1278847

Final
Libby Amphibole Screening Investigation In Wood Waste Piles

Sampling and Analysis Plan

For
Lincoln County Landfills
Troy And Libby, Montana

Prepared for:
Montana Department of Environmental Quality
Remediation Division
Helena Montana

Prepared by:
Tetra Tech
Helena, Montana

May 2012

FINAL

LIBBY AMPHIBOLE SCREENING INVESTIGATION IN WOOD WASTE PILES

SAMPLING AND ANALYSIS PLAN

FOR

LINCOLN COUNTY LANDFILLS TROY AND LIBBY, MONTANA

Prepared for:

Montana Department of Environmental Quality
Remediation Division
P.O. Box 200901
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Contract Number 407026
Task Order Number 97

May 2012

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SAMPLING AND ANALYSIS PLAN

FOR

LINCOLN COUNTY LANDFILLS TROY AND LIBBY, MONTANA

Prepared for:

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

REVIEWS AND APPROVALS

Tetra Tech Project Manager: J. Edward Surbrugg, Ph.D. Date: May 22, 2012

DEQ Project Officer: John Podolinsky Date: May 25, 2012

EPA Remedial Project Manager: Elizabeth Pagen Date: May 25, 2012

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ACRONYMS AND ABBREVIATIONS

≥	Greater than or equal to
µm	Micrometer
AHERA	Asbestos Hazard and Emergency Response Act
BMP	Best Management Practices
CCA	Chromated copper arsenate
cm	Centimeter
COC	Chain-of-custody
DEQ	Montana Department of Environmental Quality
DQO	Data Quality Objectives
EDXA	Energy dispersive x-ray analysis
EPA	U.S. Environmental Protection Agency
ESAT	Environmental Services Assistance Team
FDI	Fiber-free deionized water
FSDS	Field Sample Data Sheet
g	Gram
GPS	Geographical positioning system
HASP	Health and safety plan
ISO	International Organization for Standardization
LA	Libby Amphibole
mL	Milliliter
mm	Millimeter
OSHA	Occupational Safety and Health Administration
PDA	Trimble Geo XT GPS (Personal Digital Assistant)
PPE	Personal protective equipment
QA	Quality assurance
QC	Quality control
SAP	Sampling and analysis plan
SAED	Selective area electron diffraction
SOP	Standard operating procedure
SRC	Scientific Research Corporation
TEM	Transmission electron microscopy

1.0 PROJECT DESCRIPTION AND MANAGEMENT

Tetra Tech received Task Order No. 97 from the Montana Department of Environmental Quality (DEQ) under Contract No. 407026. The task order is to provide asbestos sampling of wood waste piles at the Lincoln County Landfills in Troy and Libby, Montana (Troy and Libby Landfill sites). This Sampling and Analysis Plan (SAP) provides guidance and quality control (QC) methods for selecting the sampling locations, documenting sample collection methods, and analyzing samples of the wood waste pile components: brush, bark, and manufactured wood product debris. Tetra Tech will submit the samples for analysis and complete data verification and cursory validation. A data summary report will be generated after the completion of tasks described in this SAP. The report will be written by Tetra Tech's Helena, Montana project staff and will adhere to the Tetra Tech internal quality assurance/quality control (QA/QC) review process.

Figures and appendices are at the end of the document. Appendix A contains pertinent standard operating procedures (SOP), Appendix B contains the site Health and Safety Plan (HASP), and Appendix C contains field forms. The field team member's training certificates are in Appendix D and site photographs are in Appendix E. Finally, the Analytical Requirements Summary table for brush, bark, and manufactured wood waste materials is in Appendix F.

1.1 PURPOSE OF THE INVESTIGATION

This investigation and general investigation objectives are to characterize wood waste material stockpiles in two Lincoln County landfills for Libby Amphibole (LA) asbestos prior to processing and disposal. This SAP was prepared to:

- Provide a standardized method for collection of samples of wood wastes in both landfills to be analyzed for LA asbestos.
- Submit samples to an analytical laboratory for determination of LA asbestos concentrations using approved sample preparation and analytical techniques.
- Conduct QC and cursory data validation to ensure the quality of analytical results.
- Provide LA detection results to allow Lincoln County to make decisions for handling the wood wastes (off-site disposal, chipping and grinding).

