and depth on the downstream side of the rod. Depth is measured to the nearest 0.2 foot. This depth is used to set the vertical location of the current meter.

The setting rod is then adjusted downward so that the scored mark of the setting rod that corresponds to the range of depth in feet (e.g., if depth = 0.46, range in feet = 0; or if depth = 1.72, range in feet = 1) is aligned with the stream depth value transposed to the vernier scale. This automatically positions the meter for use in the 0.6 method as the meter is then six-tenths of the total depth from the surface of the water.

For using the two-point method of velocity measurement, the depth of water is divided by 2. This value is set so that the meter will be at the 0.8-depth position from the water surface. The depth of water is then multiplied by two, and this value is set. The meter will then be at the 0.2-depth position measured down from the water surface. These two positions represent the conventional 0.2- and 0.8-depth positions. If depths are less than 0.30 foot, the 0.5 method may be used. The observation depth recorded will then be 0.5 of the total depth.

If water quality or sediments are sampled in conjunction with discharge measurement, samples will be collected prior to making discharge measurements. The following steps are to be followed in discharge measurement:

- Evaluate the measurement location. Choose a location where flow is least turbulent. If the prescribed location is in a stream reach with highly turbulent flow conditions, try to select a location immediately upstream or downstream. Flow should be visible from bank to bank. Eddies and slack water must not be present. Neither the type AA meter nor the pygmy meter will be used for measuring velocities slower than 0.1 ft/s unless absolutely necessary.

- Remove aquatic vegetation, ice, or other minor flow impediments. When such modifications are made, exercise great care to avoid unnecessary movement of sediments allow flow to stabilize before the current meter measurement begins.

- Position a tape about 1 foot above the surface of the water. Secure the tape so that it remains taut and perpendicular to the channel.

- Select a starting point at either the left bank (left edge of water, LEW) or the right bank (right edge of water, REW). LEW and REW are determined when facing downstream.

- Note the distance in feet, and the stream direction, that this cross-section lies from the prescribed location. For example, the note may read "25 feet downstream" or "15 feet upstream."

- Measure the width of the stream. After selecting the appropriate meter, select the number of subsections in which to measure velocity attempting to measure no more than 10 percent of the total flow in any one section, if possible.

- After determining the distance desired between measuring points, commonly referred to as sections, measurement can begin. Record the time and bank at which measurements start on the discharge measurement notes as "REW Start 0000", using REW or LEW depending upon whether starting at the right or the left edge of the water.

- Note the distance to the beginning edge of water from the initial point. The initial point is an arbitrary point on the tape, preferably zero, which lies on the shoreside of the stream. All station locations are recorded as distances from the initial point.

- Proceed to the first station beyond the edge of water. Record the distance from the initial point on the discharge measurement notes. Place the wading rod into the stream so the base plate rests on the stream bed.

- Stand downstream of the tagline or tape and face upstream. Do not stand behind or close to the meter. Raise the current meter on the wading rod so that it is well above the surface of the water.

- Measure stream depth at the measurement point as indicated on the wading rod. Record the stream depth to the nearest 0.2 foot (for example 0.32 feet or 1.54 feet).

- Lower the meter to the required depth and record the observation depth. The observation depth as a fraction of total depth is 0.6, 0.2, 0.8 or occasionally 0.5.

- The technician will stand in a position that least affects the velocity of the water passing the current meter. That position is usually obtained by facing upstream with the arm fully extended. The technician will stand at about a 45-degree angle downstream from the wading rod. The wading rod is held in a vertical position with the meter parallel to the direction of flow. Avoid standing in the water when possible.

- Start the digital counter. After 40 seconds, stop the counter. Note that the counter reports velocity.

- If using the headset rather than the digital counter, start the stopwatch on the first click and begin counting clicks. The first click counted after starting the stopwatch is counted as one.

- After at least 40 seconds have passed, stop the stopwatch on a click. Record the number of seconds and the number of revolutions (clicks) on the same line of the notes as the recorded depth.

- Determine velocity as a function of elapsed time and number of revolutions from the velocity chart specific to the flow meter. The manufacturer provides these charts with the instrument. Record velocity in the appropriate column. The flow meter must be aligned parallel to the direction of flow.

- Proceed to the next station. Record the distance from the initial point to the station. Repeat measurements of depth and velocity. Continue in this manner across the stream.

- After recording the distance measurement at the last station, record the time at which the ending edge of water is reached (e.g., LEW [or REW] FINISH 1330).

- Note velocity and depth at the edge of water as zero.

- Evaluate and record flow characteristics, weather conditions, air temperature, water temperature, observer(s), type of meter, and remarks.

- If less than 20 subsections have been used for the measurement, repeat the measurement steps. Begin from the opposite bank from where the previous measurement began.

5.3.2.4 Discharge Calculation

Calculate discharge on the discharge notes as follows:

- Use the distances from initial point to compute width for each subsection. The first width is computed by subtracting the first distance (edge of water) from the second distance and dividing this quantity by two. The second width will be the difference between the third distance and the first distance divided by two. For each subsequent width, subtract the previous station distance from the following station distance and divide this quantity by two. The final width is calculated as the difference between

the final distance and the second-to-last distance divided by two. Sum the width column and check to ensure that the calculated width equals the distance between the REW and LEW.

- Multiply the width by the depth for each station to determine the area of each subsection. Sum the areas to determine total area.
- Multiply the velocity by the area for each station to obtain the discharge for each subsection.
- Sum the discharges for each subsection to determine total discharge and record the value.
- If two sets of discharge measurements beginning at opposite banks were taken, repeat the discharge calculations for the second set of data. Average the total discharges for the two measurements. Record the average value and report it for input into the database.

5.3.3 Control Structures

Control structure such as flumes can be used to determine discharge. These structures have regular dimensions that allow for a consistent relationship between water level and discharge. A calibrated constriction placed in a stream channel changes the level of the water in or near the constriction. Flumes are constructed so that a restriction in the channel causes the water to accelerate, producing a corresponding change (drop) in the water level. When the physical dimensions of the flume constriction are known, discharge through constriction may be determined from measurement of depth. See below for a description of discharge measurement for Parshall flumes.

Typical flumes consist of three sections:

- A converging section to accelerate the approaching flow.
- A throat section, whose width is used to designate flume size.
- A diverging section, designed to ensure that the level downstream is lower than the level in the converging section.

The stage of a stream is the height of the water surface above an established elevation. Stage is usually expressed in feet. The Parshall flume consists of a converging section with a level floor, a throat section with a downward sloping floor, and a diverging section with an upward sloping floor. The principal feature of the Parshall flume (developed by R. Parshall in 1922) is an approach reach having converging sidewalls and a level floor, the downstream end of which is a critical depth cross-section. The primary stage measurement is made in the approach reach at some standard distance upstream from the critical-depth cross-section.

The flumes are designated by the width (w) of the throat. Flumes having throat widths from 3 inches (in.) to 8 feet (ft.) have a rounded entrance whose floor slope is 25 percent. Smaller and larger flumes do not have that feature. Ideally, flow rate through a flume may be determined by measurements at a single point some distance downstream from the inlet and above the throat.

5.3.3.1 Equipment

The following equipment will be needed:

- Field notebook, indelible marker
- GPS unit;
- Marking stakes;
- Digital Camera;
- Calculator;
- Current meter;
- Carpenter's level;
- Framing square;
- Measuring tapes; and
- Staff gauge.

5.3.3.2 Maintenance And Calibration

All flumes will be inspected to determine that entrance conditions provide a uniform influent flow distribution, the converging throat section is level, and that the throat section walls are vertical. The

flume will be closely examined to determine that it is discharging freely. Any problems observed during the inspection will be noted and reported to the field manager.

5.3.3.3 Procedures

Steps to be followed in measuring discharge.

- Remove any material that may have accumulated in the flume or on the weir;
- If the station includes a chart recorder, inspect the strip chart on the recorder to verify that it is operating;
- Note any deterioration of the station; report these conditions to the field manager at the conclusion of daily data collection activities;
- Measure and record the throat width (W) to the nearest 1/10 of an inch;
- Use the staff gauge to measure and record the gauge height (H) to the nearest 0.2 foot;
- Calculate discharge as described in Subsection 2.5.6; and
- Record the calculated discharge and the time and date of the site visit.

5.3.3.4 Discharge Calculation

A set of flume tables is necessary for calculating flows. The flume tables are specific to the type and size of flume and are usually supplied by the flume manufacturer. Based on the gage height (head, H, in feet) and the throat width of the flume (size of flume, W), the discharge is read directly from the table provided from the manufacturer. Note that the approximate values of discharge for heads other than those shown may be found by direct interpolation in the table. The following equation and table gives calculation coefficients for discharge calculations with Parshall flumes.

The free-flow discharge equations for the standard Parshall flume sizes are of the form:

$$Q = Ch_a^{\,n}$$

where:

h_a = measuring head (ft)
Q = discharge (ft^3/s)
C and n = coefficients specific to flume size

Coefficients (C) and exponents (n) for Parshall flume discharge calculations are listed in the following table.

Throat width	Coefficient (C)	Exponent (n)
1 in	0.338	1.55
2 in	0.676	1.55
3 in	0.992	1.55
6 in	2.06	1.58
9 in	3.07	1.53
1 ft	3.95	1.55
2 ft	8.00	1.55
3 ft	12.00	1.57
4 ft	16.00	1.58
5 ft	20.00	1.59
6 ft	24.00	1.59
7 ft	28.00	1.60
8 ft	32.00	1.61
10 ft	39.38	1.60
12 ft	46.75	1.60
15 ft	57.81	1.60
20 ft	76.25	1.60
25 ft	94.69	1.60
30 ft	113.13	1.60
40 ft	150.00	1.60
50 ft	186.88	1.60

6.0 DOCUMENTATION

Information required by this SOP, including rationale for changes, will be documented in detail in a bound field notebook and on appropriate field forms (see attached). This information includes the calibration data for flow measurement devices and field discharge measurement data.

Documentation will also include the type of flow measurement device, including a model number and instrument serial number; a detailed description of measurement location and weather conditions during the measurement; and calculations.

7.0 QUALITY ASSURANCE AND QUALITY CONTROL

All data must be documented in the field logbooks and/or field forms, including rationales deviations from this SOP. The Field Team Leader or designated QA reviewer will check and verify that field documentation has been completed per this procedure and other procedures referenced herein. All equipment must be operated according to the manufacturer's specifications, including calibration and maintenance.

7.1 Calculation Check

All calculations will be reviewed for accuracy and conformance with these procedures. The calculation review will be performed by a technically qualified individual before results are reported or interpreted. The calculation check shall be documented by the reviewer's initials and date of review. A copy of the reviewed calculations should be included in the project file.

7.2 Records Review and Management

The project manager or designated reviewer will verify that documentation has been completed and filed per this procedure.

8.0 DECONTAMINATION

All equipment used in the discharge measurement process shall be decontaminated prior to field use and between locations. Decontamination procedures are presented in SOP-7. Personnel shall don appropriate personal protective equipment as specified in the health and safety plan. Any investigation-derived waste generated in the sampling process shall be managed in accordance with the procedures outlined in SOP-12.

9.0 REFERENCES

Agency for Toxic Substances and Disease Registry. 2006. Asbestos Exposure and Your Health.

Rantz, S.E. et al., 1982. *Measurement and Computation of Streamflow: Volume 1, Measurement of Stage and Discharge*, U.S. Geological Survey Water Supply Paper 2175. U.S. Government Printing Office, Washington, D.C.

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

U.S. Environmental Protection Agency, 1986. *Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual*. Environmental Services Division, Region IV, Athens, GA.

U.S. Environmental Protection Agency. 2007. Guidance for Preparing Standard Operating Procedures (SOPs). EPA QA/G-6. U.S. Environmental Protection Agency, Office of Environmental Information. EPA/600/B-07/001. April 2007.

SURFACE WATER FLOW RECORD | STATION ID:

Date: _____ Time: _____ Weather: _____

_____ Page ____ of ____

Weather Past 48 hours: _____ Personnel: _____

Measuring Point Description: _____

Measuring Device: _____ UTM (NAD83): _____

VOLUMETRIC METHOD:

Trial #	Volume	Time	Discharge
1			
2			
3			
4			
5			

Average Discharge (gpm) = _____

FLUME METHOD:

Circle Flume: 4" Baski Cutthroat 8" Baski Cutthroat

Ha (ft) = _____

Flow from table (gpm) = _____

Estimated Leakage (%) = _____

Adjusted Flow for Leakage (gpm) = _____

Comments: _____

_____

AREA - VELOCITY METHOD

Circle Method: 0.6 Times Depth 0.2 and 0.8 Times Depth

Bank Looking Downtream (Left/Right)	Tape Reading (ft)	Distance From Bank (ft)	Total Depth (ft)	Velocity (ft/sec)	Section Width (ft)	Section Area (ft^2)	Section Discharge (cfs)	Comments
							TOTAL DISCHARGE (cfs) =	

MAP / COMMENTS:

SIGNATURE: _____

LIBBY OU3
PHASE I

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Libby Superfund Site Operable Unit 3 Standard Operating Procedure

Date: September 26, 2007

OU3 SOP 7 (Rev. 0)

Title: EQUIPMENT DECONTAMINATION

APPROVALS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Remedial Project Manager		9/26/07
SOP Author		9/26/07

Revision Number	Date	Reason for Revision
0	09/26/2007	--

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) is based on MWH SOP-02, Equipment Decontamination, Revision 1.0, March 2004, modified for use at the Libby Asbestos Superfund Site OU3. Decontamination of drilling, sampling, and monitoring equipment is a necessary and critical aspect of environmental field investigations. Proper decontamination is a key element in reducing the potential for cross-contamination between samples from different locations, as well as ensuring that samples are representative of the sampled materials. Improper decontamination may result in costly re-collection and re-analysis of samples. All equipment used in the sampling process will be properly decontaminated prior to the collection of each sample and after completion of sampling activities.

The procedures outlined in this SOP will be followed during decontamination of field equipment used in the sampling process, including drilling, soil/water sample collection, and monitoring activities. Any deviations from these procedures will be noted in the field notebooks and approved by the appropriate oversight agency, if significant. Three major categories of field equipment, along with applicable decontamination methods for each, are discussed below.

2.0 HEALTH AND SAFETY WARNING

All personnel engaged in equipment decontamination must follow health and safety protocols described in the health and safety plan. Asbestos fibers are thin and long fibers so small that they cannot be seen by the naked eye. Asbestos fibers are easily inhaled when disturbed and when embedded in the lung tissue can cause health problems. Significant exposure to asbestos increases the risk of lung cancer, mesothelioma, asbestosis (non-cancerous lung disease), and other respiratory diseases (ATSDR 2006).

3.0 DEFINITIONS

Bailer: A cylindrical tool designed to remove material from a well. A valve at the bottom of the bailer retains the contents in the bailer.

Bladder Pump: Groundwater sampling equipment consisting of a flexible bladder, usually made of Teflon®, contained within a rigid cylindrical body (commonly made of stainless steel). The lower end of the bladder is connected to the intake port through a check valve, while the upper end is connected through a second check valve to a sampling line that leads to the ground surface.

Brass Sleeve: Hollow, cylindrical sleeves made of brass and used as liners in split-spoon samplers for collection of undisturbed samples.

Auger Flight: An individual auger section, usually 5 feet in length.

Continuous Core Barrel: 3-5 foot long steel barrels that can be joined together to allow continuous cores to be collected during a single run.

Drill Pipe: Hollow metal pipe used for drilling, through which soil and groundwater sampling devices can be advanced for sample collection.

Peristaltic Pump: A low-volume suction pump. The compression of a flexible tube by a rotor results in the development of suction.

Source Water: A drilling quality water source identified to be used for steam cleaning. This source should be sampled at the beginning of each field program to set baseline concentrations.

Distilled Water: Commercially available water that has been distilled. Each batch of distilled water should be analyzed to set baseline concentrations.

Hand Auger: A sampling tool consisting of a metal tube with two sharpened spiral wings at the tip.

Split-Spoon Sampler: A sampling tool consisting of a thick-walled steel tube with a removable head and drive shoe. The steel tube splits open lengthwise when the head and drive shoe are removed.

Scoop: A sampling hand tool consisting of a small shovel- or trowel-shaped blade.

Submersible Pump: Groundwater sampling pump that consists of a rotor contained within a chamber and driven by an electric motor.

4.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often, additional personnel may be involved. Project team member information will be included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel will always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

Project Manager: Responsible for project implementation and coordination, selects project-specific drilling and sampling methods, and associated decontamination procedures with input from other key project staff, and appropriate oversight agencies.

Quality Control Manager: Overall management and responsibility for quality assurance and quality control (QA/QC). Selects QA/QC procedures for the sampling and analytical methods, performs project audits, and ensures that data quality objectives are fulfilled.

Field Team Leader (FTL) and/or Geologist, Hydrogeologist, or Engineer: Implements the field program and supervises other sampling personnel, and ensures that SOPs are properly followed. Prepares daily logs of field activities.

Field Sampling Technician (or other designated personnel): Assists the FTL, geologist, hydrogeologist, or engineer in the implementation of tasks and is responsible for the decontamination of sampling equipment.

5.0 DECONTAMINATION PROCEDURES

Drilling and sampling procedures require that decontaminated tools be employed in order to prevent cross-contamination. The decontamination procedures described below will be followed to ensure that only uncontaminated materials will be introduced to the subsurface during drilling and sampling. The equipment decontamination process will be undertaken before and after each use of the equipment and include either steam cleaning or washing. Steam cleaning of equipment, if used, will be performed at a temporary decontamination site. The flooring of the temporary decontamination site will be impermeable to water and large enough to contain the equipment and the rinsate produced.

If the quantity of water in the pad area exceeds its holding capacity, the water will be drummed temporarily until analytical results are obtained and the water can be properly disposed of. Steam cleaning will not be performed over bare ground, but will always be conducted so that rinsate can be collected and disposed of properly. Wherever applicable, equipment will be disassembled to permit adequate cleaning of the internal portions.

5.1 Drilling and Large Equipment

The following procedure will be used for decontamination of large pieces of equipment. These include well casings, auger flights, drill pipes and rods, and those portions of the drill rig that may stand directly over a boring or well location, or that may come into contact with casing, auger flights, pipes, or rods.

- Establish a decontamination area large enough to contain the equipment and any decontamination waste
- Place equipment on sawhorse or equivalent, if possible.

- Steam clean the external surfaces and internal surfaces, as applicable, on equipment using high-pressure steam cleaner from an approved water source. If necessary, scrub using brushes and a phosphate-free detergent (e.g., Alconox™), or equivalent laboratory-grade detergent until all visible dirt, grime, grease, oil, loose paint, rust, etc., have been removed.

- Rinse with potable water

- Remove equipment from decontamination pad and allow to air dry

- Record date and time of equipment decontamination

5.2 Soil and Groundwater Sampling Equipment

The following procedure will be used to decontaminate sampling equipment such as split-spoon samplers; brass sleeves; continuous core barrels; scoops; hand augers; non-dedicated bailers; submersible pumps, bladder pumps; and other sampling equipment that may come into contact with samples. To minimize decontamination procedures in the field, dedicated equipment will be used wherever feasible:

- Wash and scrub equipment with phosphate-free, laboratory-grade detergent (e.g., Alconox™ or equivalent) and off-site distilled water

- Triple-rinse with distilled water

- Air dry

- Wrap in aluminum foil, or store in clean plastic bag or designated casing.

- Record date and time of equipment decontamination

Personnel involved in decontamination activities will wear appropriate protective clothing as defined in the project-specific health and safety plan.

5.3 Monitoring Equipment

The following procedure will be used to decontaminate monitoring devices such as slug-test equipment, groundwater elevation and free product thickness measuring devices, and water quality checking instruments. Note that organic solvents can not be used to decontaminate free product measuring devices because they will cause damage to the probes. Spray bottles may be used to store and dispense distilled water.

- Wash equipment with laboratory-grade, phosphate-free detergent (e.g., Alconox™ or equivalent) and distilled water
- Triple-rinse with distilled water
- Store in clean plastic bag or storage case.
- Record date and time of equipment decontamination

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

All equipment decontamination must be documented in the field logbooks and/or field forms, including rationales deviations from this SOP. The Field Team Leader or designated QA reviewer will check and verify that field documentation has been completed per this procedure and other procedures referenced herein.

To assess the adequacy of decontamination procedures, field rinsate blanks may be collected. The specific number of rinsate blanks will be defined in a FSP or work plan or by the Project

Manager. In general, at least one field rinsate blank should collected per sampling event or per day.

Rinsate blanks with elevated or detected contaminates will be evaluated by the Project Manager, who will relay the results to the site workers. Such results may be indicative of inadequate decontamination procedures that require corrective actions (e.g., retaining).

7.0 PROCEDURE FOR WASTE DISPOSAL

All decontamination water that has come into contact with contaminated equipment will be handled, labeled, stored and disposed according to SOP 12. Unless otherwise specified in the FSP, waste generated from other sources and classified as non-hazardous waste (e.g., PPE, pastic sheeting, rope and misc. debris) will be disposed into trash receptacles.

8.0 REFERENCES

Agency for Toxic Substances and Disease Registry. 2006. *Asbestos Exposure and Your Health*.

U.S. Environmental Protection Agency, *RCRA Ground-Water Monitoring: Draft Technical Guidance*, November 1992. Page 7-17.

Libby Superfund Site Operable Unit 3 Standard Operating Procedure

Date: September 26, 2007

OU3 SOP 8 (Rev. 0)

Title: SAMPLE HANDLING AND SHIPPING

APPROVALS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Remedial Project Manager		9/26/07
SOP Author		9/26/07

Revision Number	Date	Reason for Revision
0	09/26/2007	--

1.0 INTRODUCTION

This standard operating procedure (SOP) is based on MWH SOP-09, Sample Handling and Shipping, Revision 1.0, March 2004, modified for use at the Libby Asbestos Superfund Site OU3. This SOP describes the requirements for sample handling, storage and shipping. The purpose of this SOP is to define sample management activities as performed from the time of sample collection to the time they are received by the laboratory.

2.0 HEALTH AND SAFETY WARNING

All personnel engaged in soil sampling must follow health and safety protocols described in the health and safety plan. Asbestos fibers are thin and long fibers so small that they cannot be seen by the naked eye. Asbestos fibers are easily inhaled when disturbed and when embedded in the lung tissue can cause health problems. Significant exposure to asbestos increases the risk of lung cancer, mesothelioma, asbestosis (non-cancerous lung disease), and other respiratory diseases (ATSDR 2006).

3.0 DEFINITIONS

Chain-of-Custody: An accurate written record of the possession of each sample from the time of collection in the field to the time the sample is received by the designated analytical laboratory.

Sample: Physical evidence collected for environmental measuring and monitoring. For the purposes of this SOP, sample is restricted to solid, aqueous, air, or waste matrices. This SOP does not cover samples collected for lithologic description nor does it include remote sensing imagery or photographs (refer to SOP-9 for field documentation procedures).

Sampler: The individual who collects environmental samples during fieldwork.

4.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often additional personnel may be involved. Project team member information will be included in project-specific plans (e.g., work plan, field sampling plan (FSP), quality assurance plan, and etc.), and field personnel will always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

Project Manager: The Project Manager is responsible for ensuring that the requirements for sample management are included in the appropriate project plans. The Project Manager is responsible for coordinating sample management efforts with input from other key project staff and applicable government agencies.

Quality Control Manager: Overall management and responsibility for quality assurance and quality control (QA/QC). Selects QA/QC procedures for the sampling and analytical methods, performs project audits, and ensures that data quality objectives are fulfilled.

Field Team Leader and/or Field Hydrogeologist, Geologist or Engineer: Implements the sampling program, supervises other sampling personnel, and ensures compliance with SOPs and QA/QC requirements. Prepares daily logs of field activities.

Field Technician: Responsible for sample collection, documentation, packaging, and shipping. Assists the FTL and/or geologist, hydrogeologist, or engineer in the implementation of tasks.

5.0 PROCEDURES

5.1 Applicability

The information in this SOP may be used by direct reference or incorporated into project-specific plans. Deviations or modifications to procedures addressed herein must be brought to the attention of, and approved by, applicable government agencies.

5.2 Sample Management

Sample Containers: The sample containers to be used will be dependent on the sample matrix and analyses desired, and are specified in the project FSP. Only certified pre-cleaned sample containers will be used. Sample containers will be filled with adequate headspace (approximately 10 percent) for safe handling upon opening, except containers for volatile organic compound (VOC) analyses, which will be filled completely with no headspace. This no-headspace requirement applies to both soil and groundwater samples.

Once opened, the containers will be used immediately. If the container is used for any reason in the field (e.g., screening) and not sent to the laboratory for analysis, it will be discarded. Prior to discarding the contents of the used container and the container, disposal requirements will be evaluated. When storing before and after sampling, the containers will remain separate from solvents and other volatile organic materials. Sample containers with preservatives added by the laboratory will not be used if held for an extended period on the job site or exposed to extreme heat conditions. Containers will be kept in a cool, dry place. For preserved samples (except VOCs), the pH of the sample will be checked following collection of the sample. If the pH is not at the required level, additional preservative (provided by the laboratory) will be added to the sample container.

Numbering and Labeling: Refer to OU3 SOP-9.

Custody Seals. Custody seals with the date and initials of the sampler will be used on each shipping container to ensure custody. The custody seal will be placed on opposites sides of the cooler across the seam of the lid and the cooler body. Alternatively, if the sample containers are all placed inside a liner bag within the cooler, the custody seal may be placed across the seal of the liner bag inside of the cooler.

Chain-of-Custody: COC procedures require a written record of the possession of individual samples from the time of collection through laboratory analyses. A sample is considered to be in custody if it is:

- In a person's possession
- In view after being in physical possession
- In a secured condition after having been in physical custody
- In a designated secure area, restricted to authorized personnel

The COC record will be used to document the samples taken and the analyses requested. Refer to SOP-9 Attachment 2 for the OU3-specific COC form. Information recorded by field personnel on the COC record will include the following:

- Sample identifier (Index ID)
- Date and time of collection
- Sample matrix
- Preservation
- Type of analyses requested
- Unique COC number
- Lab being shipped to
- Signature of individuals involved in custody transfer (including date and time of transfer)
- Airbill number (if appropriate)
- Any comments regarding individual samples (e.g., organic vapor meter readings, special instructions).

COC records will be placed in a waterproof plastic bag (e.g., Ziploc®), taped to the inside lid of the cooler or placed at the top of the cooler, and transported with the samples. Signed airbills will serve as evidence of custody transfer between the field sampler and courier, as well as between the courier and laboratory. If a carrier service is used to ship the samples (e.g., Federal Express, etc.), custody will remain with the courier until it is relinquished to the laboratory. Upon receiving the sample cooler, a laboratory representative should sign in the receiving box of the COC, thus establishing custody. The sampler will retain copies of the COC record and airbill.

Sample Preservation/Storage: The requirements for sample preservation are dependent on the desired analyses and the sample matrix, and are specified in the FSP.

5.3 Sample Shipping

The methods and procedures described in this SOP were developed from these sources:

- 49 CFR 173. Shippers – Shippers – General Requirements for Shipping. United States Code of Federal Regulations available online at http://www.gpoaccess.gov/cfr/index.html

- 49 CFR 178. Specifications for Packaging. United States Code of Federal Regulations available online at http://www.gpoaccess.gov/cfr/index.html

- ASTM D 4220. Standard Practice for Preserving and Transporting Soil Samples. American Society for Testing and Materials available online at http://www.astm.org/

- ASTM D 4840. Standard Practice for Sampling Chain-of-Custody Procedures. American Society for Testing and Materials available online at http://www.astm.org/

Procedures for packaging and transporting samples to the laboratory are dependent on the chemical, physical, and hazard properties of the material. The procedures may also be based on an estimation of contaminant concentrations/properties in the samples to be shipped. Samples will be identified as environmental samples, excepted quantities samples, limited quantities samples, or standard hazardous materials. Environmental samples are defined as solid or liquid samples collected for chemical or geotechnical analysis. Excepted quantities involve the shipment of a few milliliters of either an acid or base preservative in an otherwise empty sample container. Limited quantities are restricted amounts of hazardous materials that may be shipped in generic, sturdy containers. Standard hazardous material shipments require the use of stamped/certified containers. All samples will be packaged and shipped or hand delivered to the laboratories the same day of sample collection, unless otherwise specified in the project-specific FSPs.

The following paragraphs describe standard shipping procedures for different types of samples. Any exceptions to these procedures will be defined in the FSP. It is the responsibility of the sampler to refer to the U.S. Department of Transportation (DOT) (http://hazmat.dot.gov/regs/rules.htm) regulations when dealing with a substance not addressed in this SOP for requirements and limitations associated with the shipment.

Sample Shipping via Commercial Carrier:

Aqueous or Solid Samples: Samples will be packaged and shipped to the laboratories the same day of sample collection, unless otherwise specified in the FSP and depending on holding time requirements for individual samples. For aqueous or solid samples that are shipped to the laboratory via a commercial carrier the following procedures apply:

- Sample labels will be completed and attached to sample containers.
- The samples will be placed upright in a waterproof metal (or equivalent strength plastic) ice chest or cooler.
- For shipments containing samples for volatile organic analysis, include a trip blank.
- Ice in double Ziploc® bags (to prevent leakage) will be placed around, among, and on top of the sample bottles. Enough ice will be used so that the samples will be chilled and maintained at 4°C ± 2°C during transport to the laboratory. Dry ice or blue ice will not be used.
- To prevent the sample containers from shifting inside the cooler, the remaining space in the cooler will be filled with inert cushioning material, such as shipping peanuts, additional bubble pack, or cardboard dividers, such that the sample containers remain upright and do not break.
- Tape shut the cooler's drain plug
- The original copy of the completed COC form will be placed in a waterproof plastic bag and taped to the inside of the cooler lid or placed at the top of the cooler.
- The lid will be secured by wrapping strapping tape completely around the cooler in two locations.

- Mark the cooler with arrow labels indicating the proper upright position of the cooler.

- Custody seals consisting of security tape with the date and initials of the sampler will be used on each shipping container to ensure custody. Two signed custody seals will be placed on the cooler, one on the front and one on the back.

- A copy of the COC record and the signed air bill will be retained for the project files.

- Affix a label containing the name and address of the shipper to the outside of the cooler

Hand-Delivered Samples: For aqueous or solid samples that will be hand carried to the laboratory, the same procedures apply.

Excepted Quantities: Usually, corrosive preservatives (e.g., hydrochloric acid, sulfuric acid, nitric acid, or sodium hydroxide) are added to otherwise empty sample bottles by the analytical laboratory prior to shipment to field sites. However, if there is an occasion whereby personnel are required to ship bottles with these undiluted acids or bases, the containers will be shipped in the following manner:

1. Each individual sample container will have not more than 30 milliliters of preservative.

2. Collectively, the preservative in these individual containers will not exceed a volume of 500 milliliters in the same outer box or package.
3. Despite the small quantities, only chemically compatible material may be placed in the same outer box, (e.g., sodium hydroxide, a base, must be packaged separately from the acids).

4. Federal Express will transport nitric acid only in concentrations of 40 percent or less.

5. A "Dangerous Goods in Excepted Quantities" label will be affixed to the outside of the outer box or container. Information required on the label includes:

   - Signature of Shipper
   - Title of Shipper
   - Date
   - Name and Address of Shipper
   - Check of Applicable Hazard Class
   - Listing of UN Numbers for Materials in Hazard Classes

Limited Quantities: Occasionally, it may become necessary to ship known hazardous materials, such as pure or floating product. DOT regulations permit the shipment of many hazardous materials in "sturdy" packages, such as an ice chest or cardboard box (not a specially constructed and certified container), provided the following conditions are met:

1. Each sample bottle is placed in a plastic bag, and the bag is sealed. Each VOC vial will be placed in a sealable bag. As much air as possible is squeezed from the bag before sealing. Bags may be sealed with evidence tape for additional security.

2. Or each bottle is placed in a separate paint can, the paint can is filled with vermiculite, and the lid is affixed to the can. The lid must be sealed with metal clips, filament, or evidence tape. If clips are used, the manufacturer typically recommends six clips.

3. The cans are placed upright in a cooler that has had the drain plug taped shut inside and outside, and the cooler is lined with a large plastic bag. Approximately 1 inch of adsorbent material sufficient to retain any liquid that may be spilled, is placed in the bottom of the liner. Only containers having chemically compatible material may be packaged in each cooler or other outer container.

4. The COC record is sealed inside a plastic bag and placed inside the cooler. The sampler retains one copy of the COC record. The laboratory will be notified if the

sample is suspected of containing any substance for which the laboratory personnel should take safety precautions.

5. The cooler is shut and sealed with strapping tape (filament type) around both ends. Two signed custody seals will be placed on the cooler, one on the front and one on the back. Additional seals may be used if the sampler and/or shipper consider more seals to be necessary. Wide, clear tape will be placed over the seals to ensure against accidental breakage.

6. The following markings are placed on the side of the cooler:

   - Proper Shipping Name (Column B, List of Dangerous Goods, Section 4, IATA Dangerous Goods Regulations [DGR])
   - UN Number (Column A, List of Dangerous Goods, Section 4, IATA DGR)
   - Shipper's name and address
   - Consignee's name and address
   - The words "LIMITED QUANTITY"
   - Hazard Labels (Column E, List of Dangerous Goods, Section 4, IATA DGR)
   - Two Orientation (Arrow) labels placed on opposite sides.

7. The Airbill/Declaration of Dangerous Goods form is completed as follows:

   - Shipper's name and address
   - Consignee's name and address
   - Services, Delivery & Special Handling Instructions
   - Cross out "Cargo Aircraft Only" in the Transport Details Box
   - Cross out "Radioactive" under Shipment Type
   - Nature and Quantity of Dangerous Goods

- Proper Shipping Name (Column B, List of Dangerous Goods, Section 4, IATA DGR)
- Class or Division (Column C, List of Dangerous Goods, Section 4, IATA DGR)
- UN Number (Column A, List of Dangerous Goods, Section 4, IATA DGR)
- Packing Group (Column F, List of Dangerous Goods, Section 4, IATA DGR)
- Subsidiary Risk, if any (Column D, List of Dangerous Goods, Section 4, IATA DGR)
- Quantity and type of packing (number and type of containers: for example, "3 plastic boxes", and the quantity per container, "2 L", is noted as "3 Plastic boxes X 2 L" This refers to 3 plastic boxes (coolers are referred to as plastic boxes) with 2 liters in each box.
- Packing Instructions (Column G, List of Dangerous Goods, Section 4, IATA DGR).
- Note: Only those Packing Instructions in Column G that begin with the letter "Y" may be used. These refer specifically to the Limited Quantity provisions.
- Authorization (Write in the words Limited Quantity)
- Emergency Telephone Number (List 800-535-5053. This is the number for INFOTRAC.)
- Printed Name and Title, Place and Date, Signature.

Standard Hazardous Materials: Shipment of standard hazardous materials presents the most difficulty and expense. However, there may be occasion whereby a hazardous material cannot be shipped under the Limited Quantity provisions, (e.g., where there is no Packing Instruction in Column G, List of Dangerous Goods, IATA Dangerous Goods Regulations, that is preceded by the letter "Y").

In such cases, the general instructions noted above but for non-Limited Quantity materials will apply, with one important difference: standard hazardous materials shipment requires the use of certified outer shipping containers. These containers have undergone rigid testing and are, therefore, designated by a "UN" stamp on the outside, usually along the bottom of a container's side. The UN stamp is also accompanied by codes specifying container type, packing group rating, gross mass, density, test pressure, year of manufacturer, state of manufacturer, and manufacturer code name. The transport of lithium batteries in Hermit Data Loggers is an example of a standard hazardous material where only a designated outer shipping container may be used.

5.4 Holding Times

The holding times for samples will depend on the analysis and the sample matrix. Refer to the FSP for holding times requirements.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

All sample shipments must be documented in the field logbooks and/or field forms, including rationales deviations from this SOP. The Field Team Leader or designated QA reviewer will check and verify that handling and shipment documentation has been completed per this procedure and other procedures referenced herein.

7.0 DECONTAMINATION

All shipment coolers shall be maintained clean of sampled material to avoid exposure during shipment. Any investigation-derived waste generated in the sampling process shall be managed in accordance with the procedures outlined in SOP-12.

8.0 REFERENCES

Agency for Toxic Substances and Disease Registry. 2006. Asbestos Exposure and Your Health.

Enforcement Considerations for Evaluations of Uncontrolled Hazardous Waste Disposal Sites by Contractors, Draft, Appendix D, April 1980.

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Date: May 20, 2009 OU3 SOP 9 (Rev. 5)

Title: FIELD DOCUMENTATION

APPROVALS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Remedial Project Manager	/RPM	5/21/09
SOP Author	W S Brattin	5/22/09

Revision Number	Date	Reason for Revision
0	09/26/2007	--
1	10/5/2007	• Add section for "Corrections and Modifications" and Field Modification Approval form (Attachment 3) • Update Labeling section and COC (Attachment 2) to reflect non-asbestos analysis and container details • Update FSDS forms (Attachment 1) based on field team input
2	02/22/2008	• Incorporate changes to FSDS forms (Attachment 1) based on field input • Remove OU3 phase specificity in SOP text
3	05/29/2008	• Incorporate changes to FSDS forms (Attachment 1) based on field input
4	06/30/2008	• Update Attachment 1 with all OU3 FSDS forms (including those used in Phase I and Phase II) • Remove OU3 phase specificity in Attachments
5	05/20/2009	• Add FSDS form for ABS Personal Air • Add FSDS form for Small Mammal Tissue • Modified COC to change medium code to "A-Air" to accommodate both ambient and activity-based sampling (ABS) air samples • Added new media code for small mammal tissue "MT"

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) is a general guidance document for the required documentation to be completed by field personnel during field investigations. This SOP is based on MWH SOP-04, Field Documentation, Revision 1.0, March 2006, modified for use at the Libby Mine Site. Documentation in the form of field logbooks, reports, and forms shall be completed for every activity in the field. Records shall be maintained on a daily basis as the work progresses. All field documentation shall be accurate and legible because it is deliverable to the client as potentially a legal document.

2.0 HEALTH AND SAFETY WARNING

All personnel engaged in soil sampling must follow health and safety protocols described in the site health and safety plan. Asbestos fibers are thin and long fibers so small that they cannot be seen by the naked eye. Asbestos fibers are easily inhaled when disturbed and when embedded in the lung tissue can cause health problems. Significant exposure to asbestos increases the risk of lung cancer, mesothelioma, asbestosis (non-cancerous lung disease), and other respiratory diseases (ATSDR 2006). All personnel engaged in soil sampling must follow health and safety protocols described in the health and safety plan.

3.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often, additional personnel may be involved. Project team member information shall be included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

Project Manager: Selects project-specific field documentation with input from other key project staff.

Quality Control Manager: Overall management and responsibility for quality assurance and quality control (QA/QC). Selects QA/QC procedures for the sampling and analytical methods, performs project audits, and ensures that data quality objectives are fulfilled.

Field Team Leader (FTL) and/or Field Geologist, Hydrogeologist, or Engineer: Implements the sampling program, supervises other sampling personnel, and ensures compliance with SOPs and QA/QC requirements. Prepares daily logs of field activities.

Field Technician (or other designated personnel): Assists the FTL and/or field geologist, hydrogeologist, or engineer in the implementation of field tasks and field documentation.

Field Sample/Data Manager: Responsible for proper handling and shipping of all samples collected by the field crew, electronic data entry of field sample data sheet (FSDS) and chain-of-custody (COC) forms, and scanning/posting of field documentation PDFs (FSDS, COC, field logbooks, digital photographs) to a dedicated FTP site.

4.0 FIELD DOCUMENTATION PROCEDURES

Field documentation serves as the primary foundation for all field data collected that will be used to evaluate the project site. There are two main forms of field documentation – field logbooks and FSDS forms. All field documentation shall be accurate, legible and written in indelible black or blue ink. Absolutely no pencils or erasures shall be used. Incorrect entries in the FSDS forms or field logbooks will be corrected by crossing out the incorrect entry with one line, the individual making the correction will initial and date next to the correction.

4.1 Field Logbooks

The field logbook shall be a bound, weatherproof book with numbered pages, and shall serve primarily as a daily log of the activities carried out during the fieldwork. All entries shall be made in indelible black or blue ink. A field logbook shall be completed for each operation undertaken during the field tasks. To further assist in the organization of the field log books, the project name and the date shall be recorded on top of each page along with the significant

activity description (e.g., surface sample or soil boring number). All original field documentation shall be retained in the project files.

Skipped pages or blank sections at the end of a field log book page shall be crossed out with an "X" covering the entire page or blank section; "No Further Entries," initials, and date shall be written by the person crossing out the blank section or page. The responsible field team member shall write his/her signature, date, and time after the day's last entry.

Field activities vary from project to project; however, the concept and general information that shall be recorded are similar. The descriptions of field data documentation given below serve as an outline; individual activities may vary in documentation requirements. A detailed description of two basic example logbooks, suitable for documentation of field activities, is given below. These field logbooks include the FTL logbook and the field geologist/sampling team logbook.