To complete this investigation, Tetra Tech will collect eight composite samples from the wood waste pile at the Troy Landfill (Figure 1-1) and 15 composite samples from the wood waste pile at the Libby Landfill (Figure 1-2). Sample analysis of the three wood waste components; brush, bark, and manufactured wood product debris, will be used to evaluate the presence or absence of LA asbestos. The three wood waste pile components will be sampled separately to provide individual component results for future handling and disposal decisions.

1.1.1 Site Background

The Lincoln County Environmental Health Department manages the Troy and Libby landfills and has requested residents bring their wood wastes to the landfills rather than disposing of the materials on their properties. The wood waste piles at the landfills have been accumulating waste materials for approximately two years; there is currently little space remaining for additional wood wastes at either landfill. Therefore, wood waste materials at the Troy and Libby landfill sites are slated for chipping, grinding and removal or disposal. Recent analysis of bark and wood chip samples from other operable units in the Libby Asbestos Superfund Site has yielded detectable levels of LA asbestos. Prior to proceeding with the wood waste processing and disposal at the Troy and Libby landfills, DEQ requested sampling and analysis of the wood waste pile materials to determine the presence or absence of LA asbestos. The tasks described in this SAP are designed to implement this sampling and analysis effort. The sample collection and analytical procedures proposed are similar to the U.S. Environmental Protection Agency (EPA) Region 8 procedures established for the remedial investigation work for Operable Unit 3 at the Libby Asbestos Superfund site. The procedures for collection and analysis of the wood waste samples are guided by two separate SOPs provided in Appendix A.

1.2 PROJECT DESCRIPTION

The sampling and analysis is to identify the presence or absence of LA in the Troy and Libby landfill wood waste piles. This project will include collecting composite brush, bark, and manufactured wood product material samples from eight representative perimeter locations from the wood waste pile at the Troy Landfill site (Figure 1-1) and 15 representative perimeter locations from the wood waste pile at the Libby Landfill site (Figure 1-2).

Samples will be from the three wood waste pile components: (1) brush materials (branches averaging ¼ inch to 4 inches in diameter and foliage and other organic debris from various species, predominantly conifers), (2) tree bark (bark only from tree stumps and branches or trees larger than 4 inches in diameter), and (3) manufactured wood product debris. Samples will be obtained from selected perimeter

locations around the wood waste piles. This sampling effort is considered a screening survey since the wood waste materials in the pile interiors cannot be safely sampled during this initial investigation. If LA is detected in the wood waste material samples, the DEQ and EPA may recommend further characterization. Additional samples may be needed from the interior areas of the wood waste piles, or additional activity-based sampling may be done during future chipping and grinding activities. If no LA is detected in the stockpiled wood waste materials, the DEQ and EPA may still recommend additional samples be collected from other interior areas of the wood waste piles. Additional samples can also be collected from the processed wood chips and analyzed for LA.

Samples will be prepared for analysis using a process involving drying, ashing, acid treatment, and filtration followed by analysis using transmission electron microscopy (TEM).

1.3 PROJECT TEAM ORGANIZATION

Mr. John Podolinsky of the DEQ is the Project Officer. He will provide oversight of Tetra Tech for all tasks listed under this task order, will review this draft SAP, and will solicit reviews from EPA prior to initiation of field activities. Ms. Elizabeth Fagen, EPA Remedial Project Manager for the Libby Superfund site, will review the draft SAP or designate other EPA personnel to review and provide comments. Ms. Kathi Hooper is the Lincoln County contact for this project. She, or the landfill supervisor, Mr. Ray Miller, will provide site access to Tetra Tech for all activities identified in this SAP.

Tetra Tech will address DEQ and EPA comments, if any, on the draft SAP and prepare the final SAP, and will provide field personnel to collect the samples, ship the samples to the analytical laboratory, complete cursory data validation, and prepare a data summary report of the results. Tetra Tech will provide individual wood waste pile component results that will be used by the County to make future wood waste processing, handling, and disposal decisions.