FTL Logbook: The FTL's responsibilities include the general supervision, support, assistance, and coordination of the various field activities. As a result, a large portion of the FTL's day is spent rotating between operations in a supervisory mode. Records of the FTL's activities, as well as a summary of the field team(s) activities, shall be maintained in a logbook. The FTL's logbook shall be used to fill out daily/weekly reports and daily quality control reports (DQCRs), and therefore, shall contain all required information. Entries shall be preceded with time in military units for each observation. Items to be documented include:

- Record of tailgate meetings
- Personnel and subcontractors on job site and time spent on the site
- Field operations and personnel assigned to these activities
- Site visitors
- Log of FTL's activities: time spent supervising each operation and summary of daily operations as provided by field team members
- Problems encountered and related corrective actions
- Deviations from the sampling plan and reasons for the deviations
- Records of communications; discussions of job-related activities with the client, subcontractor, field team members, and project manager

- Information on addresses and contacts
- Record of invoices signed and other billing information
- Field observations

Field Geologist/Sampling Team Logbook: The field geologist or sampling team leader shall be responsible for recording the following information in a logbook:

- Health and Safety Activities
  - Calibration records for health and safety equipment (e.g., type of PID, calibration gas used, associated readings, noise dosimeters, etc.)
  - Personnel contamination prevention and decontamination procedures
  - Record of daily tailgate safety meetings
- Weather
- Calibration of field equipment
- Equipment decontamination procedures
- Personnel and subcontractors on job site and time spent on the site
- Station identifier
- Sampling activities
  - Sample location (sketch)
  - Equipment used
  - Names of samplers
  - Date and time of sample collection
  - Sample interval
  - Number of samples collected
  - Analyses to be performed on collected samples
- Disposal of contaminated wastes (e.g., PPE, paper towels, Visqueen, etc.)
- Field observations
- Problems encountered and corrective action taken
- Deviations from the sampling plan and reason for the deviations
- Site visitors

4.2 Field Sample Documentation

Sample Labels: A unique sample identification label shall be affixed to all sample containers. All samples will be labeled in a clear, precise way for proper identification in the field and for tracking in the laboratory. At the time of collection, each sample will be labeled with a unique 5-digit sequential identification (ID) number, referred to as the Index ID. The Index ID for all samples collected as part of OU3 sampling activities will have a two-character prefix specific to the sampling Phase (e.g., Phase 1 samples will have a "P1" prefix, P1-12345) as specified in the applicable SAP. Index ID labels will be ½ inch x 1 ¾ inch in size and pre-printed for use in the field. For each Index ID, multiple labels will be printed to allow for multiple containers of the same sample (i.e., for different analyses).

Index ID Label Example:

P1-12345

Each collection container will be labeled with a container label that enables the field team member to record the container-specific details, such as the method of sample preparation (e.g., filtered/unfiltered), method of preservation, and the analytical methods that will be requested. Container labels will be 2 inch x 4 inch in size and pre-printed for use in the field. Any container-specific information shall be written in indelible ink.

Container Label Example:

Date/Time:_____

Index ID:

Media (circle one): AQ SO A BK DB TC MT
For AQ, Filtered? (circle one): Yes No
Container: _____
Preservation: _____
Analyses: _____
_____

Media acronyms: AQ – aqueous media, SO – solid media, A – air,
BK – tree bark, DB – organic debris, TC – tree age core, MT – mammal tissue

After labels have been affixed to the sample container, the labels will be covered with clear packaging tape to ensure permanence during shipping.

Any unused Index ID labels should be crossed out to avoid the possibility of using unused labels for a different sample.

Field Sample Data Sheet (FSDS) Forms: Data regarding each sample collected as part of the OU3 sampling will be documented using Libby-specific FSDS forms (provided as Attachment 1). These FSDS forms are medium-specific and designed to facilitate data entry of station location, sample details, and field measurements needed for the OU3 investigation.

In the field, one field team member will be responsible for recording all sample details onto the appropriate FSDS form. At the time of sample labeling, one Index ID label will be affixed to the FSDS form in the appropriate field. All written entries on the FSDS form shall be accurate, legible and written in indelible black or blue ink.

Once the FSDS form is complete, written entries will be checked by a second field team member. These two field team members will initial the bottom of the FSDS form in the appropriate field to document who performed the written data entry and who performed the QC check of the FSDS form.

On a weekly basis (or more frequently as conditions permit), information from the hard copy FSDS form will be manually entered into a field-specific OU3 database using electronic data entry screens by the Field Sample/Data Manager. Once electronic data entry is complete, QC of all data entry will be completed by the FTL or their designate. The Field Sample/Data Manager and the FTL will initial in the appropriate field on the paper FSDS form to document who performed the data entry into the database and who performed the QC check.

4.3 Photologs

Photologs are often used in the field to document site conditions and sample location characteristics. While photographs may not always be required, they shall be used wherever

applicable to show existing site conditions at a particular time and stage of the investigation or related site activity. Photolog information shall include:

- station location identifier
- Index ID (if applicable)
- date and time of photo
- direction/orientation of the photo
- description of what the photo is intended to show

An engineer's scale or tape shall be included in any photographs where scale is necessary. Any wasted frames or images in a roll of film or sequence of digital images shall be so noted in the field logbook.

4.4 Chain-of-Custody Records

Custody Seals: Custody seals with the date and initials of the sampler will be used on each shipping container to ensure custody. The custody seal will be placed on opposites sides of the cooler across the seam of the lid and the cooler body. Alternatively, if the sample containers are all placed inside a liner bag within the cooler, the custody seal may be placed across the seal of the liner bag inside of the cooler.

Chain-of-Custody Forms: COC procedures allow for the tracking of possession and handling of individual samples from the time of field collection through to laboratory analysis. Documentation of custody is accomplished through a COC form that lists each sample and the individuals responsible for sample collection and shipment, sample preparation, and receipt by the analytical laboratory. The COC form also documents the analyses requested for each sample. Whenever a change of custody takes place, both parties will sign and date the COC form, with the relinquishing party retaining a copy of the form. The party that accepts custody will inspect the COC form and all accompanying documentation to ensure that the information is complete and accurate. Any discrepancies will be noted on the COC form. Shipping receipts shall be signed and filed as evidence of custody transfer between field sampler(s), courier, and laboratory.

Attachment 2 provides an example of the COC form that will be used for all samples collected as part of OU3 sampling. This form will be printed as a carbonless triplicate form to facilitate retention of COC copies by relinquishing parties. As seen, the COC form includes the following information:

- sample identifier (Index ID)
- date and time of collection
- method of sample preparation and preservation
- number of sample containers
- analyses requested
- shipping arrangements and airbill number, as applicable
- recipient laboratories
- signatures of parties relinquishing and receiving the sample

On a daily basis, the Field Sample/Data Manager will package samples for shipping, complete hard copy COC forms, and ship all samples as outlined in SOP No. 8. On a daily basis, information from the hard copy COC form necessary for sample tracking will be manually entered into a field-specific OU3 database using electronic data entry screens by the Field Sample/Data Manager. Once electronic data entry is complete, QC of all data entry will be completed by the FTL or their designate.

5.0 FIELD DATA TRANSMITTAL

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 daily. 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_20090831.pdf).

Electronic copies of all digital photographs will also be posted weekly (or more frequently as conditions permit) 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_20090831_12459.tif).

A copy of the field-specific OU3 database will be posted to the project-specific FTP site on a weekly basis (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_20090831.mdb).

6.0 CORRECTIONS AND MODIFICATIONS

6.1 Field Deviations and Modifications

It is recognized that deviations and modifications from the standard operating procedures may be necessary based on site conditions. Any requested field modifications will be submitted by Robert Marriam (Remedium Group, Inc. - W.R. Grace contractor) to Bonita Lavelle (EPA Region 8 - Remedial Project Manager) for review and approval. All modification requests will be recorded in a Field Modification Approval Form (see Attachment 3).

6.2 Corrections to Hard Copy Forms

If an error is identified on an FSDS or COC form prior to entry into the field-specific OU3 database, the information should be corrected on the hard copy form by crossing out the incorrect entry with one line, the individual making the correction will initial and date next to the correction. Data entry into the field-specific OU3 database and scanning/posting of the hard copy forms should proceed following the data entry procedures described above.

If an error is identified on an FSDS or COC form after entry into the field-specific OU3 database, the information should be corrected on the hard copy form by crossing out the incorrect entry with one line, the individual making the correction will initial and date next to the correction. The corrected form should be scanned and posted to the project-specific FTP site. File names for corrected FSDS forms will include the Index ID of the corrected sample to facilitate document organization (e.g., FSDS_C_P1-12345.pdf). File names for corrected COC

forms will include the COC ID of the corrected COC form to facilitate document organization (e.g., COC_C_OU3-36512.pdf). Necessary data corrections will be made to the master OU3 database by the database manager.

If changes are made to a COC form, the analytical laboratory should be provided with a corrected COC form.

7.0 REFERENCES

Agency for Toxic Substances and Disease Registry. 2006. Asbestos Exposure and Your Health.

RCRA Ground-Water Monitoring: Draft Technical Guidance, November 1992.

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ATTACHMENT 1

OU3 FIELD SAMPLE DATA SHEET (FSDS) FORMS

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Sheet No.: AA2-_____

LIBBY OU3 FIELD SAMPLE DATA SHEET (FSDS) rev2
STATIONARY AMBIENT AIR MONITOR

☐ Check box if GPS information has been recorded previously

Field Logbook No: _____ Page No: _____

Station ID: _____ Station Comments: _____

GPS Coordinate System: UTM Zone 11 North, NAD83 datum, meters

X coord: _____ Y coord: _____ Elevation: _____m

Sampling Team: _____ Sampler Initials: _____

Data Item	Cassette 1			Cassette 2			Cassette 3		
Index ID	*AFFIX LABEL HERE*			*AFFIX LABEL HERE*			*AFFIX LABEL HERE*		
Sample Height (ft)									
Location Description									
Field QC Type (circle)	FS-(field sample) FB-(field blank) FD-(field dup) For FD, Parent ID: _____			FS-(field sample) FB-(field blank) FD-(field dup) For FD, Parent ID: _____			FS-(field sample) FB-(field blank) FD-(field dup) For FD, Parent ID: _____		
Matrix Type	Outdoor			Outdoor			Outdoor		
Flow Meter Type	Rotameter			Rotameter			Rotameter		
Archive blank (circle)	Yes No			Yes No			Yes No		
Pump ID Number									
Flow Meter ID Number									
Start Date (mm/dd/yy)									
Start Time (hh:mm)									
Start Counter									
Daily Flow Check: Record time (hh:mm) and flow rate (L/min) in fields provided	Check1	Time	Flow	Check1	Time	Flow	Check1	Time	Flow
	Check2			Check2			Check2		
	Check3			Check3			Check3		
	Check4			Check4			Check4		
Stop Date (mm/dd/yy)									
Stop Time (hh:mm)									
Stop Counter									
Pump fault? (circle)	Yes No			Yes No			Yes No		
Stop Flow (L/min)									
Field Comments Cassette Lot Number: _____									
Entered By (Provide initials):				**Validated By (Provide initials):**					

For Data Entry Completion (Provide Initials)	Completed by:	QC by:

Sheet No.: FSB1- _____

LIBBY OU3 FIELD SAMPLE DATA SHEET (FSDS) rev2
FOREST SOIL AND TREE BARK

Field Logbook No: _____ Page No: _____

Station ID: _____ Sampling Date: _____

GPS Coordinate System: UTM Zone 11 North, NAD83 datum, meters

X coord: _____ Y coord: _____ Elevation: _____m

Sampling Team: _____ Sampler Initials: _____

Station Comments: _____

TREE BARK SAMPLES

Index ID:	**Field QC Type (circle one):** FS (field sample) FD (field duplicate) For FD, Parent ID: _____	**Sample Area (cm^2):** _____	**Tree Species:** _____ **Collection Height (ft):** _____ **Diameter* (in):** _____	**Age Core Collected? (circle one):** Y N
Index ID:	**Field QC Type (circle one):** FS (field sample) FD (field duplicate) For FD, Parent ID: _____	**Sample Area (cm^2):** _____		
Field Comments:				
Entered by (Provide initials):		**Validated by (Provide initials):**		

*Measured with "D-tape"

FOREST SOIL SAMPLES

Index ID:	**Field QC Type (circle one):** FS (field sample) FD (field duplicate) For FD, Parent ID: _____	**Bulk Soil Description** **Depth (in)** **Start:** _____ **End:** _____	**Sample Type:** Grab Composite **# of Comp.:** ___	**Organic Debris Collected? (circle one):** Y N
Index ID:	**Field QC Type (circle one):** FS (field sample) FD (field duplicate) For FD, Parent ID: _____	**Bulk Soil Description** **Depth (in)** **Start:** _____ **End:** _____	**Sample Type:** Grab Composite **# of Comp.:** ___	**Organic Debris Collected? (circle one):** Y N
Index ID:	**Field QC Type (circle one):** FS (field sample) FD (field duplicate) For FD, Parent ID: _____	**Bulk Soil Description** **Depth (in)** **Start:** _____ **End:** _____	**Sample Type:** Grab Composite **# of Comp.:** ___	**Organic Debris Collected? (circle one):** Y N
Field Comments:				
Entered by (Provide initials):		**Validated by (Provide initials):**		

For Data Entry Completion (Provide Initials)	Completed by	QC by

Sheet No.: GW2- _____

LIBBY OU3 FIELD SAMPLE DATA SHEET (FSDS) rev3
GROUNDWATER

☐ Check box if GPS information has been recorded previously

Field Logbook No: _____ Page No: _____

Station ID: _____ Station Alias:_____ Sampling Date: _____

GPS Coordinate System: UTM Zone 11 North, NAD83 datum, meters

X coord: _____ Y coord: _____ Elevation (meters): _____

Sampling Team: _____ Sampler Initials: _____

Station Comments: _____

Well: Measuring Point (MP) of Well: _____ MP Units: _____

Screened Interval (ft BGL): _____ Filter Pack Interval (ft BGL):_____

Casing Stickup (ft) _____ Sample Intake Depth (ft BMP): _____

Calibration:

☐ Daily Verification Weekly Date: _____

VOA Vial pH: _____ Other pH:_____

Purge Method:

☐ Dedicated Submersible (SP) ☐ Portable Bladder (BP) ☐ Peristalic (PP)

☐ Portable Submersible (SP) ☐ Dedicated Bailer (B) ☐ Grab (G)

☐ Dedicated Bladder (SP) ☐ Disposable Bailer (B) ☐ Other: _____

Multiplication Factors:

1" = 0.04 2" = 0.16

3" = 0.37 4" = 0.65

6" = 1.47

Purge:

Starting Water Level (ft BMP):_____ Total Depth (ft BGL): _____ Water Column Height (ft): _____

Casing Diameter (in ID): _____ Multiplication Factor: _____ Casing Volume (gal): _____ 2X: _____ 3X: _____ 4X: _____

Water Level (ft BMP) at End of Purge: _____ Total Depth (ft BMP) at End of Purge: _____

Time (hh:mm)	Temp. (°C)	pH	Spec. Cond. (mS/cm@25°C)	ORP (mV)	Diss. O_2 (mg/L)	Turbidity (NTU)	Vol. Evac. (gal)	Flow Rate (gal/min)	Comments
Final Parameters									

Data Item	**Sample 1**	**Sample 2**	**Sample 3**
Index ID	*AFFIX LABEL HERE*	*AFFIX LABEL HERE*	*AFFIX LABEL HERE*
Field QC Type (circle one):	FS SP FD MS MSD PE EB FB TB Parent ID: _____	FS SP FD MS MSD PE EB FB TB Parent ID: _____	FS SP FD MS MSD PE EB FB TB Parent ID: _____
Field Comments:			
Cooler:			
Entered by (Provide initials):		**Validated by (Provide initials):**	

Note:

FS	Field Sample	**SP**	Field Split Sample	**FD**	Field Duplicate Sample
TB	Trip Blank Sample	**MS**	Matrix Spike Sample	**MSD**	Matrix Spike Duplicate Sample
FB	Field Blank Sample	**EB**	Equipment Decon Blank Sample	**PE**	Performance Evaluation Sample

For Data Entry Completion (Provide Initials)	Completed by	QC by

Sheet No.: P3-_____

LIBBY OU3 FIELD SAMPLE DATA SHEET
ACTIVITY-BASED SAMPLING (ABS) PERSONAL AIR MONITOR

ABS Area: ABS-_____ **Sampling Date: _____** **Sampling Team:** MWH

Person #1 Name: _____ **Index ID:** *AFFIX LABEL HERE*

Person #2 Name: _____ **Index ID:** *AFFIX LABEL HERE*

Field Blank Index ID: *AFFIX LABEL HERE* **Cassette Lot Number: _____**

Field Logbook Number: _____ **Field Logbook Pages: _____**

ABS Activity	Activity Sample Time (hh:mm)		Rotometer Flow (L/min)			
			Person #1		Person #2	
	Start	Stop	Start	Stop	Start	Stop
ATV Riding						
Hiking						
Sawing/Stacking						
Raking/Digging						
Fire						

Person #1 Pump ID No.: _____ Rotometer ID No.: _____ GPS ID No.: _____
Person #2 Pump ID No.: _____ Rotometer ID No.: _____ GPS ID No.: _____

Field Comments:

Weather Description--

Other--

Field Data Entered by:		**Field Entries Checked by:**	

Database Entry:		*Database QC:*

Sheet No.: SM- _____

LIBBY OU3 FIELD SAMPLE DATA SHEET (FSDS) rev2
SOIL-LIKE MATERIALS

Field Logbook No: _____ Page No: _____

Station ID: _____ Sampling Date: _____

GPS Coordinate System: UTM Zone 11 North, NAD83 datum, meters

Sampling Team: _____ Sampler Initials: _____

Station Comments: _____

Data Item	**Sample 1**	**Sample 2**	**Sample 3**
Index ID	*AFFIX LABEL HERE*	*AFFIX LABEL HERE*	*AFFIX LABEL HERE*
Matrix (circle one):	Surface Soil Tailings Waste Rock Roadway Other _____	Surface Soil Tailings Waste Rock Roadway Other _____	Surface Soil Tailings Waste Rock Roadway Other _____
Sample Time (hh:mm)			
Sample Type (circle one):	Grab Composite # of Comp: _____	Grab Composite # of Comp: _____	Grab Composite # of Comp: _____
Sample Depth	Start Depth (in): _____ End Depth (in): _____	Start Depth (in): _____ End Depth (in): _____	Start Depth (in): _____ End Depth (in): _____
Field QC Type (circle one):	FS (field sample) FD (field duplicate) For FD, Parent ID: _____ TB (trip blank) Cooler:_____ PE (perf. eval.) ID:_____	FS (field sample) FD (field duplicate) For FD, Parent ID: _____ TB (trip blank) Cooler:_____ PE (perf. eval.) ID:_____	FS (field sample) FD (field duplicate) For FD, Parent ID: _____ TB (trip blank) Cooler:_____ PE (perf. eval.) ID:_____
Transect Start Location or Grab Sample Location	X coord:_____m Y coord:_____m Elevation:_____m	X coord:_____m Y coord:_____m Elevation:_____m	X coord:_____m Y coord:_____m Elevation:_____m
Transect End Location	X coord:_____m Y coord:_____m Elevation:_____m	X coord:_____m Y coord:_____m Elevation:_____m	X coord:_____m Y coord:_____m Elevation:_____m
Field Comments:			
Cooler:			
Entered by (Provide initials):		**Validated by (Provide initials):**	

For Data Entry Completion (Provide Initials)	Completed by	QC by

Sheet No.: *SWS-* _____
SED- _____

LIBBY OU3 FIELD SAMPLE DATA SHEET
SURFACE WATER AND SEDIMENT

Station ID: _____ **Sampling Date**: _____
Field Logbook ID: _____ **Logbook Page No**: _____
GPS Coordinate System: UTM Zone 11 North, NAD83 datum, meters
***For New Stations Only*:** **X coord:** _____ **Y coord:** _____ **Elev:** _____
Sampling Team: **MWH** **Samplers Initials:** _____

WATER QUALITY PARAMETERS (if applicable)

Time Measured (hh:mm)	Temp. (°C)	pH	Specific Conductance (mS/cm Auto-comp @ 25°C)	Diss. O_2 (mg/L)	ORP (mV)	Turbidity (NTU)

SAMPLE COLLECTION

Index ID	*AFFIX LABEL HERE*	**Sampling Time:**_____ **Sample Type: Field Sample** **Media : Surface Water Sediment**	**Sampling Method** (if applicable)**:** **Grab or Composite** **# of Composites:**_____ **Sampling Depth: Top (in)**_____ **Bot (in)**_____
Index ID	*AFFIX LABEL HERE*	**Sampling Time:**_____ **Sample Type: SP FD** **MS MSD PE** **FB TB EB** **Media : Surface Water Sediment**	**Sampling Method (if applicable):** **Grab or Composite** **# of Composites:**_____ **Sampling Depth: Top (in)**_____ **Bot (in)**_____
Index ID	*AFFIX LABEL HERE*	**Sampling Time:**_____ **Sample Type: SP FD** **MS MSD PE** **FB TB EB** **Media : Surface Water Sediment**	**Sampling Method (if applicable):** **Grab or Composite** **# of Composites:**_____ **Sampling Depth: Top (in)**_____ **Bot (in)**_____
Index ID	*AFFIX LABEL HERE*	**Sampling Time:**_____ **Sample Type: SP FD** **MS MSD PE** **FB TB EB** **Media : Surface Water Sediment**	**Sampling Method (if applicable):** **Grab or Composite** **# of Composites:**_____ **Sampling Depth: Top (in)**_____ **Bot (in)**_____

COMMENTS

Note:						
	FS	Field Sample	**SP**	Field Split Sample	**FD**	Field Duplicate Sample
	TB	Trip Blank Sample	**MS**	Matrix Spike Sample	**MSD**	Matrix Spike Duplicate Sample
	FB	Field Blank Sample	**EB**	Equipment Decon Blank Sample	**PE**	Performance Evaluation Sample

Field Data Entered by:		**Field Entries Checked by:**	

Database Entry:		*Database QC:*

Sheet No.: SM- _____

LIBBY OU3 FIELD SAMPLE DATA SHEET (FSDS)
SMALL MAMMAL TISSUE COLLECTION

Field Logbook ID: _____ **Logbook Page No**: _____

Necropsy Date: _____ **Personnel Initials**: _____

Small Mammal Field ID: **SM-**_____-_____-_____-_____ **Animal Weight (grams):** _____(w/o fetuses if pregnant)

*[**SM** - station ID - transect ID - trap# - animal#]*

General Necropsy Comments: _____

_____

_____

	TISSUE #1	TISSUE #2	TISSUE #3	TISSUE #4
Tissue Type (circle one):	TY AR ES ST SIN LIN LU EY CAR Other:_____	TY AR ES ST SIN LIN LU EY CAR Other:_____	TY AR ES ST SIN LIN LU EY CAR Other:_____	TY AR ES ST SIN LIN LU EY CAR Other:_____
Weight (mg):				
Index ID:	*Affix Label Here*	*Affix Label Here*	*Affix Label Here*	*Affix Label Here*
Field QC Type (circle one):	FS FD TB	FS FD TB	FS FD TB	FS FD TB
Tissue Comments:				

	TISSUE #5	TISSUE #6	TISSUE #7	TISSUE #8
Tissue Type (circle one):	TY AR ES ST SIN LIN LU EY CAR Other:_____	TY AR ES ST SIN LIN LU EY CAR Other:_____	TY AR ES ST SIN LIN LU EY CAR Other:_____	TY AR ES ST SIN LIN LU EY CAR Other:_____
Weight (mg):				
Index ID:	*Affix Label Here*	*Affix Label Here*	*Affix Label Here*	*Affix Label Here*
Field QC Type (circle one):	FS FD TB	FS FD TB	FS FD TB	FS FD TB
Tissue Comments:				

	TISSUE #9	TISSUE #10	TISSUE #11	TISSUE #12
Tissue Type (circle one):	TY AR ES ST SIN LIN LU EY CAR Other:_____	TY AR ES ST SIN LIN LU EY CAR Other:_____	TY AR ES ST SIN LIN LU EY CAR Other:_____	TY AR ES ST SIN LIN LU EY CAR Other:_____
Weight (mg):				
Index ID:	*Affix Label Here*	*Affix Label Here*	*Affix Label Here*	*Affix Label Here*
Field QC Type (circle one):	FS FD TB	FS FD TB	FS FD TB	FS FD TB
Tissue Comments:				

Tissue Type Descriptors: TY = thyroid; ARD = adrenal gland; ES = esophagus; SIN = small intestine; LIN = large intestine; LU = lung; EY = eyeball; CAR = carcass
Field QC Type Descriptors: FS = Field Sample; FD = Field Duplicate; TB = Tissue Blank

For Data Entry Completion (Provide Initials)	Completed by	QC by

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ATTACHMENT 2

OU3 CHAIN OF CUSTODY FORM

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LIBBY OU3 – CHAIN-OF-CUSTODY RECORD/REQUEST FOR ANALYSIS

COC No. _____

PAGE: _____ OF: _____

ENTERED BY (Signature): _____ PROJECT MANAGER: _____ DATE: _____

METHOD OF SHIPMENT: _____ CARRIER/WAYBILL NO.: _____ DESTINATION: _____

SAMPLES							ANALYSIS REQUEST																													
							Asbestos			Non-Asbestos (a)																										
Index ID	Date	Time	Media*	Air Volume (L) or Tree Bark Sample Area (cm^2)	Filtered	Archive	TEM-ISO 10312 (b,c)	PLM (d)		TAL Metals+Boron	Mercury	TOC	DOC	Paste pH	Fluoride	Chloride, Sulfate	Total Phosphorus	Cyanide	VPH	EPH	OPP Pesticides	Chlorinated Pesticides	Herbicides	PCBs	SVOCs	VOCs	TDS, TSS, Nitrite, Alkalinity	Ammonia, Nitrate, TKN	Orthophosphate	Radiochemistry	Radium, Uranium	Hardness			Age core (e)	Remarks

	TOTAL NUMBER OF CONTAINERS	LABORATORY COMMENTS/CONDITION OF SAMPLES	Cooler Temp:

RELINQUISHED BY:			DATE	TIME	RECEIVED BY:		
SIGNATURE	PRINTED NAME	COMPANY			SIGNATURE	PRINTED NAME	COMPANY

** Media: AQ - Aqueous SO – Solid A –Air BK – Tree Bark DB – Organic Debris (Duff) TC – Tree Age Core MT – Mammal Tissue*

Notes --

(a) Method, container, and preservation details are provided in the attached tables

(b) With Libby-specific modifications. See applicable O3 SAP for counting and stopping rules

(c) See applicable SAP for details on preparation methods.

(d) Preparation by ISSI-LIBBY-01 and analysis by SRC-LIBBY-01 (PLM-Grav) and SRC-LIBBY-03 (PLM-VE)

(e) In accordance with procedures in Phipps (1985).

DISTRIBUTION: PINK: Field Copy YELLOW: Laboratory Copy WHITE: Return to Originator

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ATTACHMENT 3

OU3 FIELD MODIFICATION APPROVAL FORM

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FIELD MODIFICATION APPROVAL FORM
LFM-OU3-_____
Libby OU3 Phase ___ Sampling & Analysis Plan

Requested by:_____ Date:_____

Description of Deviation:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

☐ EPA Region 8 has reviewed this field modification approves as proposed.

☐ EPA Region 8 has reviewed this field modification and approves with the following exceptions:

_____
_____
_____
_____
_____
_____
_____

☐ EPA Region 8 has reviewed this field modification and does not agree with the proposed approach for the following reasons:

_____
_____
_____
_____
_____
_____

_____ _____
Bonita Lavelle, EPA RPM Date

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Libby Superfund Site Operable Unit 3 Standard Operating Procedure

Date: September 26, 2007 OU3 SOP 12 (Rev. 0)

Title: INVESTIGATION DERIVED WASTE (IDW) MANAGEMENT

APPROVALS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Remedial Project Manager		9/26/07
SOP Author		9/26/07

Revision Number	Date	Reason for Revision
0	09/26/2007	--

1.0 INTRODUCTION

This SOP is based on MWH SOP-07, Investigation-Derived Waste (IDW) Management, Revision 1.0, April 2007, modified for use at the Libby Asbestos Superfund Site OU3. IDW may be generated during field investigations at the Libby Asbestos Superfund Site OU3. The National Contingency Plan (NCP), codified in 40 Code of Federal Regulations (CFR) 300, requires that IDW be handled to attain all the applicable or relevant and appropriate requirements (ARARs) to the extent practicable, considering the urgency of the situation. The purpose of this SOP is to present procedures to be followed in the management of IDW generated during the field investigations.

Typical IDW generated during field activities are solid wastes and may include (but are not limited to) the following media and waste types:

Fluids	Solids
Purge water and groundwater	Soils and soil cuttings
Drilling mud	Plastic tarps or sheeting
Grout	Drill pipe and well casing/screen
Decontamination fluids and wastewater	Decontamination solids
	Disposable equipment (i.e., rope, bailers, sampling equipment, & other consumables)
	Spent personal protective equipment (PPE)
	Used containers, sample bottles
	Packaging materials

The above wastes may or may not be encountered, generated or managed while performing field investigations. However, all solid waste streams will be characterized to determine if they are hazardous wastes per 40 CFR § 262.11 for the purposes of handling and disposal. Guidance from this document shall be used as part of project planning to estimate total volumes of IDW likely to be generated as well as how the IDW will be managed and disposed.

2.0 HEALTH AND SAFETY WARNING

All personnel engaged in IDW handling must follow health and safety protocols described in the health and safety plan. Asbestos fibers are thin and long fibers so small that they cannot be seen by the naked eye. Asbestos fibers are easily inhaled when disturbed and when embedded in the lung tissue can cause health problems. Significant exposure to asbestos increases the risk of lung cancer, mesothelioma, asbestosis (non-cancerous lung disease), and other respiratory diseases (ATSDR 2006).

3.0 DEFINITIONS

Area of Contamination (AOC) unit: The AOC unit concept is critical to the IDW management at a CERCLA investigation site. Although EPA has not promulgated a definition of an AOC unit, an AOC unit is generally an area within a CERCLA investigation site with similar characteristics with respect to contamination and the associated risks to human health and the environment. A CERCLA investigation site may contain one or more AOC units.

Decontamination fluids: Any fluids, including aqueous wash water, solvents, and contaminants that are used or generated during decontamination procedures.

Decontamination solids: Any solids, including soils and soil cuttings, fill materials, and contaminants that are generated during decontamination procedures.

Grout: A fluid mixture of cement and water (neat cement) of a consistency that can be forced through a pipe and placed as required.

Hazardous waste: A solid waste that meets the definition of a hazardous waste under RCRA as defined in 40 CFR § 261.3.

Investigation-derived waste (IDW): Solid wastes, as defined in 40 CFR § 261.2, directly generated as result of performing the field activities.

Nonhazardous waste: A solid waste that does not meet the definition of a hazardous waste as defined in 40 CFR § 261.3 or is excluded from hazardous waste regulation per 40 CFR § 261.4(b).

Soils and soil cuttings: Solid material generated from excavation or drilling processes. Soils may include native soils, fill materials, and/or other historical plant waste streams used as fill materials on the site.

Solid waste: Any waste stream (solid, liquid or containerized gas) that meets the definition of solid waste under RCRA as defined in 40 CFR § 261.2**.**

4.0 RESPONSIBILITIES

This section presents a brief definition of the field team roles and responsibilities for management of IDW generated while conducting field investigations. This list is not intended to be a comprehensive list as additional personnel may be involved. Project team member information shall be included in project-specific plans (e.g., work plan, field sampling plan (FSP), quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

Project Manager: Responsible to ensure that all field team members are properly trained per their responsibilities associated with IDW and that appropriate equipment and facilities are available for appropriate IDW management.

Field Team Leader (FTL): Implements the field program and supervises all field team members in the appropriate management of IDW. Ensures that only properly trained personnel are managing IDW on the site.

Environmental, Health and Safety (EHS) Officer: Assists the Team Leader in the supervision of all IDW management on site. The EHS officer shall be responsible for all IDW identification

and characterization, on site disposal, off site shipment and disposal, waste accumulation, emergency response and contingency planning, IDW training, and IDW reporting and recordkeeping.

Project Team Members: Ensure that they are properly trained prior to any IDW management as well as follow the appropriate IDW procedures and training.

5.0 REGULATORY BASIS AND GUIDANCE

IDW encountered, generated, or managed during the field investigations may contain hazardous substances as defined by CERCLA. Some IDW may be hazardous wastes under RCRA while others may be regulated under other federal laws such as TSCA. These regulatory requirements may be applicable or relevant and appropriate requirements (ARARs) which impact how the IDW is managed.

5.1 EPA Guidance on IDW Management

The management of IDW shall be in accordance with EPA Guidance "Management of Investigation-Derived Wastes During Site Inspections", May 1991 (EPA, 1991). The specific elements of EPA's guidance for IDW management are as follows:

- Characterizing IDW through the use of existing information (manifests, MSDSs, previous test results, knowledge of the waste generation process, and other relevant records) and best professional judgement.

- Delineating an AOC unit for leaving RCRA hazardous soil cuttings within the unit.

- Containerizing and disposing of RCRA hazardous groundwater, decontamination fluids, PPE, and disposable equipment at RCRA Subtitle C facilities.

- Leaving on-site RCRA nonhazardous soil cuttings, groundwater, and decontamination fluids preferably without containerization and testing.

In general, EPA does not recommend removal of wastes from sites, in particular, from those sites where IDW do not pose any immediate threat to human health or the environment. Actions taken during field investigations with respect to IDW that leave conditions essentially unchanged should not require a detailed analysis of ARARs or assurance that conditions at the site after field investigations will comply with the ARARs. At the same time, field personnel ensure that their handling of IDW does not create additional hazards at the site.

In brief, compliance with the NCP can generally be assured by:

1) Identifying contaminants, if any, present in the IDW based upon existing information and best professional judgement; testing is not required in most circumstances.

2) Determining ARARs and the extent to which it is practicable to comply with them.

3) Delineating an AOC unit based upon existing information and visual observation if soil cuttings are RCRA hazardous.

4) Burying RCRA hazardous soil cuttings within the AOC unit, so long as no increased hazard to human health and the environment will be created. Containerization and testing are not required.

5) Containerizing RCRA hazardous groundwater and other RCRA hazardous IDW such as PPE, disposable sampling equipment, and decontamination fluids for off-site disposal.

5.2 Hazardous Waste Regulation

The RCRA hazardous waste regulations are clearly ARARs for hazardous IDW generated and managed during field investigations. However, with the application of EPA IDW guidance, RCRA requirements apply to management of IDW in the following manner:

- If RCRA hazardous IDW is stored or disposed off-site, then comply with all RCRA (and other ARAR) requirements.

- If RCRA hazardous IDW is stored on-site, then comply with RCRA (and other ARAR) requirements to the extent practicable.

For these field investigations, the following general guidance is expected to be practicable and therefore followed, recognizing that each situation will be evaluated against EPA IDW guidance (EPA, 1991) as well as RCRA hazardous waste requirements and other ARARs:

- IDW may be assumed not to be a "listed" hazardous waste under RCRA 40 CFR 261 Subpart D, unless available information about the site suggests otherwise.

- IDW characterization to determine if the IDW exhibits RCRA hazardous waste characteristics do not typically require testing if the characterization can be made by "applying knowledge of the hazardous characteristics in light of the materials or processes used" or by historical testing consistent with 40 CFR § 262.11(c).

- Compliance with the RCRA hazardous waste generator requirements of 40 CFR Part 262 for all RCRA hazardous IDW generated and/or managed (with exception of soil cuttings managed in accordance with the EPA IDW guidance). It is presumed that the RCRA hazardous IDW generated will fall within the large quantity generator (LQG) requirements.

- Land disposal does <u>not</u> occur (and thus the Land Disposal Restrictions [LDR] of 40 CFR Part 268 are <u>not</u> applicable) when IDW soil cutting wastes are:

  - Moved, stored or left in place within a single AOC unit;
  - Capped in place;
  - Treated in situ (without moving the IDW to another AOC unit for treatment); or
  - Processed within the AOC unit to improve structural stability (without placing the IDW into another AOC unit for processing).

- Conversely, land disposal does occur (and the LDR of 40 CFR Part 268 are applicable) when IDW soil cutting wastes are:

  - Moved from one AOC unit to another AOC unit for disposal;
  - Moved outside an AOC unit for treatment or storage and returned to the same AOC unit for disposal;
  - Excavated from an AOC unit and placed in a container, tank, surface impoundment, etc. and then re-deposited back into the same AOC.

5.3 TSCA PCB Regulation

IDW containing PCBs at detectable levels may be generated, although the concentration of PCBs in any IDW generated is expected to be far below 50 ppm. However, IDW generated will be evaluated for PCBs and managed according to the following per the requirements of 40 CFR Part 761 Subpart D:

- Liquid IDW at concentrations greater than or equal to 50 ppm PCBs will be incinerated off-site at a TSCA-approved incinerator site.

- Nonliquid IDW at concentration greater than or equal to 50 ppm PCBs may be incinerated, treated by an equivalent TSCA-approved method, or disposed in a TSCA chemical landfill off-site.

- IDW at concentrations less than 50 ppm are generally not regulated under TSCA, and may be disposed in an acceptable Subtitle D facility.

6.0 DESCRIPTION OF ANTICIPATED IDW MANAGEMENT

The following subsections provide a description of the anticipated IDW to be encountered, generated, and/or managed at the Libby Asbestos Superfund Site OU3 during field activities and the anticipated management of each. It should be noted that this information is provided for planning purposes, and will be evaluated and may need to be revised based upon actual experience while on site.

6.1 Soil and Soil Cuttings

During field investigations, surface soil samples, samples of mine waste rock, and samples of fine tailings will be collected. Only a small portion of material will be collected for analysis. While the soil and soil cuttings IDW generated will be evaluated on a case-by-case basis, the general approach will follow the EPA guidance for IDW (EPA, 1991) which includes:

- Characterizing the IDW through the use of existing information (previous test results, previous waste characterization, knowledge of the waste generation process, and other relevant records) and best professional judgement.

- Soil and soil cuttings which are not used directly for sample makeup will not be taken outside of the AOC unit in which they were generated.

- Soil and soil cuttings within the AOC where they are generated will be placed back into the same investigation pit, trench, or bore hole and in the same order from which the material was removed, to the extent practicable and unless noted otherwise in the FSP.

- Soil cuttings potentially requiring RCRA disposal will be handled per the procedures presented in Section 7.0 below and disposed in an off-site RCRA facility.

6.2 Spent Sampling-Related Equipment

During field investigations, spent sampling-related equipment will be generated. This may include (but not limited to) plastic sheeting/tarps, rope, bailers, sampling equipment, spent PPE, sample bottles, used containers, packaging materials, and other consumables. Although the vast majority of the spent sampling-related equipment is expected to be nonhazardous, these IDW may contain a listed hazardous waste (e.g., spent solvents) or may exhibit a hazardous waste characteristic (e.g., toxicity from metals).

While the spent sampling-related equipment will be evaluated on a case-by-case basis, the general approach to be followed for spent sampling-related equipment IDW will follow the EPA guidance for IDW (EPA, 1991) which includes:

- Containerizing the spent sampling-related equipment, typically in a satellite accumulation station.

- Characterizing the spent sampling-related equipment IDW through the use of existing information (previous test results, previous waste characterization, knowledge of the contaminants present, and other relevant records) and best professional judgement. This characterization will be documented and maintained as part of the solid/hazardous waste determination records.

- Those spent sampling-related equipment IDW that are determined to be nonhazardous will be disposed of onsite or as municipal waste.

- Those spent sampling-related equipment IDW that are determined to be hazardous will be managed per the procedures presented in Section 7.0 below and disposed in an off-site RCRA facility.

6.3 Decontamination Fluids and Solids

During field investigations, decontamination fluids and solids will be generated. Typically, these will be generated at a common decon area, although there may be more than one decon

area. Typically, the decontamination IDW will include (but not limited to) washwater from vehicles/equipment, and cleaning agents. Although the vast majority of decontamination IDW is expected to be nonhazardous, this IDW may contain a listed hazardous waste (e.g., spent solvents) or may exhibit a hazardous waste characteristic (e.g., toxicity from metals).

While the decontamination IDW will be evaluated on a case-by-case basis, the general approach to be followed for decontamination IDW will follow the EPA guidance for IDW (EPA, 1991) which includes:

- Containment of decontamination fluids (typically washwater) as generated. The washwater will be segregated from solids to the extent practicable (i.e., solids will be allowed to settle out of the washwater on the decontamination containment pad). Washwater will then be containerized to await waste determination. Solids will also be containerized in a separate container to await waste determination.

- Other decontamination solids such as cleaning utensils and PPE will also be containerized to await waste determination.

- Characterizing the decontamination IDW through the use of existing information (previous test results, previous waste characterization, knowledge of the contaminants present, and other relevant records) and best professional judgement. This characterization will be documented and maintained as part of the solid/hazardous waste determination records.

- The decontamination solids IDW that are determined to be nonhazardous will be disposed of onsite.

- The decontamination liquids IDW that are determined to be nonhazardous will be disposed as a nonhazardous solid waste, preferably on-site.

- The decontamination IDW (either liquid or solid) that are determined to be hazardous will be managed per the procedures presented in Section 7.0 below and disposed in an off-site RCRA facility.

6.4 Drilling, Well Purging, and Development Water

Generally, water at the Site that is extracted from boreholes, wells or piezometers for the purpose of drilling, development, sampling, or hydraulic testing is considered non-hazardous and will be discharged to designated shallow sumps away from the boreholes or wells at the site. If the water generated is determined to be hazardous will be managed per the procedures presented in Section 7.0 below and disposed in an off-site RCRA facility.

7.0 PROCEDURES FOR HAZARDOUS IDW MANAGEMENT

The following procedures apply to all IDW that have been determined to be hazardous except for soil cuttings IDW that remain with the AOC unit.

7.1 Introduction

Once an IDW has been determined to be hazardous, the federal RCRA Subtitle C waste management requirements apply to that waste. The scope of this procedure covers the requirements for large quantity generators (LQG) of hazardous IDW which manage the hazardous IDW on site such that RCRA permitting is not required.

7.2 Determine Land Disposal Restrictions

The 1984 amendments to the RCRA law included a prohibition of land disposal of certain hazardous wastes without first meeting some treatment standards. For the most part, all listed and characteristic hazardous wastes must be treated according to the treatment levels and technologies outlined in 40 CFR Part 268 to reduce the toxicity and/or mobility of hazardous constituents prior to being disposed of on the land, i.e., landfilled. Therefore, a generator must

determine if the waste is a "restricted waste" under the land ban rules, and if so, off site treatment and disposal is limited. Note that these rules apply only to wastes destined for land disposal which is defined as: placement in or on the land including a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, underground mine or cave, or concrete vault or bunker. Wastes which are shipped off site for disposal other than land disposal are not regulated under the land disposal restriction regulations of 40 CFR Part 268.

Generators of hazardous wastes must determine if the waste is restricted from land disposal under 40 CFR Part 268. The following reporting and recordkeeping requirements apply.