Dr. J. Edward Surbrugg will be the project manager for Tetra Tech and Mr. Mark Stockwell will be the field sampling team leader. Dr. Surbrugg will be the project quality assurance manager and Mr. Stockwell will be responsible for collecting the samples and properly shipping them to the laboratory. The samples will be collected as described in sections below.

Samples collected will be delivered for preparation and analysis for LA asbestos to the EMSL Laboratory in Libby, Montana as approved and coordinated with EPA. The EPA Environmental Services Assistance Team (ESAT) has procured the EMSL Laboratory for this particular type of analytical laboratory services. Mr. Don Goodrich (EPA Region 8) is responsible for managing the ESAT laboratory support

contract. The laboratory coordinator for the Libby project is TechLaw, Inc. and the primary point of contact, Mr. Doug Kent, will help direct the analytical laboratory, prioritize the analysis needs, and manage laboratory capacity.

The DEQ will be responsible for all aspects of data management for this project. The primary database administrator is Ms. Randy Dorian (Tetra Tech) who will be responsible for sample tracking, data uploads, performing error checks, and ensuring data is properly loaded into the Libby Superfund Site database.

1.4 SPECIAL TRAINING AND CERTIFICATION

A project-specific HASP for Tetra Tech personnel has been prepared and will be available on site for guidance before and during the sampling. The HASP includes general site information, site-specific waste characteristics, hazard evaluation, summary of the field tasks, and emergency information including contact phone numbers and a map identifying the routes from both landfills to the hospital in Libby. The HASP is attached as Appendix B.

Each member of the field team has taken the Occupational Safety and Health Administration (OSHA) 40-hour hazardous materials handling course, meeting the requirements of 29 Code of Federal Regulations 1910.120 along with various updates and supplemental training. The Tetra Tech field team members are certified as asbestos inspectors and contractor/supervisors through the EPA Asbestos Hazard and Emergency Response Act (AHERA) training program. Copies of the field team members' training certificates are in Appendix D.

2.0 DATA QUALITY OBJECTIVES

The Data Quality Objectives (DQO) process is a series of planning steps designed to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended purpose. The DQOs presented in this section were developed in accordance with EPA guidance (EPA 2006).

DQOs help to clarify the study objectives, define the most appropriate data to collect and the conditions under which to collect the data, and specify tolerable limits on decision errors that will be used as the basis for establishing the quantity and quality of data needed to support decision-making. The DQOs are used to develop a scientific and resource-effective design for data collection.

The DQO process consists of seven steps; output from each step influences the choices made later in the process. These steps are:

1. State the problem
2. Identify the decision
3. Identify the inputs to the decision
4. Define the study boundaries
5. Develop decision rules
6. Specify tolerable limits on decision errors
7. Optimize the investigation design

2.1 STEP 1 – STATE THE PROBLEM

This step describes the problem to be addressed. One issue of high priority to EPA is an evaluation of the presence or absence of LA asbestos in the wood waste materials at the Troy and Libby landfill sites – answers are needed for these questions:

- Is LA asbestos present in wood waste materials at the Troy or Libby landfills that could pose an unacceptable risk to human health?
- If LA asbestos is present, what are the disposal options?

To help evaluate the reuse or disposal options of the wood waste materials in regards to protectiveness of human health, information is needed to complete characterization of potential risk exposure to wood waste materials during processing, reuse, or disposal. The objective of this SAP is to specify how to obtain specific data to be used in answering the problem statements.

2.2 STEP 2 – IDENTIFY THE DECISION

This step identifies the questions the wood waste materials sampling project is designed to answer and what actions may result. The principal questions and possible alternative actions are included in Table 2-1:

TABLE 2-1
PRINCIPAL STUDY QUESTIONS AND ALTERNATIVE ACTIONS

Response Item Evaluated	Principal Study Question	Alternative Actions
Quantify concentrations of LA asbestos in three types of wood waste materials (brush, bark, and manufactured wood products).	1. Is LA asbestos present in wood waste materials? 2. Is LA asbestos present in wood waste materials at concentrations that trigger specific handling and disposal options to prevent further risk to human health?	▪ Using sampling protocols similar to those stated in EPA Bark and Duff Sampling SOPs (2012a and 2012b) collect brush, bark, and manufactured wood waste samples at the Troy and Libby landfills. ▪ Take no action
		▪ Using air monitoring and activity based sampling protocols while grinding or chipping in preparation for disposal or reuse for manufactured wood waste samples at the Troy and Libby landfills. ▪ Using best management practices (BMP)such as wetting of materials or implementing water mist curtains to prevent migration of dust from the chipping/grinding area. ▪ Take no action

LA Libby Amphibole
SOP Standard operating procedure
BMP Best management practices

2.3 STEP 3 – IDENTIFY THE INPUTS TO THE DECISION

This step identifies the information and measurements needed to resolve the decision statements. The information needed to resolve the principal study questions is summarized in Table 2-2.

TABLE 2-2

SUMMARY OF INPUTS TO RESOLVE STUDY QUESTIONS AND USE OF INFORMATION ACQUIRED FROM INPUTS

Principal Study Question	Input to Resolve Question	Use of Input to Resolve Question
1. Is LA asbestos present in wood waste materials? 2. Is LA asbestos present in wood waste materials at concentrations that trigger specific handling and disposal options to prevent further risk to human health?	1. Brush, bark, and manufactured wood samples. 2. Air monitoring during chipping/grinding, activity based sampling, implementation of BMPs.	At the troy and Libby landfills, brush, bark, and manufactured wood samples will be collected using protocols similar to those used in the Tree Bark and Duff SOP. Depending on analytical results, the DEQ, EPA, and Lincoln County will make a determination on the reuse of the material as mulch, or, if not suitable for reuse, the necessary handling and disposal options for the wood wastes or need for further sampling.

Notes:

LA Libby Amphibole
BMP Best management practices

The data needed to achieve the objectives of this effort consist of accurate and reliable measures of LA in wood waste materials present at both the Troy and Libby landfills. The following sections identify key attributes of the data needed for this effort.

2.3.1 Sampling Locations

The wood waste pile at the Troy landfill is approximately 90 by 141 feet and averages approximately 12 feet high (approximately 5,640 cubic yards). It is along the northwest side of the Troy landfill. Tetra Tech intends to collect eight samples from the brush, bark, and manufactured wood product materials around the perimeter of the wood waste pile. The wood waste pile at the Libby landfill is approximately 261 by 231 feet and averages approximately 14 feet high (approximately 31,262 cubic yards). The pile is along the north side of the Libby landfill. Tetra Tech intends to collect 15 samples from the brush, bark, and manufactured wood product materials around the perimeter of the wood waste pile.

2.3.2 Types of Samples

This project will include collecting composite brush, bark, and manufactured wood product material samples from eight representative perimeter locations from the wood waste pile at the Troy Landfill site and 15 representative perimeter locations from the wood waste pile at the Libby Landfill site.

2.3.3 Target Analyte List

Bark samples will be prepared and analyzed for LA asbestos in accordance with Section 6 of *Libby Asbestos Superfund Site Standard Operating Procedure, Sampling and Analysis of Tree Bark for Asbestos*, Revision 3 (EPA 2012a) (Appendix A). Brush and manufactured wood product debris samples will be prepared and analyzed in accordance with Section 6 of *Libby Asbestos Superfund Site Standard Operating Procedure, Sampling and Analysis of Duff for Asbestos, Revision 2* (EPA 2012b) (Appendix A). Preparation and analytical requirements for bark, brush, and manufactured wood product debris samples are summarized in Appendix F.

If during the investigation the field team members suspect that any manufactured wood product present in the pile may contain chromated copper arsenate (CCA) treated materials, then those materials will be noted in the field logbook and photographed. No samples of suspected treated manufactured wood products will be collected for asbestos analyses.

2.4 STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

This step specifies the spatial and temporal boundaries of the ABS.

2.4.1 Spatial Bounds

The spatial bounds of this study are restricted to the wood waste materials piles at both the Troy and Libby landfills.