- If a generator determines that he is managing a restricted waste and the waste does not meet the applicable treatment standards, with each shipment of waste, the generator must notify the treatment or storage facility in writing of the appropriate treatment standards;
- If the generator determines that he is managing a restricted waste and the waste can be disposed without further treatment, with each shipment of waste, the generator must submit to the treatment, storage or disposal facility a notice and certification stating that the waste meets the applicable treatment standards;
- If the generator determines that he is managing a waste subject to an exemption from a prohibition on the type of land disposal method utilized for the waste, with each shipment of waste, the generator must submit to the receiving facility a notice stating that the waste is not prohibited from land disposal;
- If the generator is managing prohibited waste in tanks, containers, or containment buildings regulated under 40 CFR 262.34, and is treating such waste in such tanks, containers, or containment buildings to meet applicable treatment standards, the generator must develop a waste analysis plan which describes the procedures the generator will carry out to comply with the treatment standards; and

- If the generator determines whether the waste is restricted based solely on his knowledge of the waste, all supporting data used to make this determination must be retained on-site in the generator's files.

The generator must retain on-site a copy of all notices, certifications, demonstrations, waste analysis data, and other documentation produced pursuant to these requirements for at least three years from the date the waste was last shipped from the site. It should also be noted that it is prohibited to dilute a hazardous waste in order to circumvent the land disposal prohibitions (40 CFR 268.3). Once a waste is determined to be a "restricted waste", an appropriate Treatment, Storage, and Disposal Facility (TSDF) can be selected to properly treat and dispose of the waste.

7.3 On-Site Accumulation

As discussed in Section 5.0 above for each IDW generated, a large quantity generator (LQG) must make the appropriate hazardous waste determination per 40 CFR Part 262.11. If the IDW is determined to be hazardous, then the IDW will typically be stored on-site prior to shipment off-site for disposal. The following requirements apply to all hazardous IDW being stored on-site prior to shipment.

7.3.1 EPA Identification Number (40 CFR Part 262.12)

Any facility which is a LQG of hazardous wastes must not treat, store, dispose, transport or offer for transportation any hazardous waste without first obtaining a EPA identification number from EPA (or the authorized state). Hazardous wastes cannot be offered to transporters or to treatment, storage or disposal facilities that have not received a EPA identification number.

7.3.2 On-Site Hazardous Waste Accumulation (Storage) (40 CFR 262.34(d))

Two types of accumulation areas for hazardous waste are permissible for a LQG without RCRA interim status or a Part B permit. These are the "90-day storage area" and the "satellite accumulation station" (SAS). The SAS requirements are discussed below. With regards to a

"90-day storage area", a LQG may store hazardous wastes on-site for up to 90 days or less in a storage area, provided that the following conditions are met:

- If the waste is placed in containers, the requirements of 40 CFR Part 265 Subpart I (container requirements) are met. See below for container requirements;
- If the waste is placed in tanks, the requirements of 40 CFR 265 Subpart J (tank requirements) are met. See below for the tank requirements.
- At closure, the generator closes the storage area per the requirements of 40 CFR 265.111 and 40 CFR 265.114;
- The date which the hazardous waste is placed in the storage area is clearly marked on the container, and the container is clearly marked as "Hazardous Waste";
- The facility complies with 40 CFR Part 265 Subpart C, Preparedness and Prevention (See Section 6.3.3 below);
- The facility complies with 40 CFR Part 265 Subpart D, Contingency Plan and Emergency Procedures (See Section 6.3.4);
- The facility complies with 40 CFR Part 265.16 training requirements (See Section 6.6 below);
- Any hazardous wastes which are stored longer than 90 days must first be granted an extension by EPA (or authorized state).

90-Day Storage Area Container Requirements (40 CFR Part 265 Subpart I)

Hazardous waste stored in containers must meet the following requirements:

- Containers must be in good condition, free of leaks;
- Hazardous wastes must be compatible with container (or liner) material;
- Containers must always be kept closed except to add or remove wastes;

- Containers must be handled in a manner to avoid ruptures;
- The storage area must be inspected at least weekly to check for container deterioration; and
- Incompatible wastes must be stored separately with separate secondary containment.

Incompatible wastes are wastes that are unsuitable for co-mingling because the co-mingling could result in any of the following:

- Extreme heat or pressure generation;
- Fire;
- Explosion or violent reaction;
- Formation of substances that have the potential to react violently;
- Formation of toxic dusts, mists, fumes, gases, or other chemicals; and/or
- Volatization of ignitable or toxic chemicals due to heat generation.

90-Day Storage Area Tank Requirements (40 CFR Subpart J)

LQGs that accumulate or store hazardous wastes in tanks or tank systems must meet the following requirements:

- For tanks existing prior to July 14, 1986, an assessment of tank must be performed and certified by an independent, qualified, licensed engineer. The written certification must be kept on file at the facility (40 CFR 265.191);
- New tank systems (those built after July 14, 1986) must meet tank technical standards and have been certified by an independent, qualified, licensed engineer. The written certification must be kept on file at the facility (40 CFR 265.192);

- New tank systems must have adequate secondary containment and leak detection systems. Existing tanks must be upgraded to meet these standards by the time the tank is 15 years of age (40 CFR 265.193);
- Tanks must be operated to prevent system failure, overflow and spills. Tanks must be operated with sufficient freeboard to prevent overtopping (40 CFR 265.194);
- Inspect the tanks at least once each operating day for the following:
  - Discharge control equipment;
  - Monitoring equipment and controls;
  - Tank level; and
  - Evidence of leaks or spills. (40 CFR 265.195)
- Inspect the tanks at least weekly for corrosion, erosion or leaks;
  - The tank must meet the closure and post-closure care provisions of 40 CFR 265.197; and
  - Store incompatible wastes separately (40 CFR 265.199).

Satellite Accumulation Station (SAS) Requirements (40 CFR 262.34(c))

A SAS is a container placed at or near the point of waste generation for the purpose of collecting the waste as it is being generated. For example, a container may be placed in the quality control laboratory for collection of hazardous wastes generated in the laboratory. This SAS may collect up to 55 gallons of hazardous waste or 1 quart of acute hazardous waste. The SAS does not need to meet the requirements of a storage area, provided the following conditions are met:

- The amount of hazardous waste accumulated at the SAS does not exceed 55 gallons (or 1 quart of acute hazardous waste);

- The SAS is located at or near the point of generation where the waste is initially accumulated and is under the control of the operator of the process generating the waste;
- The container used is in good condition, is compatible with the wastes being accumulated, and is kept closed except to add or remove wastes;
- The container is marked with the words "Hazardous Waste" or other words to identify the contents; and
- Once the 55-gallon limit is reached, the date is marked on the container and the container is moved from the SAS within three days to a proper location. For example, the wastes must either be moved to the storage area or be picked up by a waste transporter and moved off-site.

7.3.3 Preparedness and Prevention (40 CFR Part 265 Subpart C)

The following preparedness and prevention steps must be taken concerning the hazardous waste storage area:

- The storage area must be operated and maintained to minimize the possibility of fire, explosions or releases of hazardous waste;
- The facility must have appropriate communication systems, fire-fighting equipment, spill control equipment and decontamination equipment;
- All emergency response systems and equipment must be tested monthly with documentation and maintained to assure proper operation;
- Persons handling hazardous wastes must have immediate access to alarms and/or communication systems;
- The storage area shall have adequate aisle space for emergency response activities; and

- The facility must attempt to make arrangements with the local police, fire departments, emergency response teams, and local hospitals to assure readiness for potential emergencies associated with the storage area.

7.3.4 Contingency Plan and Emergency Procedures (40 CFR Subpart D)

A LQG that accumulates or stores hazardous waste on site in a 90-day storage area must develop and keep current a contingency plan for the facility. The purpose of the contingency plan is to provide an organized plan of action and delegation of responsibilities and authority to specific facility personnel to respond to emergency situations that may require both the facility and/or outside resources. The contingency plan is designed to minimize hazards to humans or the environment from fires, explosion or any unplanned sudden or non-sudden release of hazardous waste/hazardous waste constituent to air, soil or surface water in compliance with the requirements of 40 CFR 265 Subpart D. A Contingency Plan will be maintained on the site if hazardous IDW are accumulated on-site.

The key components of the contingency plan include the following (40 CFR 265.52):

- A description of the emergency response organization, including designation of the Emergency Coordinator and alternates;
- Response procedures;
- Emergency notification;
- Arrangements with local authorities;
- List of names, addresses and phone numbers of designated emergency personnel and alternates;
- List of emergency response communication equipment and locations;
- Evacuation procedures, routes and alternates; and
- Procedures for amending the plan.

Copies of the plan must be sent to (40 CFR 265.53):

- The Project Manager;
- Lincoln County Sheriff's department;
- Libby fire department; and
- Other agencies as deemed appropriate.

The emergency coordinator (EC) is the key person facilitating emergency preparedness and response. The EC or designated alternate shall be on-site or on-call at all times. The EC and alternates must be trained and thoroughly familiar with the contingency plan, emergency response activities and operation of the facility. The EC must know the locations and characteristics of all waste generated, location of all records within the facility and the facility layout. The EC must have the authority to commit the resources needed to carry out the spill response plan. Any person or department who first discovers any spill of a hazardous waste/material is responsible for notifying the spill response/emergency response coordinator. The EC for the Libby Mine Site field investigations will be the EHS Officer with the Field Team Leader and the Project Manager as alternates.

The contingency plan should be reviewed and immediately amended when:

- Changes in applicable regulations occur;
- The plan fails in an emergency;
- Changes are made to emergency procedures;
- Changes occur in emergency personnel list; or
- Changes occur in emergency equipment list.

7.4 Pre-Transportation Requirements

Prior to transporting hazardous wastes or offering hazardous wastes for transportation off-site, the generator must comply with the following:

- Package the hazardous wastes in DOT-approved containers per 49 CFR Parts 173, 178 and 179. DOT-approved containers (such as drums) are usually marked as being DOT-approved);
- Label the hazardous wastes according to DOT labeling requirements per 49 CFR Part 172;
- Mark each container (of 110 gallons or less) used in transportation with the following:

  HAZARDOUS WASTE - Federal Law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority or the EPA.

  - Generator's Name and Address
  - Manifest Document Number
- Ensure that the initial transporter placards the transport vehicle with the appropriate placard in accordance with 49 CFR Part 172 Subpart F.

7.5 Manifesting Off-Site Shipments of Hazardous IDW

Any generator which transports or offers for transportation hazardous waste for off-site treatment, storage or disposal must prepare a manifest according to manifest instructions for each shipment of similar hazardous wastes. The manifest must be carefully filled out with each shipment. Take care to follow the instructions and use the terms as listed in the instructions. A generator must designate on the manifest one facility (designated facility) which is permitted to handle the waste described on the manifest (40 CFR 262.20).

The generator must determine if the state to which the wastes are destined (consignment state) requires use of its own manifest. If so, then the consignment state's manifest must be used. If the consignment state does not require use of its manifest, and the state in which the waste

shipment originates (generator state) does, then the manifest from the generator state must be used. If both states have manifests, use the consignment state manifest, making sure that there are sufficient copies to meet the generator state distribution requirements. If neither state requires use of its manifest, then any uniform hazardous waste manifest may be used (40 CFR 262.21).

The manifest must contain at least enough copies such that the generator gets two copies, the transporter gets one copy and the designated facility gets one copy. Some states require additional copies to be sent to the state. At the time of shipment, the generator must keep one copy (the generator copy) of the completed, signed manifest and give the remaining copies to the transporter. Each copy must have the signature of the generator and the transporter at the time of shipment. The original manifest shall be returned to the generator once the shipment reaches the designated facility and the manifest is signed by the designated facility (40 CFR 262.21).

If the original, signed manifest is not received by the generator within a certain number of days, action by the generator is required. These requirements are discussed in the following sections:

- If, after 35 days from the date of shipment, the original manifest copy is not yet received by the LQG, the LQG must contact the transporter and/or the designated disposal facility to determine the status of the hazardous waste (40 CFR 262.42(a)(1)).
- If after 45 days from the date of shipment, the original manifest copy is not yet received by the LQG, the LQG must submit an exception report to the U.S. EPA (or authorized state). The exception report must include a copy of the manifest along with an explanation of efforts to locate the hazardous wastes and the result of these efforts (40 CFR 262.42(a)(2)).

7.6 Personnel Training

Any person, and their immediate supervisor(s), involved in waste management at a LQG facility which stores hazardous waste in a 90-day storage area must undergo initial and annual training

for hazardous waste management (40 CFR 262.34(a)(4) and 40 CFR 265.16). Facility personnel are required to successfully complete a program of classroom instruction or on-the-job training that teaches them to perform hazardous waste management duties relevant to their jobs. The program must be directed by a person trained in hazardous waste management procedures.

The training must be designed to enable personnel to effectively respond to emergencies by becoming familiar with emergency procedures, emergency equipment and emergency systems, including the following;

- Procedures for using, inspecting, repairing and replacing facility emergency and monitoring equipment;
- Communications or alarm systems;
- Response to fires or explosions; and
- Off-site communication.

Employee training is to be held at regular intervals. Emergency planning information, e.g., the Contingency Plan, also should be provided to state and local emergency response agencies at regular intervals (40 CFR 265.37 and 265.53). Employees required to receive the training cannot work unsupervised until they have completed the training requirements (either classroom or on-the-job training). In addition, facility personnel must take part in an annual review of the initial training.

The following records must be maintained at the facility for employees affected by this training:

- Job title for each position and name of employee filling each job;
- Job descriptions for each position related to hazardous waste management;
- Written description of type and amount of initial and continuing training that will be given to each person filling the various job positions; and

- Documentation that necessary training has been given and completed by each affected personnel.

Training records are required to be kept on current personnel until closure of the facility. For former employees, training records must be kept for at least three years from the date the employee last worked at the facility and may be transferred if the employee stays within the same company (40 CFR 265.16(e).

7.7 Reporting and Recordkeeping

The following reports are required of a LQG:

- Manifest exception reports as discussed in Section 6.5 above.
- A LQG must submit a Biennial Report to the EPA (or authorized state) every even numbered year by March 1, e.g., March 1, 2008 for the 2007 reporting year. The Biennial Report is to be submitted on EPA form 8700-13A.

The following records are required to be kept for a minimum of three years by the LQG:

- The signed original manifests;
- Biennial reports;
- Exception reports;
- All records pertaining to hazardous waste determinations; and
- Land disposal determination records, notification and certification records.

8.0 QUALITY ASSURANCE AND QUALITY CONTROL

All IDW data must be documented in the field logbooks, field forms, manifests, including rationales deviations from this SOP. The Field Team Leader or designated QA reviewer will

check and verify that IDW documentation has been completed per this procedure and other procedures referenced herein.

9.0 REFERENCES

Agency for Toxic Substances and Disease Registry. 2006. Asbestos Exposure and Your Health.

EPA, 1991. Management of Investigation-Derived Wastes During Site Inspections, EPA May 1991, EPA/540/G-91/009

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Date: May 27, 2008 OU3 FISH-LIBBY(Rev. 0)

Title: FISH SAMPLING

APPROVALS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Remedial Project Manager	/ RPM	9/16/08
SOP Author		9/16/08

Revision Number	Date	Reason for Revision
0	05/27/2008	--
1		

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the protocols to be followed when fish are collected for biological surveys, chemical analysis of tissues and/or histopathological examination. The procedures presented herein apply to fish sampling from surface waters, wetlands, ponds, drainage structures, etc.

This document focuses on methods and equipment that are readily available and typically applied in collecting fish samples. It is not intended to provide an all-inclusive discussion of fish collection methods. Specific sampling problems may require the adaptation of existing equipment or design of new equipment. Such innovations shall be clearly described in the project-specific sampling plan and approved by the Project Manager and the Quality Manager.

2.0 HEALTH AND SAFETY WARNING

All personnel engaged in fish sampling must follow health and safety protocols described in the health and safety plan. Asbestos fibers are thin and long fibers so small that they cannot be seen by the naked eye. Asbestos fibers are easily inhaled when disturbed and when embedded in the lung tissue can cause health problems. Significant exposure to asbestos increases the risk of lung cancer, mesothelioma, asbestosis (non-cancerous lung disease), and other respiratory diseases (ATSDR 2006).

3.0 DEFINITIONS

Environmental Sample: A solid sample collected for chemical or geotechnical analysis. These samples are used to support remedial investigation, feasibility studies, treatability studies, remediation design and performance assessment, waste characterization, etc.

Net Seine: Seine nets are constructed of mesh panels hung from a float line with a weighted lead line attached to the lower edge.

4.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often additional personnel may be involved. Project team member information shall be included in project-specific plans (e.g., work plan, field sampling plan (FSP), quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

Project Manager: Selects site-specific sampling methods, sample locations, and constituents to be analyzed with input from other key project staff.

Quality Control Manager: Overall management and responsibility for quality assurance and quality control (QA/QC). Selects QA/QC procedures for the sampling and analytical methods, performs project audits, and ensures that data quality objectives are fulfilled.

Field Team Leader (FTL) and/or Field Biologist: Implements the sampling program, supervises other sampling personnel, and ensures compliance with SOPs and QA/QC requirements. Prepares daily logs of field activities.

Sampling Technician (or other designated personnel): Assists the FTL, field biologist, or engineer in the implementation of tasks. Performs the actual sample collection, packaging, and documentation (e.g., sample label and log sheet, chain-of-custody record, etc).

5.0 METHOD SUMMARY

This section describes fish sampling from the bottom of a surface water drainage course or pond. The collected samples will be placed in appropriate sample containers, as designated by the FSP or Quality Assurance Project Plan (QAPP), for transfer to a laboratory for the analyses identified in the FSP. Details of sample collection will be described on the attached fish sampling form.

6.0 EQUIPMENT

The selection of sampling equipment listed above depends on the site conditions and sample type required. In addition, the following equipment is needed to collect fish samples:

GENERAL

Field notebook, indelible marker
Global Positioning System (GPS) unit
Marking stakes
Digital Camera
Compass
100 m measuring tapes
Detergent solution (0.1-0.3 % Alconox)
Distilled water
Latex gloves
Ziploc bags
Paper Towel
Chain of custody and sample labels
Coolers
Sample bottles
Plastic sheeting

Equipment needed for fish collection is listed below, by procedure.

SEINING

Seine
Buckets
Carpet needle and string
Waders
Wader belts

ELECTROFISHING

Backpack electroshocker
Battery
Waders
Buckets
Wader belts
Fiberglass handled dip nets

FISH PROCESSING

Data Sheets Measuring board

Balance or scale	Field guides or keys
Coin envelopes	Knife
Forceps	Saw
Probe	Pliers
Ziploc® bags	Aluminum foil
Large scissors	Small scissors
Dissecting microscope	Glass scintillation vials with lids
Glass jars with lids	Preservative
Scalpel	Fillet knives
Knife sharpener	Dissecting trays

7.0 SAMPLE COLLECTION

Fish samples will be collected using either seining and/or electroshock collection methods as specified in the following subsections. Attachment A provides a Field Sample Data Sheet (FSDS) for recording field information on each fish sample. [Note: in some cases, an alternative FSDS may be specified and provided in the project specific SAP]. Note any special circumstances or conditions about the sampling location. Obtain and record the GPS coordinates of the sampling location on the FSDS form.

7.1 Seining

Seine nets are constructed of mesh panels hung from a float line with a weighted lead line attached to the lower edge. Seines are selective sampling gear, and will not capture all sizes of fish. The size of fish you want to sample will determine the mesh size of the seine. Mesh size should be small relative to the target fish. Too large a mesh size will allow fish to escape through the net, however mesh sizes too small will be difficult to pull through the water. Seines are most effective in water no deeper than two-thirds the height of the net.

The net should have a pole at each end which is at least equal to the height of the net. Poles should be held at a 45o angle away from the direction of movement when pulling the seine.

For sampling a stream, the seine should be long enough to reach from bank to bank. Unless stream flow is very low, the seine is pulled against the current. Care should be taken to run the poles holding the seine directly along the bank, and under it if the bank is undercut. The leadline must remain in contact with the bottom to prevent fish from escaping under the net, and the float

line must stay on or above the water surface. Several fish species (e.g. largemouth bass) will attempt to jump over the top of the seine when confined, so the float line should be above water when these are the target species.

After a collection is made, both seiners should walk onshore and pull the leadline up immediately. If there is no convenient place to beach the seine, the leadline can be lifted above water by both collectors at the same time. After the net is out of the water, captured fish should immediately be transferred to water-filled containers.

In a lake, a seine may be pulled parallel to the shore or from offshore toward the shore. Alternatively, one end of the seine can be planted on the bank, and the other end can be pulled out, around, then back in to the bank.

Mesh size and length of a seine will determine size of fish which can be caught, and may affect how efficiently the seine can be pulled. Mesh sizes too small will be difficult to pull, especially if there is much debris in the water. High current velocity in a stream will also decrease seining effectiveness.

To prevent fish from escaping under or over the net, it is imperative that the leadline be kept in contact with the bottom, and the float line must stay on or above the water surface. Streams or lakes with rocky bottoms or debris that snags the leadline will be difficult to seine effectively. Having a third person follow the seine and free it from snags helps prevent losing fish when the seine gets caught.

Seines can be torn as they are pulled through the water, leaving holes through which fish can escape. The seine should be inspected frequently, and repaired as necessary.