2.4.2 Temporal Bounds

The exact dates of the waste wood pile sampling are not important and neither field protocol nor analytical results should be affected by temporal variability.

2.5 STEP 5 – DEVELOP DECISION RULES

This step describes the method to determine whether the data collected indicate acceptance with decision rules and the resulting decision applied when acceptance is not obtained. The principal study questions, inputs to resolve study questions, action levels, and decision rules are summarized in Table 2-3.

TABLE 2-3
DECISION RULES

Principal Study Question	Input to Resolve Question	Input Requirements	Action Level	Decision Rule
1. Is LA asbestos present in wood waste materials? 2. Is LA asbestos present in wood waste materials at concentrations that trigger specific handling and disposal options to prevent further risk to human health?	1. Brush, bark, and manufactured wood samples. 2. Air monitoring during chipping/grinding, activity based sampling, implementation of BMPs.	1. Bark/Duff SOPs 2. Air monitoring/ABS guidance. BMP SOPs.	1. Not determined at this time. However, any detectable LA asbestos in laboratory samples will trigger disposal of materials. 2. Not determined at this time, however, any detectable LA in laboratory samples will trigger special handling requirements based on findings of monitoring during grinding and ABS activities post grinding/chipping.	If brush, bark, and manufactured wood sample results exceed a specified level (yet to be determined), these concentrations could pose an unacceptable risk to human health if the waste is chipped or ground for reuse as mulch; therefore, alternative processing methods may be required. If brush, bark, and manufactured wood sample results exceed a specified level (yet to be determined), or air monitoring during grinding or ABS sampling after grinding produces detectable concentrations of LA asbestos, these concentrations could trigger specific handling and disposal options.

Notes:
LA Libby Amphibole
ABS Activity based sampling

The decision rules for evaluating risks from processing and disposal of LA contaminated wood waste piles properties are:

- If brush, bark, and manufactured wood sample results exceed a specified level (yet to be determined), these concentrations could pose an unacceptable risk to human health if the waste is chipped or ground for reuse as mulch; therefore, alternative processing methods may be required.

- If brush, bark, and manufactured wood sample results exceed a specified level (yet to be determined), these concentrations could trigger specific handling and disposal options to prohibit further risk to human health; therefore, alternative handling and disposal options may be required.

EPA developed a quantitative procedure for evaluating the concentration of LA asbestos in tree bark and duff (EPA 2012a and EPA 2012b). The following analytical methods will be implemented to produce appropriate data to assess the presence or absence of LA asbestos in the wood waste materials (brush, bark, and manufactured wood wastes).

TEM examination will be done on the wood waste pile samples. Sample preparation and analytical methods are described in Section 6 of the Libby Asbestos Superfund Site SOPs in Appendix A. The laboratory will prepare three grids for TEM analysis as detailed in International Organization for Standardization (ISO) TEM method 10312, also known as ISO 10312:1995(E). The laboratory will use two grids for analysis, and archive one grid.

Samples will be delivered to the EMSL office in Libby for processing and analysis, or as instructed by the DEQ and EPA project officers. Analytical turnaround will be requested on priority basis (7-day turn-around times) and coordinated through the Libby-site EPA staff. Any problems during the analytical process will be addressed through a coordinated discussion between the EPA and the DEQ project officer.

All waste from the analytical process will be disposed of as per Section 6 of the Libby Asbestos Superfund Site SOPs.

Counting Rules

Grids will be examined using TEM in accord with ISO 10312, with all relevant Libby site-specific modifications, including using the most recent version of all relevant project specific modifications, including LB-000016, LB-000019, LB-000028, LB-000029, LB-000030, LB-000053, and LB-000066. All fibrous amphibole structures that have appropriate Selective Area Electron Diffraction (SAED) patterns and Energy Dispersive X-Ray Analysis (EDXA) spectra, and having length greater than or equal

to 0.5 micrometer (µm) and an aspect ratio (length:width) greater than or equal to (≥) 3:1, will be recorded on the Libby site-specific laboratory bench sheets. Data recorded for any observed chrysotile and any other amphibole will also be recorded.

Bark Material Analysis Stopping Rules

The target analytical sensitivity for sample analysis will be no higher than 100,000 centimeters $(cm)^{-2}$. The analytical sensitivity is calculated using the following equation:

$$S = \frac{EFA}{GO \times Ago \times A \times F}$$

Where:

S = Sensitivity (cm^{-2})
EFA = Effective filter area (millimeters $[mm]^2$)
GO = Number of grid openings counted
Ago = Area of one gird opening (mm^2)
A = Area of tree bark sample being analyzed (cm^2)
F = Fraction of original sample deposited on the filter

Count the sample until one of the following occurs:

- The target sensitivity is achieved.
- Fifty or more LA structures are observed. In this case, counting may cease after completion of the grid opening that contains the 50th LA structure.
- One hundred grid openings are counted without reaching the target sensitivity or observing 50 LA structures. In this event, the laboratory should contact Tetra Tech and DEQ to ask for direction.

Brush and Manufactured Wood Product Materials Analysis Stopping Rules

The target analytical sensitivity for sample analysis will be no higher than 1E+07 $(grams)^{-1}$ that is likely to correspond to a mass fraction of less than about 0.005 grams (g) asbestos per g duff (dry weight). The analytical sensitivity is calculated using the following equation:

$$S = \frac{EFA}{GO \times Ago \times Mass \times F}$$

Where:

S = Sensitivity (1/g dry weight)
EFA = Effective filter area (mm^2)
GO = Number of grid openings counted
Ago = Area of one gird opening (mm^2)
Mass = Mass of the dried (but not ashed) duff sample (g)
F = Fraction of starting duff sample applied to the filter

Count the sample until one of the following occurs:

- The target sensitivity is achieved.
- Fifty or more LA structures are observed. In this case, counting may cease after completion of the grid opening that contains the 50th LA structure.
- One hundred grid openings are counted without reaching the target sensitivity or observing 50 LA structures. In this event, the laboratory should contact Tetra Tech or DEQ to ask for direction.

This document is focused on methods for collecting data on the concentration of LA asbestos that may be in the wood waste piles at the Troy and Libby landfills. These data will be used to evaluate the risk from the wood waste disturbance pathways such as processing and disposal.

2.6 STEP 6 – SPECIFY TOLERABLE LIMITS ON DECISION ERRORS

This step specifies the tolerable limits on decision errors, used to establish performance goals for the data collection design.

In making decisions about the concentration of LA in the waste wood piles at the Troy and Libby landfills and the level of health risk associated with potential exposures from processing and disposal of the wood waste, two types of decision errors are possible:

- A false negative decision error would occur if a risk manager decides that exposure to wood waste materials is not of significant health concern when in fact it is of concern.
- A false positive decision error would occur if a risk manager decides that exposure to wood waste materials is above a level of concern when in fact it is not.

EPA and DEQ are most concerned about guarding against the occurrence of false negative decision errors because this error type may result in exposure to unacceptable levels of LA during processing and disposal of the wood waste piles.

For this reason, it is anticipated that decisions regarding exposure to processing and reuse of the wood wastes for mulch will be based not only on the original waste wood samples collected from the perimeter of the piles, but may also may include future monitoring during grinding of the material for reuse or disposal and future ABS sampling that simulates the handling and spreading of the mulch.

EPA and DEQ are also concerned with the probability of making false positive decision errors. Although this type of decision error does not result in unacceptable human exposure, it may cause unnecessary expenditure of resources. For this effort, the strategy for controlling false positive errors is to collect a

large number of samples, consisting of 20 aliquots each, that will allow for sampling of a representative portion of the wood waste piles. The large number of samples, combined with the low sensitivity of the analytical method, substantially reduces the probability of a false positive decision error and that additional data may be needed to strengthen decision-making. For completing all seven steps of the DQO process, the null hypotheses and consequences of making an incorrect decision are summarized in Table 2-4.

2.7 STEP 7 – OPTIMIZE THE INVESTIGATION DESIGN

This step identifies a resource-effective data collection design for generating data to satisfy the DQOs. The data collection design is described in detail in the remaining sections of this SAP and other site documents referenced in Section 4.0.