7.2 Electrofishing

Use of electricity to capture fish is one of the least selective of all active fish capture methods. This method involves creating an electrical field in the water by passing a current between two submersed electrodes. There are two types of electrical current. DC always flows in one direction because the negative and positive ends (electrodes) of the circuit do not change. Direct

current will induce galvanotaxis (forced swimming with orientation) and fish will move toward the anode. With ac, the anode (the positive electrode) and the cathode (the negative electrode) switch positions, so the current flows alternatingly in both directions. Fish exposed to ac will be stunned and lose equilibrium, and can be easily netted.

Electrofishing can be done using a backpack-mounted electroshocker unit, a shore-based unit, or from a boat. Backpack shockers are best for small streams. A minimum of three people are needed, one to run the shocker and two dip netters. The crew should wade upstream, with the dip netters beside or behind the electrode handler. All stunned fish, regardless of size or species, should be collected. The sampling area should be fished slowly and methodically, especially areas with in-stream cover. Captured fish should be placed in water-filled buckets. Nets can be set at the upper and lower ends of a stream section to prevent movement of fish out of the sample area.

Shore-based electrofishing is similar to backpack shocking, except that the power source stays onshore. Shore-based fishing is more dangerous, as voltages of shore-based units are higher than backpack units. The crew is also separated from the power source, and may not have safety switches. A buddy system should always be used during a shore-based electrofishing operation.

When electrofishing from a boat, the electrodes are suspended from a boom off the front of the boat. The boat should be driven slowly through shallow areas or along weed beds, and one or two people should stand near the bow and dip net stunned fish.

Research objectives, habitat characteristics and availability of the power source will influence the choice of current to be used. DC should be used when it is important not to damage or kill fish, and is very effective in turbid water or in thick weeds or brush. AC generators are generally less bulky, and are effective in clear unobstructed water. AC is more harmful to fish than DC, and may cause hemorrhaging, rupture swim bladders or fracture vertebrae.

Both direct and alternating currents can be modified to produce various current shapes that have different effects on fish. Pulsed DC will sustain forced swimming with less damage to fish. In addition, pulsed DC requires less voltage than ac and a smaller electrical source can be used. Pulsed ac will have the same effect as unmodified AC, but is not as potentially harmful to fish.

Water conductivity will affect the efficiency of electrofishing. In water where the conductivity ranges between 100 and 500 micromhos/cm, electrofishing will be most effective. At high conductivities, water is less resistive than fish and the current will flow around them. Electrofishing is not used in salt water habitats. Low conductivity water is more resistant than fish, and the electrical field is limited to the immediate area of the electrode.

Environmental factors which can affect electrofishing include water conductivity, temperature, season, and time of day. Electrofishing success is poor in water with very high or low conductivity. Electrofishing is most effective in shallow habitats. If water temperatures are high, some fish species may move into deeper water where temperature is lower and oxygen is higher. During spawning season, some species may be captured in shallow areas that would normally be found in deeper areas. Electrofishing at night catches more species, larger individuals, and more fish than similar effort during the day.

Because batteries and generators used for electrofishing provide more than enough current to electrocute a person, it is vital that safety rules be observed. All members of an electrofishing crew should understand the system and the risks involved. One person should be in charge of the operation, and this person should control the power source. Shut down the power source before any repairs or equipment changes are made. Electrofishing should never be done alone, and the crew and power source should stay close together.

8.0 SAMPLE PREPARATION AND ANALYSES

Fish can be collected for multiple purposes. Fish may be collected to identify if contaminants in aquatic habitats accumulate in fish tissue, cause histopathological damage, or affect fish condition or growth. Impacts on aquatic community structure can also be assessed. The specific procedures used to process fish will depend on the project objectives. This SOP focuses on the collection of fish and the measurement of biological parameters. The collection of tissues for contaminant analyses, histopathology and full necropsy are not covered in this SOP.

Data that may be recorded on collected fish in the field include length, width, weight, species, and information on external parasites or other external gross abnormalities. When possible, sex and stage of maturity should also be noted. Data are recorded on a Fish Information Form specific to the sampling location. All members of the processing staff should be trained in techniques used to make length and weight measurements as well as external examination. Inconsistencies in the way these measurements are taken can lead to errors.

Length. Fish length is measured using a measuring board on which the anterior end of a fish is placed against a stop at the beginning of a measuring scale. The fish should be measured with mouth closed, and the body positioned on its right side with the head to the measurer's left. Any one of three measurements can be taken: total, fork or standard length (Figure 1). Total length is the greatest length of a fish from its anterior most extremity (usually the mouth) to the end of the tail fin. For fish with a forked tail, the two lobes should be pressed together, and the length of the longest lobe should be taken. Fork length is measured from the anterior end of the fish to the tip of the middle rays of the tail. Standard length is the length of a fish from the anterior end of the fish to the tip of the middle rays of the tail. Standard length is the length of a fish from the anterior end to where the base of the median tail fin rays join the caudal peduncle. This spot can be located by bending the tail sharply. A crease should form where the tail fin rays end. Total length or fork length measurements are used most often. Determination of standard length is very difficult on some species. Factors which contribute to length measurement errors are musclular tension in live fish, eroded fins, shrinkage of fish due to preservation, and failure to consistently squeeze the tail to get maximum total length.

Weight. Spring balances or electronic digital scales are generally used to weigh individual fish. Fish can be weighed by themselves, or by placing them in a container of water. Taking the weight in water reduces error due to fish movement, but may not be practicable for large fish. Large numbers of fish can be weighed in bulk if individual weights are not needed (e.g., for population studies).

Because most fish maintain near-neutral buoyancy in water, their specific gravity is close to 1.0 and body volume is proportional to weight. Therefore, the amount of water

displaced in a container can also be used to determine weight. When taking weights, an attempt should be made to have fish at a standard degree of wetness. Variation in stomach contents or amount of water swallowed at capture will also affect fish weights. Other sources of error include movement of the scale due to fish movements, wind or boat motion.

Species. Study objectives will dictate what level of identification is needed for a fish. Fish collected should be identified to species level. Local authorities should be consulted before field work begins to determine whether regional taxonomic references exist.

Sex and Age of Maturity. Information on the sex and stage of maturity should be recorded for each fish where possible. If fish are collected during spawning season, some fish can be sexed based on breeding colors. Mature fish may release eggs or milt when they are handled.

Gross Pathology. All fish collected will be examined for any external signs of abnormalities or parasites. The following may be included in the gross external examination: examination of body surface and denote as normal or abnormal. Abnormalities may include excess mucus or irregular color.

9.0 QUALITY ASSURANCE AND QUALITY CONTROL

All sampling data must be documented in the field logbooks and/or field forms, including rationales deviations from this SOP. The Field Team Leader or designated QA reviewer will check and verify that field documentation has been completed per this procedure and the other procedures referenced herein. All equipment must be operated according to the manufacturer's specifications, including calibration and maintenance. If possible, species identifications will be confirmed by a regional biologist familiar with the site aquatic fauna.

10.0 DECONTAMINATION AND HEALTH AND SAFETY

All equipment used in the sampling process shall be decontaminated prior to field use and between sample locations. Decontamination procedures are presented in OU3 SOP-7. Personnel shall don appropriate personal protective equipment as specified in the health and safety plan. Any investigation-derived waste generated in the sampling process shall be managed in accordance with the procedures outlined in OU3 SOP-12.

Any time fish are collected, water and boat safety precautions must be taken. Wading can be hazardous in swift currents or if the bottom is uneven or algae-covered. Falls can be avoided by moving slowly, taking short steps, and wading sideways to the current. Guidelines for boating safety should be followed for all activities which require transportation by boat.

Safety procedures which should be observed while electrofishing include use of the buddy system, clear communication between the sampling team, and all samplers in waterproof gloves and waders which do not leak. The electrofishing equipment should be equipped with 'dead man' automatic shut-off switches, and one person should control the power source. At least one member of an electrofishing team must be certified in CPR.

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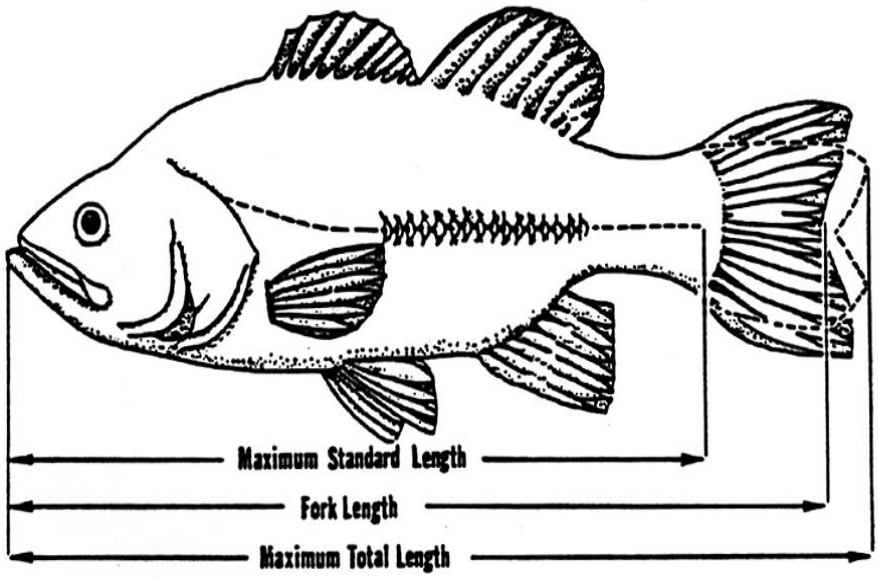
FIGURE 1. Measurements of Fish Length - Standard, Fork, and Total
(From Anderson and Gutreuter 1983)



Fish Information Form
Libby OU3, Fish Population Study

Station _____ **Date** _____

Sampling Gear and Effort (circle all methods that apply, circle capitalized words in parenthesis thay apply)

Boat shocking (DAY / NIGHT) - | Seconds _____ **Amps** _____ **Range (H or L) % of range**_____

Barge Shocking ---------- | PPS and Mode _____ **Str. Length (Meters)** _____ **Str. Ave. Width (Meters)**_____

Backpack | Seconds_____ **Str. Length** _____ **Str. Ave. Width**_____ **Amps**_____ **Volts**_____ **Freq**_____ **Width**_____

Seine | Seine Length (in Meters)_____ **Bag (Y or N) Number of Hauls**_____

Gillnet | (DAY / NIGHT / OVERNIGHT) Ave. Net Length (in Meters) _____ **# Nets Set**_____ **Ave. Set Time (Hrs.)**____ **Mesh Description**_____

Fish No.	Species	Total Length (mm)*	Weight (g)	Sex	External Abnormalities, Yes or No
1	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____
3	_____	_____	_____	_____	_____
4	_____	_____	_____	_____	_____
5	_____	_____	_____	_____	_____
6	_____	_____	_____	_____	_____
7	_____	_____	_____	_____	_____
8	_____	_____	_____	_____	_____
9	_____	_____	_____	_____	_____
10	_____	_____	_____	_____	_____
11	_____	_____	_____	_____	_____
12	_____	_____	_____	_____	_____

Sex Notes: M = Male, F = Female, U = Unknown.

Field Data Entered by:

Database Entry:	***Database QC:***

Date: September 15, 2008 SOP#BMI-LIBBY-OU3 (Rev. 0)

Title: BENTHIC MACROINVERTEBRATE SAMPLING AND PROCESSING

APPROVALS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Remedial Project Manager	RPM	9/17/08
SOP Author		9/17/08

Revision Number	Date	Reason for Revision
0	09/15/2008	--
1		

SOP-BMI-LIBBY-OU3

Benthic Macroinvertebrate Sampling & Processing

(*Adapted from ERT/REAC SOP and*

***Great Lakes National Program Office Sampling Method LG406 Revision 07*)**

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide a standardized method for sampling the benthic population at Libby OU3. This protocol summarizes the USEPA Rapid Bioassessment Protocol III (RBP III) for benthic macroinvertebrates (USEPA, 1999). RBP III utilizes the systematic field collection and analysis of major benthic taxa, and can detect subtle degrees of impairment at potentially contaminated sites. Discrimination of four levels of impairment should be possible with this assessment. The SOP also provides a second method for sampling macroinvertebrates to be completed concurrently with the RBP III samples. This method is based on those used by the US Forest Service in the Kootenai National Forest.

2.0 HEALTH AND SAFETY WARNING

All personnel engaged in sediment sampling must follow health and safety protocols described in the health and safety plan. Asbestos fibers are thin and long fibers so small that they cannot be seen by the naked eye. Asbestos fibers are easily inhaled when disturbed and when embedded in the lung tissue can cause health problems. Significant exposure to asbestos increases the risk of lung cancer, mesothelioma, asbestosis (non-cancerous lung disease), and other respiratory diseases (ATSDR, 2006).

3.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often, additional personnel may be involved. Project team member information will be included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel will always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

Project Manager: Selects site-specific field sampling program with input from other key project staff, and applicable oversight agencies.

Quality Control Manager: Overall management and responsibility for quality assurance and quality control (QA/QC). Selects QA/QC procedures for the sampling and analytical methods, performs project audits, and ensures that data quality objectives are fulfilled.

Field Team Leader (FTL) and/or Biologist, or Ecologist: Implements the sampling program, supervises other sampling personnel, and ensures compliance with SOPs and QA/QC requirements. Prepares daily logs of field activities.

Sampling Technician (or other designated personnel): Assists the FTL and/or biologist or ecologist in the implementation of tasks. Performs the actual sample collection, packaging, and documentation (e.g., sample label and log sheet, chain-of-custody record, etc).

4.0 EQUIPMENT

4.1 Field Sampling

- D-frame dip net - 0.3 m^2 "D"-shaped net (500um nytex screen) where the net attaches to a long pole. Net is cone-shaped for capture of organisms.

- Kick-net - 1 m^2 net (500um nytex screen) attached to 2 poles, which functions in a similar manner to a fish kick seine.

- Surber sampler - 12 by 12 inch square sampling grid with attached 250 micron nytex mesh net.

- Collection containers - wide-mouth bottles (500 to 1,000 ml capacity).

- Gloves - for personal protection and to prevent cross-contamination of samples. May be plastic or latex; should be disposable and powderless.

- Field notebook - a bound book used to record progress of sampling effort and record any

problems and field observations during sampling.

- Three-ring binder book- to store necessary forms used to record and track samples collected at the site. Binders will contain the Benthic Macroinvertebrate Field Data Sheet, Physical Characterization/Water Quality Field Data Sheet, and sample labels.

- Permanent marking pen - used to label samples and to record information in field logbooks and data sheets.

- Sieve Buckets - with 500um mesh. Must have 10 - 12 liter capacity.

- Forceps - to pick organisms from mesh screens and collection nets.

- 95% Ethanol - to preserve samples for analysis.

- Trash Bag - used to dispose of gloves and any other non-hazardous waste generated during sampling.

4.2 Laboratory Equipment and Supplies

- log-in sheet for samples
- standardized gridded pan (30cm x 36cm) with approximately 30 grids (6cm x 6cm)
- 500 micron sieve
- forceps
- white plastic or enamel pan (15cm x 23cm) for sorting
- specimen vials with caps or stoppers
- sample labels
- benthic macroinvertebrate laboratory bench sheet
- dissecting microscope for organism identification
- fiber optics light source

- compound microscope with phase contrast for identification of mounted organisms (e.g., midges)
- 70% ethanol for storage of specimens
- appropriate taxonomic keys

5.0 METHOD SUMMARY

Benthic macroinvertebrates are collected using two separate methodologies resulting in two separate samples per sampling location.

Surber Net Sample Collection. Benthic macroinvertebrates are first collected in a quantitative manner using a Surber net with a 250 micron mesh net. Three samples are collected and composited to form a single sample with an area of 0.279 square meters per sample. Samples are collected by disturbing the are within the square sampling frame by hand and scrubbing individual substrate particles within the square sampling area and allowing the invertebrates and detritus to was downstream into the net.

Rapid Bioassessment Sample Collection. In an area upstream of the collection area using the surber sampler, benthic invertebrates are collected systematically from all available in-stream habitats by kicking the substrate or jabbing with a D-frame dip net. A total of 20 jabs (or kicks) are taken from all major habitat types in the reach, resulting in sampling approximately 3.1 m^2 of habitat. An organism-based subsample (usually 100, 200, 300, or 500 organisms) is sorted in the laboratory and identified to the lowest practical taxon, generally genus or species.

6.0 SAMPLING PROCEDURES

6.1 Habitat Types

The following major stream habitat types are colonized by macroinvertebrates and generally support macroinvertebrate diversity in stream ecosystems. Some combination of these habitats are sampled using the specified methods for sampling benthic macroinvertebrates.

Cobble (hard substrate) - In many high-gradient streams, this habitat type will be dominant. Sample shallow areas with coarse (mixed gravel, cobble or larger) substrates by holding the bottom of the dip net against the substrate and dislodging organisms by kicking the substrate for 0.5 m upstream of the net.

Snags - Snags and other woody debris that have been submerged for a relatively long period (not recent deadfall) provide excellent colonization habitat. Sample submerged woody debris by jabbing in medium-sized snag material (sticks and branches). The snag habitat may be kicked first to help dislodge organisms, but only after placing the net downstream of the snag. Accumulated woody material in pool areas are considered snag habitat. Large logs should be avoided because they are generally difficult to sample adequately.

Vegetated banks - When lower banks are submerged and have roots and emergent plants associated with them, they are sampled in a fashion similar to snags. Submerged areas of undercut banks are good habitats to sample. Sample banks with protruding roots and plants by jabbing into the habitat. Bank habitat can be kicked first to help dislodge organisms, but only after placing the net downstream.

Submerged macrophytes - Submerged macrophytes are seasonal in their occurrence and may not be a common feature of many streams, particularly those that are high-gradient. Sample aquatic plants that are rooted on the bottom of the stream in deep water by drawing the net through the vegetation from the bottom to the surface of the water (maximum of 0.5m each jab). In shallow water, sample by bumping or jabbing the net along the bottom in the rooted area, avoiding sediments where possible.

Sand (and other fine sediment) - Usually the least productive macroinvertebrate habitat in streams, this habitat may be the most prevalent in some streams. Sample banks of unvegetated or soft soil by bumping the net along the surface of the substrate rather than dragging the net through soft substrates; this reduces the amount of debris in the sample.

6.2 Sampling Reach and General Procedures

A 100m reach that is representative of the characteristics of the stream should be selected. Whenever

possible, the area should be at least 100m upstream from any road or bridge crossing to minimize its effect on stream velocity, depth and overall habitat quality. If a 100m reach is not available for sampling, a standard number of stream widths can be used to measure the stream distance. For example, the EPA's Environmental Monitoring and Assessment Program (EMAP) uses a standard of 40 stream widths for sampling. This approach allows variation in the length of the reach, based on the size of the stream.

Before sampling, complete the physical/chemical field sheet to document site description, weather conditions, and land use. After sampling, review this information for accuracy and completeness. Record the percentage of each habitat type in the reach. Note the sampling gear used, and comment on conditions of the sampling, e.g., high flows, treacherous rocks, difficult access to stream, or anything that would indicate adverse sampling conditions. Document observations of aquatic flora and fauna. Make qualitative estimates of macroinvertebrate composition and relative abundance as a cursory estimate of ecosystem health and to check adequacy of sampling.

Draw a map of the sampling reach or stream widths on the Libby OU3 ecological study sheet. This map should include in-stream attributes (e.g., riffles, falls, fallen trees, pools, bends, etc.) and important structures, plants, and attributes of the bank and near stream areas. Use an arrow to indicate the direction of flow. Indicate the areas that were sampled for macroinvertebrates, with each sample identification number on the map. Use a hand-held GPS for latitude and longitude determination of the furthest upstream and downstream points of the sampling reach according to OU3 SOP 11.

6.3 Sample Collection of Community Samples

6.3.1 Surber Net Collection

Benthic macro invertebrates are first collected in a quantitative manner using a Surber net with a 250 micron mesh net. Surber net collections are made in riffle areas. Three samples are collected and composited to form a single sample with an area of 0.279 square meters per sample. Samples are collected by disturbing the are within the square sampling frame by hand and scrubbing individual

substrate particles within the square sampling area and allowing the invertebrates and detritus to was downstream into the net.

Transfer the sample from the net to the sample container(s) and preserve in enough 95% ethanol to cover the sample. Forceps may be needed to remove organisms from the dip net. Place a sample identification label that includes date, stream name, sampling location, and collector name into the sample container. The outside of the container should include the same information and the words "preservative: 95% ethanol". If more that one container is needed for a sample, each container label should contain all the information for the sample and should be numbered (e.g., 1 of 2, 2 of 2, etc.). This information will be recorded in the "Sample Log" at the biological laboratory. Complete the top portion of the Benthic Macroinvertebrate Field Data Sheet.

6.3.2 Rapid Bioassessment Sample

The Rapid Bioassessment Sample is collected in wadable waterbodies (eg: streams, rivers) using a kick-net or dip net. Begin sampling at the downstream end of the reach and proceed upstream. A total of 20 jabs or kicks will be taken over the length of the reach; a single jab consists of forcefully thrusting the net into a productive habitat for a linear distance of 0.5m. A kick is a stationary sampling accomplished by positioning the net and disturbing the substrate for a distance of 0.5m upstream of the net.