TABLE 2-4

LIMITS ON DECISION ERRORS

Principal Study Question	Null Hypothesis	Type I Error Will Result in:	Type II Error Will Result in:
1. Is LA asbestos present in wood waste materials?	Disturbance of LA asbestos-contaminated wood waste exceeds a specified level during chipping and grinding and prohibits mulch reuse.	Determining that wood waste samples do not exceed a specified level when LA asbestos actually does exceed this level would lead to an increased risk to human health during chipping and grinding and mulch reuse	Determining that wood waste samples do exceed a specified level when LA asbestos actually does not exceed this level would lead to unnecessary and more costly processing and an inability to reuse the processed wood chips.
2. Is LA asbestos present in wood waste materials at concentrations that trigger specific handling and disposal options to prevent further risk to human health?	Disturbance of LA asbestos-contaminated wood waste piles exceeds a specified level and triggers specific handling and disposal options.	Determining that wood waste samples do not exceed a specified level when LA asbestos actually does exceed this level would lead to an increased risk to human health during handling and could lead to inappropriate disposal.	Determining that wood waste samples do exceed a specified level when LA actually does not exceed this level would lead to unnecessary and more costly handling and disposal.

Notes:
LA Libby Amphibole

3.0 DATA GENERATION AND ACQUISITION

The following sections describe sample collection and handling procedures.

3.1 SAMPLING DESIGN AND ANALYSIS

The initial sampling protocol includes eight composite samples collected from the wood waste pile at the Troy landfill site (Figure 1-1) and 15 composite samples collected from the wood waste pile at the Libby landfill site (Figure 1-2). Samples will be collected to represent each wood waste component in the wood waste piles: brush, bark, and manufactured wood product debris. The eight samples at Troy landfill will include four brush, two bark, and two manufactured wood product debris. The 15 samples at the Libby landfill will include eight brush, four bark, and three manufactured wood product debris.

If laboratory analysis detects LA in the wood waste piles, further characterization may be deemed necessary by the DEQ and EPA project officers. Additional characterization may include testing of other areas throughout the wood waste piles rather than just the pile perimeter. The exact sampling protocol will be determined as the project progresses. Sample collection could be recommended at additional locations as the circumferences of the piles are reduced during processing and disposal. Additional samples could also be collected from new brush, tree bark, and manufactured wood product materials that are brought in after this initial screening is completed.

3.1.1 Sampling Locations

The wood waste pile at the Troy landfill is approximately 90 by 141 feet and averages approximately 12 feet high (approximately 5,640 cubic yards). It is along the northwest side of the Troy landfill. Tetra Tech intends to collect eight samples from the brush, bark, and manufactured wood product materials around the perimeter of the wood waste pile. The wood waste pile at the Libby landfill is approximately 261 by 231 feet and averages approximately 14 feet high (approximately 31,262 cubic yards). The pile is along the north side of the Libby landfill. Tetra Tech intends to collect 15 samples from the brush, bark, and manufactured wood product materials around the perimeter of the wood waste pile.

Site photos of both landfill wood waste piles are shown in Appendix E.

3.1.2 Sampling Methods

Sample locations will be delineated on site sketches and recorded on a Trimble Geo XT Geographical Positioning System (GPS) personal digital assistant (PDA). The PDA will be used to record the midpoint latitude and longitude for each composite sample location. If there are general problems during the sampling process, the field team manager will contact Tetra Tech's QA officer and the DEQ project manager for clarification.

Bark waste sampling will proceed in general accordance with Section 5 of *Libby Asbestos Superfund Site Standard Operating Procedure, Sampling and Analysis of Tree Bark for Asbestos*, Revision 3 (EPA 2012a), and brush and manufactured wood product debris sampling will proceed in general accordance with Section 5 of *Libby Asbestos Superfund Site Standard Operating Procedure, Sampling and Analysis of Duff for Asbestos*, Revision 2 (EPA 2012b). Both of these SOPs are in Appendix A. Specific sampling procedures are provided below.