Different types of habitat are sampled in approximate proportion to their representation of surface area of the total macroinvertebrate habitat in the reach. For example, if snags comprise 50% of the habitat in a reach and riffles comprise 20%, then 10 jabs are taken in snag material and 4 jabs are taken in riffle areas. The remainder of the jabs (6) are taken in any remaining habitat type. Habitat types contributing less than 5% of the stable habitat in the stream reach are also sampled. In this case, the remaining jabs are allocated proportionately among the predominant substrates. The number of jabs taken in each habitat type are recorded on the Benthic Macroinvertebrate Field Data Sheet.

The jabs or kicks collected from the multiple habitats are composited to obtain a single homogeneous sample. Every 3 jabs (more often if necessary) wash the collected material by running clean stream water

through the net two to three times, being careful to retain the sample inside the net. If clogging does occur, discard the material in the net and redo that portion of the sample in the same habitat type but in a different location. Remove large debris after rinsing and inspecting it for organisms; place any organisms found into the sample container. Do not spend time inspecting small debris in the field.

Transfer the sample from the net to sample container(s) and preserve in enough 95% ethanol to cover the sample. Forceps may be needed to remove organisms from the dip net. Place a sample identification label that includes date, stream name, sampling location, and collector name into the sample container. The outside of the container should include the same information and the words "preservative: 95% ethanol". If more that one container is needed for a sample, each container label should contain all the information for the sample and should be numbered (e.g., 1 of 2, 2 of 2, etc.). This information will be recorded in the "Sample Log" at the biological laboratory. Complete the top portion of the Benthic Macroinvertebrate Field Data Sheet.

6.3 Habitat Assessment

A habitat assessment is completed after sampling of the benthic community. The information is recorded the Habitat Assessment Field Data Sheet. The habitat assessment should be conducted with at least 2 team members. Habitat Assessment data should also be recorded in a spreadsheet.

6.4 Laboratory Processing for Community Samples

Macroinvertebrate samples are processed in the laboratory under controlled conditions. Aspects of laboratory processing include subsampling and sorting, identification of organisms and calculation of metrics. All samples are dated and recorded in the Sample Log upon receipt by laboratory personnel. All information from the sample container label must be included on the sample log sheet. If more than one container was used, the number of containers should be indicated as well. All samples should be sorted in a single laboratory to enhance quality control.

6.4.1 Subsampling and Sorting

Subsampling and sorting are completed using procedures according to sample collection type. The surber samples and rapid bioassessment samples are subsampled and sorted according to the following procedures.

Surber Sample

The general procedures are those used by the U.S. Forest Service in the Kootenai National Forest. Samples are sub-sampled if the sample appears to contain more than 600 organisms. Sub-samples were obtained by pouring the sample into an appropriate diameter 250 micron sieve, floating this material by placing the sieve within an enamel pan partially filled with water and leveling the material within the sieve. The sieve is then removed from the water pan and the material within the sieve is divided into equal parts. One side of the sieve is then randomly chosen to be processed and the other side is set aside. The sieve is then placed back in the enamel pan an the material in the sieve again leveled and split in half. This process is repeated until approximately 600 organisms remain in one-half of the sieve. This material is then placed into a petri dish and all organisms are removed under a dissecting microscope at 10-30 power. Additional sub-samplesare taken until at least 600 organisms are removed. All organisms within a sub-sample are removed. During the sorting process the organisms are separated into Orders. When the sorting of the sub-samples is completed, the entire sample is spread throughout a large white enamel pan and searched for 10 minutes to remove any taxa that might not have been picked up during the initial sorting process. The object6ive of this “big/rare” search is to provide a more complete taxa list by finding rarer taxa that may have been excluded during the sub-sampling process. These rarer bugs are placed into a separate vial and tracked separately from the bugs removed during the sub-sampling process.

Rapid Bioassessment Sample

The Rapid Bioassessment Protocol III uses a fixed-count approach to subsampling and sorting the organisms from the sample matrix of detritus, sand, and mud. The following protocol is based on a 200-organism subsample, but it could be used for any subsample size (100, 300, 500, etc.). The

subsample is sorted and preserved separately from the remaining sample for quality control checks.

Prior to processing any samples in a lot (i.e., samples within a collection date, specific watershed, or project), complete the sample log-in sheet to verify that all samples have arrived at the laboratory, and are in proper condition for processing. The following steps are specified in USEPA (1999).

1. Prior to processing any samples in a lot (i.e., samples within a collection date, specific watershed, or project), the sample log-in sheet is completed to verify that all samples have arrived at the laboratory, and are in proper condition for processing.

2. The sample is thoroughly rinsed in a 500um mesh sieve to remove preservative and fine sediment. Large organic material (whole leaves, twigs, algal or macrophyte mats, etc.) not removed in the field are rinsed, visually inspected, and discarded. If the samples are preserved in alcohol, it is necessary to soak the sample contents in water for about 15 minutes to hydrate the benthic organisms, which will prevent them from floating on the water surface during sorting. If the sample is stored in more than one container, the contents of all containers for a given sample are combined at this time. The sample is gently mixed by hand while rinsing to make homogeneous.

3. After washing, the sample is spread evenly across a pan marked with grids approximately 6cm x 6cm. On the laboratory bench sheet, the presence of large or obviously abundant organisms are noted but they are not removed from the pan.

4. A random numbers table is used to select 4 numbers corresponding to squares (grids) within the gridded pan. All material (organisms and debris) is removed from the four grid squares, and is placed into a shallow white pan with a small amount of water added to facilitate sorting. If there appear (through a cursory count or observation) to be 200 organisms ± 20% (cumulative of 4 grids), then subsampling is complete.

Any organism that is lying over a line separating two grids is considered to be on the grid containing its head. In those instances where it may not be possible to determine the location of the head (worms for instance), the organism is considered to be in the grid containing most of its body.

If the density of organisms is high enough that many more than 200 organisms are contained in the 4 grids, the contents of the 4 grids are transferred to a second gridded pan. Randomly select grids for this second level of sorting as was done for the first, sorting grids one at a time until 200 organisms ± 20% are found. If picking through the entire next grid is likely to result in a subsample of greater than 240 organisms, then that grid may be subsampled in the same manner as before to decrease the likelihood of exceeding 240 organisms. That is, the contents of the last grid are spread into another gridded pan. Grids are picked one at a time until the desired number is reached. The total number of grids for each subsorting level are noted on the laboratory bench sheet.

5. The sorted debris residue in stored in a separate container. The sample is labeled with words including "sorted residue" in addition to all prior sample label information and preserve in 95% ethanol. The remaining unsorted sample debris residue is saved in a separate container labeled "sample residue"; this container should include the original label. Samples are stored until the laboratory is instructed to discard them.

6. The sorted 200-organism (±20%) subsample is placed into glass vials, and preserved in 70% ethanol. The vials are labeled with the sample identifier or lot number, date, stream name, sampling location and taxonomic group. If more than one vial is needed, each are labeled separately and numbered (e.g., 1 of 2, 2 of 2). For convenience in reading the labels inside the vials, the labels are inserted left-edge first. If identification is to occur immediately after sorting, a Petri dish or watch glass can be used instead of vials.

7. Midge (Chironomidae) larvae and pupae should be mounted on slides in an appropriate medium (e.g., Euperal, CMC-9); slides should be labeled with the site identifier, date collected, and the

first initial and last name of the collector. As with midges, worms (Oligochaeta) are also be mounted on slides and should be appropriately labeled.

8. Fill out header information on Laboratory Bench Sheet (Attachment 2). Also check subsample target number. Complete back of sheet for subsampling/sorting information. Note number of grids picked, time expenditure, and number of organisms. If QC check was performed on a particular sample, person conducting QC should note findings on the back of the Laboratory Bench Sheet. Calculate sorting efficiency to determine whether sorting effort passes or fails.

9. Record date of sorting and slide monitoring, if applicable, on Log-in Sheet (Attachment 1) as documentation of progress and status of completion of sample lot.

Ten percent of the sorted samples in each lot should be examined by laboratory QC personnel or a qualified co-worker as specified in USEPA (1999). (A lot is defined as a special study).

As an improvement to the mechanics of the technique, a sorting tray may be used that is designed with two parts, a rectangular plastic or plexiglass pan (36cm x 30cm) with a rectangular sieve insert. The sample is placed on the sieve, in the pan and dispersed evenly. When a random grid(s) is selected, the sieve is lifted to temporarily drain the water. A "cookie-cutter" like metal frame 6cm x 6cm is used to clearly define the selected grid; debris overhanging the grid may be cut with scissors. A 6cm flat scoop is used to remove all debris and organisms from the grid. The contents are then transferred to a separate sorting pan with water for removal of macroinvertebrates. These modifications have allowed for rapid isolation of organisms within the selected grids and easy removal of all organisms and debris within a grid while eliminating investigator bias.

6.4.2 Identification of Macroinvertebrates

Organisms are to be identified to the lowest practical level (generally genus or species) by a qualified taxonomist using a dissecting microscope. Each taxon found in a sample is recorded and enumerated in a laboratory bench notebook and then transcribed to the laboratory bench sheet for subsequent reports. Any

difficulties encountered during identification (e.g., missing gills) are noted on these sheets.

Labels with specific taxa names (and the taxonomist's initials) are added to the vials of specimens by the taxonomist. (Note that individual specimens may be extracted from the sample to be included in a reference collection or to be verified by a second taxonomist.) Slides are initialed by the identifying taxonomist. A separate label may be added to slides to include the taxon (taxa) name(s) for use in a voucher or reference collection.

The identity and number of organisms are recorded on the Laboratory Bench Sheet. Either a tally counter or "slash" marks on the bench sheet is used to keep track of the cumulative count. Also, the life stage of the organisms is recorded, the taxonomist's initials and the Taxonomic Certainty Rating (TCR) as a measure of confidence. In the spaces provided on the bench sheet, explain certain TCR ratings or condition of organisms. Other comments can be included to provide additional insights for data interpretation. If QC was performed, this is recorded on the back of the bench sheet.

For archiving samples, specimen vials, (grouped by station and date), are placed in jars with a small amount of denatured 70% ethanol and tightly capped. The ethanol level in these jars is examined periodically and replenished as needed, before ethanol loss from the specimen vials takes place. A stick-on label is placed on the outside of the jar indicating sample identifier, date, and preservative (denatured 70% ethanol).

Quality control procedures as specified on page 7-13 of USEPA (1999) should be performed and documented.

6.4.3 Metrics

Benthic metrics are calculated for each of the sampling location for which samples are provided and recorded in an Excel spreadsheet format. The metrics that should be reported and including the statistics necessary to calculate them include:

- Total number of taxa
- Taxa richness (site/reference)
- Total number of individuals
- Total density (site/reference)
- Number of Emphemeroptera, Plecoptera, Trichoptera (EPT) taxa
- EPT Index (site/reference)
- Shannon-Weaver Diversity (site/reference)
- Shannon-Weaver Diversity
- Number of Ephemeroptera Taxa
- Number of Plecoptera Taxa
- Number of Trichoptera Taxa
- % Ephemeroptera
- % Ephemeroptera (site/reference)
- Number of Tolerant Taxa (based on USEPA 1999)
- Number of Tolerant Individuals (based on USEPA 1999)
- % Tolerant Organisms (based on USEPA 1999)
- % Tolerant Organisms (site/reference) (based on USEPA 1999)
- Number of Pollution intolerant taxa (based on USEPA 1999)
- % Contribution Dominant Taxon
- % Contribution Dominant Taxon (site/reference)
- Number of Filterer Taxa
- Percent of individuals that are filterers
- % Filterers
- % Filterers (site/reference)
- Number of Scraper Taxa
- % Scrapers
- % Scrapers (site/reference)
- Number of Clinger Taxa
- % Clingers
- % Clingers (site/reference)

- Number of Predator Taxa
- Number of individuals that are shredders
- Percent of individuals that are shredders
- Number of individuals that are predators
- Percent of individuals that are predators
- Number of individuals that are Elmid beetles (Coleoptera: Elmidae: riffle beetles)
- Percent of individuals that are Elmid beetles (Coleoptera: Elmidae: riffle beetles)
- Abundance of the two most dominant taxon
- Hilsenhoff Biotic index
- Number of tolerant taxa

Tolerance values and assignment to functional feeding groups (scrapers, filterers, clingers) is to be assigned based on Appendix B of USEPA (1999).

7.0 DECONTAMINATION

All equipment used in the sampling process shall be decontaminated prior to field use and between sample locations. Decontamination procedures are presented in OU3 SOP-7. Personnel shall don appropriate personal protective equipment as specified in the health and safety plan. Any investigation-derived waste generated in the sampling process shall be managed in accordance with the procedures outlined in OU3 SOP-12.

8.0 QUALITY ASSURANCE AND QUALITY CONTROL

All sampling data must be documented in the field logbooks and/or field forms, including rationales deviations from this SOP. The Field Team Leader or designated QA reviewer will check and verify that field documentation has been completed per this procedure and other procedures referenced herein. All equipment must be operated according to the manufacturer's specifications, including calibration and maintenance. Each field crew will carry a notebook that contains the Benthic Macroinvertebrate Field Data Sheet, Physical Characterization/Water Quality Field Data Sheet, and sample labels. In addition, a

field notebook should be maintained by each individual or team that is collecting samples, as described in the Project Plan. Each sampling location must be recorded on the site diagram. Each sample should have an ID number affixed to the outside of the wide-mouth bottle, and the duplicate label must be affixed to the sample data sheet. Deviations from this sampling plan should be noted in the field notebook, as necessary.

9.0 REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR). 2001. Toxicological Profile for Asbestos. Atlanta, GA: Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services, Public Health Service.

USEPA. 1999. Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition.* EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

USEPA. 2003. Sampling and Analytical Procedures for GLNPO's Open Lake Water Quality Survey of the Great Lakes; Chapter 4 - Biological Parameters; LG406 - Standard Operating Procedure for Benthic Invertebrate Field Sampling Procedure, Revision 07. EPA 905-R-03-002. March 2003.

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (Pg. 1)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

WEATHER CONDITIONS	**Now**	**Past 24 hours**	**Has there been a heavy rain in the last 7 days?**
	❑ storm (heavy rain)	❑	❑ Yes ❑ No
	❑ rain (steady rain)	❑	**Air Temperature**_____ ^{0} C
	❑ showers (intermittent)	❑	**Other**_____
	____%❑ %cloud cover	____%	
	❑ clear/sunny	❑	
		❑	
SITE LOCATION AND MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)**		
STREAM CHARACTERIZATION	**Stream Subsystem** ❑ Perennial ❑ Intermittent ❑ Tidal **Stream Origin** ❑ Glacial ❑ Spring-fed ❑ Non-glacial montane ❑ Mixture of origins ❑ Swamp and bog ❑ Other_____		**Stream Type** ❑ Coldwater ❑ Warmwater **Catchment Area**_____km^2

Field Data Entered by:

Database Entry: ***Database QC:***

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (Pg. 2)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other _____ ❑ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ❑ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** _____
INSTREAM FEATURES	**Estimated Reach Length** _____m **Estimated Stream Width** _____m **Sampling Reach Area** _____m^2 **Area in km^2 (m^2x1000)** _____km^2 **Estimated Stream Depth** _____m **Surface Velocity (at thalweg)** _____m/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ❑ Shaded **High Water Mark** _____m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle_____% ❑ Run_____% ❑ Pool_____% **Channelized** ❑ Yes ❑ No **Dam Present** ❑ Yes ❑ No
LARGE WOODY DEBRIS	**LWD** _____m^2 **Density of LWD** _____m^2/km^2 **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** _____ **Portion of the reach with aquatic vegetation** _____%
WATER QUALITY	**Temperature**_____^{0} C **Specific Conductance**_____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other_____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other_____ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other_____
SEDIMENT/ SUBSTRATE	**Odors** ❑ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑Other_____ **Oils** ❑ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other_____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ❑ No

Field Data Entered by:

Database Entry: ***Database QC:***

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(Pg. 3)

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

Field Data Entered by:

Database Entry: ***Database QC:***

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HABITAT ASSESSMENT FIELD DATA SHEET-HIGH GRADIENT STREAMS (FRONT)

Stream Name	Location
Station # Rivermile	Stream Class
Lat Long	River Basin
Investigators	
Form Completed By	Date Time a.m. p.m. Reason for Survey

Parameters to be evaluated in sampling reach.

Habitat								Condition Category													
Parameter	**Optimal**					**Sub-optimal**					**Marginal**					**Poor**					
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e. logs/snags that are not new fall and not transient).					40-70% mix of stable habitat; well-suited for full colonization potential adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale.					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed removed.					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. **Embeddedness**	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. **Velocity/Depth Regime**	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < O.3:meters/sec Deep is > 0.5 meters					Only three of the four regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only two of the four regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by one velocity/depth regime (usually slow-deep).					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment Deposition	Little or no enlargement of is1ands or pointbars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5 – 30% (20 - 5- % for low-gradient) of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30 – 50% (50 – 80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine materia1, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25- 75% ofthe available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Data Entered by:

Database Entry: ***Database QC:***

Habitat Assessment Field Data Sheet – High Gradient Streams (Back)

Parameters to be evaluated broader than sampling reach.

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gavion or cement; over 80% of the stream reach channelized and disrupted. In-stream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ration of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles relatively frequent; ration of distance between riffles divided by width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of > 25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 '3 2 1 0
8. Bank Stability (score each blank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5 – 30% of bank in reach has areas of erosion.	Moderately unstable; 30 – 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60 – 100 % of bank has erosional scars.
SCORE ____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70 – 90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50 – 70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE _(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE _(RE)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12 – 18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6 – 12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.
SCORE _____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE _____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

T ota1 Score _____ Optimal: 160-200 Suboptimal: 110-159 Marginal: 60-109 Poor - less than 60

Field Data Entered by:

Database Entry: ***Database QC:***

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____RIVERMILE_____	STREAM CLASS	
LAT _____LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME_____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Cobble_____% ❑ Snags_____% ❑ Vegetated Banks_____% ❑ Sand_____% ❑ Submerged Macrophytes_____% ❑ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ❑ D-frame ❑ kick-net ❑ Other _____ **How were the samples collected?** ❑ wading ❑ from bank ❑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ❑ Cobble_____ ❑ Snags_____ ❑ Vegetated Banks_____ ❑ Sand_____ ❑ Submerged Macrophytes_____ ❑ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

Field Data Entered by:

Database Entry: ***Database QC:***

BENTHIC MACROINVERTEBRATE SAMPLE LOG-IN SHEET

Date Collected	Collected By	Number of Containers	Preservation	Station #	Stream Name and Location	Date Received by Lab	Lot Number	Date of Completion		
								sorting	mounting	identification

Field Data Entered by:

Database Entry:

Database QC:

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (Pg. 1)

page _____ of _____

STREAM NAME	LOCATION
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
COLLECTED BY DATE_____	LOT #
TAXONOMIST DATE_____	SUBSAMPLE TARGET ❑ 100 ❑ 200 ❑ 300 ❑ Other ____

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR	Organisms		No.	LS	TI	TCR
Oligochaeta						Megaloptera					
Hirudinea						Coleoptera					
Isopoda											
Amphipoda						Diptera					
Decapoda											
Ephemeroptera											
						Gastropoda					
						Pelecypoda					
Plecoptera											
						Other					
Trichoptera											
Hemiptera											

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills).

LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms _____ **Total No. Taxa** _____

Field Data Entered by:

Database Entry: ***Database QC:***

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (Pg. 2)

SUBSAMPLING/SORTING INFORMATION Sorter _____ Date _____	Number of grids picked: _____ Time expenditure _____ No. of organisms _____ Indicate the presence of large or obviously abundant organisms: **QC:** ❑ YES ❑ NO **QC Checker** _____ # organisms originally sorted [ ] ÷ (# organisms recovered by checker [ ] + # organisms originally sorted [ ]) = % sorting efficiency [ ] ≥90%, sample passes _____ <90%, sample fails, action taken _____
TAXONOMY ID _____ Date _____	Explain TCR ratings of 3-5: Other Comments (e.g. condition of specimens): **QC:** ❑ YES ❑ NO **QC Checker** _____ Organism recognition ❑ pass ❑ fail Verification complete ❑ YES ❑ NO

Field Data Entered by:

Database Entry: ***Database QC:***

Custody Seal

CUSTODY SEAL **Parametrix**

Date: _____ *Time:* _____

Sampler Signature: _____

Sample Label

Parametrix

Station: _____

Index ID: _____ Date: _____

Collection Method: _____ Time: _____

Media: _____

Sampler: _____

Libby OU3, Ecological Study

Station _____ Collection Date (MM/DD/YYYY): Start_____ End_____

Field Logbook ID : _____ **Logbook Page No : _____**

Sample Method: (check one)	**Note, if Primary Sample or Field Duplicate:**	**Index ID:**
☐ E = Fish, Electrofishing	_____	_____
☐ S = Macroinvertebrates, Surber	_____	_____
☐ S = Macroinvertebrates, RBP	_____	_____
☐ Other_____	_____	_____

Sampling Information

Start Time : _____ Datum : _____

Start Location:
Latitude (deg., min., sec.):_____ Longitude (deg., min., sec.):_____

End Time: _____

End Location:
Latitude (deg., min., sec.):_____ Longitude (deg., min., sec.):_____

Sampling depth:_____ Water depth (m):_____

Site Description:
_____
_____

Crew Information

Collectors' Names (print): _____

Field Team Leader (print and sign): _____

Notes and/or Sketch

Field Data Entered by:

Database Entry: ***Database QC:***

Date: May 21, 2009 SOP MAMMAL-LIBBY-OU3 (Rev. 0)

Title: SMALL MAMMAL COLLECTION AND PROCESSING

APPROVALS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Remedial Project Manager	/RPM	5/21/09
SOP Author		5/21/09

Revision Number	Date	Reason for Revision
0	05/21/2009	--

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide a standardized method for collection of small mammals for biological surveys, chemical analysis of tissues, and/or histopathological examination. This procedure will be used by USEPA Region 8 for the Remedial Investigation work for Operable Unit 3 performed at the Libby Asbestos Superfund site.

This document focuses on methods and equipment that are readily available and typically applied in collecting small mammals. It is not intended to provide an all-inclusive discussion of small mammal collection methods. Specific sampling problems may require the adaptation of existing equipment or design of new equipment. Such innovations shall be clearly described in the project-specific sampling plan and approved by the Project Manager and the Quality Manager.

2.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often additional personnel may be involved. Project team member information shall be included in project-specific plans (e.g., work plan, field sampling plan (FSP), quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

Project Manager: Selects site-specific sampling methods, sample locations, and constituents to be analyzed with input from other key project staff.

Quality Control Manager: Overall management and responsibility for quality assurance and quality control (QA/QC). Selects QA/QC procedures for the sampling and analytical methods, performs project audits, and ensures that data quality objectives are fulfilled.

Field Team Leader (FTL) and/or Field Biologist: Implements the sampling program, supervises other sampling personnel, and ensures compliance with SOPs and QA/QC requirements. Prepares daily logs of field activities.

Sampling Technician (or other designated personnel): Assists the FTL, field biologist, or engineer in the implementation of tasks. Performs the actual sample collection, packaging, and documentation (e.g., sample label and log sheet, chain-of-custody record, etc).

3.0 EQUIPMENT

3.1 Organizational and Safety Equipment

- Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP)
- Health and Safety Plan (HASP)
- Safety equipment as specified in HASP
- Clipboard, writing utensils, permanent waterproof ink marker
- Site maps
- Global Positioning System (GPS) navigation/survey equipment
- Digital camera

3.2 Trap Setting and Data Recording Equipment

- Data collection sheets and field log books
- Spring loaded scale
- Tape measure, 100-foot length
- Survey flags and flagging tape
- Leather gloves
- Traps
- Bait (e.g., oats, peanut butter)

3.3 Sample Processing and Shipment Equipment

- Nitrile gloves
- Surgical gloves
- Wet ice
- Storage cooler
- Small/large resealable plastic bags
- Glass and/or plastic vials for tissue samples
- Garbage bags
- Duct tape

3.4 Decontamination Equipment

- 5-gallon plastic buckets
- Hypochlorite bleach or Lysol™ disinfecting solution
- Scrub brushes
- Paper towels
- Garbage bags

4.0 SAMPLE COLLECTION

4.1 Preparation

A scientific collection permit shall be obtained from the appropriate federal or state agency. Most states have permit information available on the internet. A natural heritage search for threatened or endangered species should also be requested from the state. In addition, permission from the landowner(s) must be received prior to trapping at the site or reference areas.

4.2 Sampling Location Selection

The exact locations of the sampling areas and placement of trap lines should be made during an initial field reconnaissance based on the identified habitats, terrain, access and other considerations. Areas identified for small mammal trapping are described in the site-specific sampling and analysis plan (SAP).

4.3 Targeted Species

The mammalian species targeted for collection are described in the site-specific SAP. For the purposes of the OU3 Phase III investigation, the target species include the deer mouse (*Peromyscus maniculatus*) and the southern red-backed vole (*Clethrionomys gapperi*).

4.4 Trap Selection

While many types of traps are available for the collection of small mammals, this small mammal collection SOP will use live traps including Sherman Live traps and Haveahart traps. Sherman Live traps are a type of box trap that are the most effective for capturing small terrestrial mammals unharmed (Wilson et al., 1996). As shown in Figure 1, this trap is rectangular in shape with a spring-loaded door that becomes triggered once an animal enters the trap. Box traps are recommended over simple snap traps due to reduced occurrences of predation and trap disturbance by raccoons and deer. Snap traps are lightweight and easily triggered or moved by non-target species. In addition, once an animal is captured in a snap trap, it becomes a likely target for predation. The heavier box trap, with solid sides, is better suited to withstand disruption by predation. Live trapping is also preferred for the collection of samples for histopathology examination. Animals collected from kill traps may decompose prior to collection making tissue examination impossible. The Sherman Live traps come in a variety of sizes. Pearson and Ruggiero (2003) completed small mammal trapping in nine west-central Montana forest stands using Sherman live traps. The most common species they collected in traps were the deer mouse and southern red-backed vole. This indicates that the Sherman live traps can be successful at capturing the target species.

Havahart traps (www.havahart.com) (Figure 1) may also be used. These traps may prove more successful at capturing voles. These traps are not completely enclosed so they allow for examination of the captured organism. However, they are also more prone to predators killing or removing the captured mammals.

4.5 Trap Placement

Methods for capturing mammals and in particular the use of trap arrays are reviewed by Wilson et al. (1996). Typical methods of trap placement include transects, grids and webs. Pearson and Ruggiero (2003) compared transect versus grid trapping arrangements for sampling small mammal communities in two forest cover types in west central Montana. They found that transect arrangements yielded more total captures, more individual captures and more species than grid arrangements in both cover types in both of the years examined. Differences between the two methods were greatest when small mammals were least abundant. Based on this reported efficiency and the lower level of effort required for the line transect method compared to the grid method, the line transect trap method will be used to collect small mammals at Libby OU3.

Traps will be placed along trap lines as outlined in the site-specific SAP. Transect lines should be numbered or lettered sequentially. Each individual trap along the transect line should also be assigned a number, based on its position along the line. The location and orientation of each transect line should be sketched in the field logbook and also recorded on either a site map or an aerial photo. The start and end of each grid line or trap line should be marked with a survey flag and/or length of flagging tape tied to a branch at eye level. The flag or flagging should be labeled with the area identifier (e.g., station ID) and transect line identifier using a thick waterproof marker. Each trap should be labeled with the area identifier, the transect line identifier, and a unique trap number using a thick waterproof marker in the following manner.

SM-__- x - y

where:

- SM-__ is the small mammal trapping location identifier (S = site; R = reference)
- x is the unique transect line identifier
- y is the unique trap number on the transect line

In heavily vegetated areas, individual trap locations may also be marked with a labeled survey flags. This simplifies trap relocation and reduces habitat destruction during subsequent trap checks. Flags should be placed so that they do not impede an animal's progress toward the trap. Traps should be placed at habitat features (e.g., log, tree, runway, burrow) as long as they lie within 2 meters of the point. Traps should seldom be set in open areas, since small mammals usually avoid these areas due to the increased likelihood of predation. Success can still be

increased by placing traps along fallen logs, large roots, or in brushy areas. However, traps should be placed so that the release is not impeded by vegetation or other obstructions.

4.6 Trap Setting and Baiting

Traps will be set at dusk and checked after the first 2 hours of sunlight in order to capture diurnal (active in the daytime), nocturnal, and corpuscular (active at dusk and dawn) animals. Traps will be baited when they are set. Bait should be carried in a resealable plastic bag and dispensed as needed. The bait will consist of a mixture of 50:50 peanut butter and rolled oats. [Note: The relative proportions of each can be modified to suit field conditions (e.g., use less peanut butter in warmer weather)]. Traps should be baited so that the bait does not fall off. .

4.7 Trap Checks

A field team of at least two people will be used to check the traps, handle and capture the animals, and record the necessary information.

When a sprung trap is located, it will be carefully picked up, and checked for captured animals. If the trap contains an animal (regardless of species), the field personnel will transport the trap to the processing area as soon as possible.

In the case of Havahart traps, when a non-target species is identified in the trap, the animal may be released. In cases where target species are collected, they should be transported in the trap to the processing area as soon as possible. If no animal is discovered inside the trap, the trap will be placed back in the “unarmed” position on the ground until dusk and then reset and rebaited.

All personnel performing trap checks should wear appropriate personal protective equipment as specified in the site-specific Health and Safety Plan (HASP).

4.8 Data Recording for Trapped Mammals

As noted above, all traps will be transported from the field to the sample processing area.

In the sample processing area, the field team will record the check date and time, the transect line identifier, and trap number for each trap in a Small Mammal Trapping Log (Appendix A). A separate log sheet will be maintained for each trapping location over the duration of the trapping event.

Unique field sample IDs for each small mammal collected will be generated as follows:

SM-__- x - y - z

Where z is the unique sequential identification number small mammal (e.g., if two small mammals are captured at the same trap on different days, the z identifier for the first mammal will be '01' and the z identifier for the second mammal will be '02').

For example, field sample ID "SM-S-B-03-02" corresponds to the 2nd small mammal collected in trap #3 from transect line B at the Site sampling station.

All animals collected will be sacrificed at the time of sample processing. The animals will be euthanized via carbon dioxide exposure. Carbon dioxide exposure is a humane method of euthanasia approved by the American Veterinary Medical Association (AVMA, 2007) and the Institutional Animal Care and Use Committee (IACUC). Carbon dioxide asphyxiation renders the animal moribund and easier to handle. Cervical dislocation on the moribund animal (after carbon dioxide asphyxiation) will be performed to ensure animals do not recover from the asphyxiation. After euthanization, the animals will be maintained in separate containers labeled with the unique mammal field sample ID number (e.g., SM-S-B-03-02) until they can be examined.

The field team will record the following information for each trapped mammal in the Small Mammal Trapping Log (Appendix A):

Species

The species is recorded by a common name abbreviation. Abbreviations are listed in the following table.

	Common name	
Mammalian	Dusky or Montane Shrew	DSKS
	Masked Shrew	MSKS
	Pygmy Shrew	PYGS
	Vagrant Shrew	VAGS
	Northern Flying Squirrel	NFSQ
	Red-tailed Chipmunk	RTCM
	Bushy-tailed Woodrat	BTWR
	Columbian Ground Squirrel	CGSQ
	Deer Mouse	DEMO
	Golden-mantled Ground Squirrel	GMSQ
	Heather Vole	HEAV
	Hoary Marmot	HORM
	Long-tailed Vole	LTDV
	Mountain Cottontail	MTCT
	Northern Pocket Gopher	NPGO
	Pika	PIKA
	Red Squirrel	RESQ
	Southern Red-backed Vole	SRBV
	Snowshoe Hare	SNSH
	Yellow-bellied Marmot	YBMA
	Yellow pine chipmunk	YPCM
	Western Jumping Mouse	WJMO

Common name		
	Water Shrew	WATS
	Water Vole	WATV

General Lifestage

If possible the general lifestage of the mammal should be recorded. In general, guidelines for aging mammals are derived from the findings of field studies that mark individuals at birth and follow them through adulthood. Aging criteria for mammals are generally taxa specific. For the most part, mammals are assigned to broad age classes (following table) relative to developmental or reproductive milestones (Kunz et al., 1996). During the Phase III sampling efforts, it will be difficult to assess absolute age in the field as the methods for aging rely on verifying age-related differences (e.g., body size, ossification of long bones, tooth wear) by measurement on a statistically appropriate number of known-age individuals (Kunz et al., 1996). Mammals captured in the field can be aged by collecting body measurements and evaluating reproductive criteria relative to the broad age categories listed below.

Lifestage (Age) Categories	
Juvenile	A weaned young mammal that still associated with its mother or siblings and may nurse infrequently; usually smaller than a subadult.
Immature	A young mammal that is neither fully grown nor sexually mature.
Subadult	A young mammal that is not fully grown but that may or may not be sexually mature or have adult pelage.
Adult	A fully grown mammal that is sexually mature.
Old adult	An animal that shows extreme tooth wear and/or poor body condition.

Sex

Sex will be determined based on visual observations of external sexual organs.

Weight

All mammals will be weighed using a balance and the weight reported in grams. Weight will be used to identify the oldest organisms. Organisms will be selected for gross necropsy and collection of target tissue based on weight to meet the target numbers specified in the site-specific SAP.

Dead Animals

Animals found dead in a trap will not be selected for gross necropsy and the collection of target tissues. Dead mammals will be disposed of in accord with the procedures outlined in OU3 SOP No. 12.

4.9 Gross Necropsy

A subset of the mammals collected will undergo necropsy for examination of gross and microscopic lesions in several target organs. The site-specific SAP specifies the target organs which will be selected for necropsy. Mammals that are not selected for necropsy will be disposed of in accord with the procedures outlined in OU3 SOP No. 12.

All animals selected for necropsy will be placed in a container and labeled with the unique small mammal field sample ID (e.g., SM-S-B-03-02). The animal should then be wetted for the gross necropsy examination and collection of tissues. Samples will be stored on wet ice in a cooler until necropsy can be performed.

When handling animals for necropsy, the primary consideration should be personal safety. Field personnel should be trained in techniques to handle mammals in a manner to minimize potential transfer of wildlife diseases. The necropsies will be performed by experienced and trained personnel.

The general steps for necropsy include:

- Depending on the size of the mammal, examine external and internal features with the unaided eye or with a dissecting microscope, whichever is appropriate.
- Examine the body surface of the mammal, and denote as normal or abnormal.
- Document presence of lesions on body surface, whether lesions are open or closed, and location of any such lesions.
- Examine the organs for color, size (swelling), and other gross abnormalities, including the presence of macroscopic lesions, nodules or plaques.

All observations during the gross necropsy should be recorded in a necropsy log book. Any abnormalities will also be recorded using photographs.

4.10 Collection and Preparation of Tissue Samples

Selected tissues will be removed and portions of the tissues will be sent for histopathology examination and the analysis of asbestos levels by Transmission Electron Microscopy (TEM). Target tissues are specified in the site-specific SAP.

A Small Mammal Tissue Field Sample Data Sheet (FSDS) (provided in OU3 SOP No. 9) should be completed for each small mammal in which tissues are collected.

For each tissue collected, one half will be preserved for histopathological examination and the second half will be kept preserved for tissue burden analyses. For each tissue sample collected for histopathology examination, the sample will be placed into a plastic container in a volume of 10% buffered formalin solution equal to at least 10 times the tissue volume to ensure adequate preservation. For each sample collected for asbestos tissue burden, the sample will be placed in a glass scintillation vial and maintained and shipped on ice.

Personnel should wear powder-free gloves for labeling and handling of vials, and for the dissection procedure. Plastic bottles used for tissue specimens should have a wide mouth and threaded caps for secure closure. Plastic bottles eliminate the potential breakage problems. All wide-mouth plastic collection bottles need to be labeled and pre-weighed before collecting tissue samples. Ensure the balance is level with a stable zero (no sample or vial). Tissue-specific sample Index IDs (e.g., P3-12345) should be affixed to all tissue collection containers for proper identification. Sample labeling procedures are specified in OU3 SOP No. 9.

Dissecting tools will be dedicated to specific procedures. Dissecting tools used to expose the internal organs will not be used to remove tissues. Dissection tools should be decontaminated between each animal examined.

Variability between species may result in some differences in the appearance and relative size of particular organs and tissues, but their location will be similar among species. When dissecting tissues, care should be taken to avoid squeezing or distorting tissues with forceps.

Detailed procedures for tissue sample collection and preparation for each target organ of interest in the Libby OU3 Phase III investigation are described below:

- Thyroid. Remove the thyroid gland. Separate the gland into the two lobes and each into separate containers.

- Gastrointestinal (GI) Tract. To remove the GI tract, first tie off the GI tract near the throat area to prevent content from leaking out. Cut off the esophagus above the tied-off area and gently remove the entire GI area. The GI tract should be divided into four sections: esophagus, stomach, small intestine, and large intestine. The GI tract segments should be opened prior to fixation. For each GI section, the samples will be divided into two and each placed into the two separate containers.

- Lungs. Examine both lungs externally. If there are no obvious differences in size, shape or other gross pathology then remove each of the lungs and remove the lower lobe section from each and place in separate containers. If there are differences then each of the lungs should be divided into two parts and each part placed into separate containers.

- Adrenals. Remove the adrenal glands and place each in separate containers.

- Gross Lesions. If any lesions are noted, collect separate tissue samples for microscopic examination and other analyses. Cut a thin (1/8” – 1/4”) section of tissue that includes all

or portions of the lesion and adjacent apparently healthy tissue. Use caution not to crush tissue in or around the lesion. Place the tissue sample in a volume of 10% buffered formalin solution in a wide-mouth plastic bottle equal to at least 10 times the tissue volume to ensure adequate preservation. Also collect a sample of the tissue for analysis of asbestos content.

- Eye Lens. The eyeballs of each animal should be removed and preserved in a volume of 10% formalin. Eye lens dry weight will be determined using a modification of Lord's technique (Lord, 1959). The fixed lenses are removed from preserved eye balls within 12 months of preservation and dried at 95 degrees C until they reach a constant weight, usually in about 96 hours. Lenses are then removed from the oven and weight to the nearest 0.2 mg on a precision balance.

- Carcass. What remains of the animal after all tissue samples have been removed will be preserved in a volume of 10% buffered formalin solution in a wide-mouth plastic bottle equal to at least 10 times the tissue volume to ensure adequate preservation. The carcass sample will be archived.

For each target organ, the tissue sample will be weighed and the wet weight recorded on the Small Mammal Tissue FSDS form. [Note: There is not a minimum sample mass required for asbestos tissue burden analysis. In the literature, laboratory studies examining asbestos tissue burden have been performed using samples as small as 0.025 grams (Haque et al., 2001).]

Plastic containers for the histopathology samples should be filled with 10% buffered formalin solution at a volume of 10 times the tissue volume to ensure proper fixation. Formalin is classified as hazardous and the field team should take appropriate measures to prevent skin contact or vapor inhalation.

Glass scintillation vials for the asbestos tissue burden samples will contain no fluid and will be kept on wet ice.

4.11 Sample Packaging, Handling and Transportation

Field personnel will complete a chain-of-custody form for collected tissue samples in accord with Libby OU3 *Sample Documentation* (SOP No. 9) and *Sample Handling and Shipping* (SOP No. 8) procedures. It is the responsibility of the FLT to ensure that the containers are labeled and properly sealed to prevent leakage during transport. Pack the containers for shipping to minimize jarring the containers during shipment. Note that exposure of histological samples to extreme temperatures during shipping should be avoided since they can alter tissue characteristics, making tissues unsuitable for histological examination. Check with local couriers regarding current requirements or restrictions for shipment of formalin.

Samples collected and preserved for histopathology shall be transported to a laboratory qualified and experienced in performing histopathology examination of tissues. The histopathology laboratory will be responsible for further fixation and preparation of samples for histopathological examination.

Samples collected for asbestos residue analyses will be transported on wet ice to an EPA-approved analytical laboratory.

5.0 DATA VALIDATION

All data recorded on trapping logs and FSDS forms will be checked by the FTL against records kept in field logbooks. It is also the responsibility of the FTL to verify the contents of each shipping cooler against the chain-of-custody form prior to shipment.

6.0 DECONTAMINATION AND HEALTH AND SAFETY

According to the Centers for Disease Control and Prevention (CDCP), several species of small mammals (e.g., *Peromyscus maniculatus, Sigmodon hispidus,* and *Microtus pennsylvanicus*) have been found to carry and potentially transmit a hantavirus to humans (CDCP 1996). Field biologists and other personnel who are exposed to small mammal body fluids and excreta are particularly at risk of Hantavirus infection (Mills et al. 1995). This virus can cause hantavirus pulmonary syndrome (HPS), which has been fatal to a high percentage of exposed individuals. Individuals who plan to trap, handle, process, or otherwise be involved in any activities related to small mammals should be educated about the inherent risks of such activities, as well as ways to minimize those risks.

All equipment used in the sampling process shall be decontaminated prior to field use and between sample locations. Decontamination procedures are presented in OU3 SOP No. 7. Personnel shall don appropriate personal protective equipment as specified in the health and safety plan. Any investigation-derived waste generated in the sampling process shall be managed in accordance with the procedures outlined in OU3 SOP No. 12.

7.0 REFERENCES

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FIGURES

Figure 1. Examples of Small Mammal Traps

Sherman Live Trap

Havahart Trap

APPENDIX A
SMALL MAMMAL TRAPPING LOG

LIBBY OU3: Small Mammal Trapping Log (Rev 0)

Station ID: _____ **Field Logbook ID:** _____ **Logbook Page No.:** _____

Trap Collection Date/Time [mm/dd/yy hh:mm]	**Transect ID**	**Trap #**	**Animal #** [see Note 1]	**Species** [see Note 2]	**Lifestage** (circle one)	**Sex** (circle one)	**Captured Alive (A)/ Dead (D)**	**Weight** (grams)	**Notes of Physical Abnormalities**	**Photo Number(s)**	**Selected for Tissue/Histo.**
					JV IM SA AD OA	M F					
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Notes:

[1] If multiple animals are collected from the same trap, they should be assigned unique sequential identifiers.

[2] See SOP MAMMAL-LIBBY-OU3 for species identifier codes.

Age Categories: JV = juvenile; IM = immature; SA = subadult; AD = adult; OA = old adult

Sex Categories: M = Male; F = Female