Brush Sampling Method – Brush materials generally consist of tree branches that average between ¼ inch to 4 inches in diameter and foliage and other organic debris from various trees and shrubs, predominantly conifers, including pine needles, leafy vegetation, grass clippings, etc. Twenty aliquots will be collected for each 1-gallon sample. Each aliquot will be collected from a variety of tree and shrub species in an approximate area that is ten feet across and from the ground to about five feet high. The field team will document the selected species and general locations in the field logs. Aliquots will consist of tree branch cross sections and foliage collected with limb saws and pruning shears. Each 20-aliqout sample will be composited into an asbestos-free 1-gallon plastic recloseable bag.

Bark Sampling Method – Bark material debris generally consists of bark from tree stumps and branches or trees larger than 4 inches in diameter located within the slash piles and at segregated tree trunk/stump piles at both the Troy and Libby landfills. Prior to sample collection, Tetra Tech will spray the area of bark to be sampled with hairspray to help hold and secure any potential asbestos fibers that may be present on the bark sample. After the hairspray has dried, twenty aliquots will be collected for each composite sample. A 1-inch hole saw will be used to cut circular rings in the bark at each aliquot location. Aliquots will be collected from a variety of stumps and trees, and the field team will document the selected species and locations in the field logs. Following the cutting of the hole, each circular piece of bark will be pried from the tree or stump with a sharp chisel. Once detached from the tree or stump, the composite bark aliquots will be placed in a labeled asbestos-free 1-gallon plastic recloseable bag, representing one composite sample.

Manufactured Wood Product Debris Sampling Method – Manufactured wood product materials generally consists of dimensional lumber and plywood debris that appears to be from building demolition. The debris is comingled in the wood waste piles. Two 20-aliquot composite samples will be collected from the Troy landfill wood waste pile and three from the Libby landfill wood waste pile. The aliquots will be collected from a variety of debris types in the piles. The field team will document the types of selected debris and general locations in the field logs. Aliquots will consist of approximately 1-inch square pieces collected with a sawzall or hand saw. Each 20-aliqout composite sample will be placed in a labeled asbestos-free 1-gallon plastic recloseable bag.

3.1.3 Analytes of Concern

Bark samples will be prepared and analyzed for LA asbestos in accordance with Section 6 of *Libby Asbestos Superfund Site Standard Operating Procedure, Sampling and Analysis of Tree Bark for Asbestos*, Revision 3 (EPA 2012a) (Appendix A). Brush and manufactured wood product debris samples will be prepared and analyzed in accordance with Section 6 of *Libby Asbestos Superfund Site Standard Operating Procedure, Sampling and Analysis of Duff for Asbestos*, Revision 2 (EPA 2012b) (Appendix A). Preparation and analytical requirements for bark, brush, and manufactured wood product debris samples are summarized in Appendix F.

If during the investigation the field team members suspect that any manufactured wood product present in the pile may contain chromated copper arsenate (CCA) treated materials, then those materials will be noted in the field logbook and photographed. No samples of suspected treated manufactured wood products will be collected for asbestos analyses.

3.1.4 Sample Containers and Holding Times

All samples will be placed into labeled plastic bags. The reclosable plastic bag containing the sample will be placed in an outer plastic bag. Samples will not need to be chemically preserved. All procedures will follow standard EPA sample handling protocols. A pre-printed sample label will be affixed to the inner reclosable bag and the sample ID number written on the outside of the inner bag. The outer reclosable plastic bag will be labeled and marked similarly using the pre-printed sample ID numbers. Samples will be labeled with a unique sample identification number “WW-XXXXX” where “WW” indicates a wood waste pile sample. Chain-of-custody (COC) procedures will be followed for all samples. COC records will be completed in accordance with Section 3.2.4 and kept with the samples and custody seals placed on the sample bags.

3.1.5 Decontamination

Decontamination of the hole saws, sawzalls, pruning shears, chisels, and other sampling equipment will be necessary. Heavy debris will be brushed off and the equipment decontaminated where the sample was collected. The equipment will be sprayed with distilled water followed by drying with paper towels. The water will be allowed to fall on the ground in the area just sampled and the paper towels will be placed in a labeled asbestos waste bag.

Visible debris on hands or clothing will be removed by washing with soap and water. Personal protective equipment (PPE) will be asbestos-free and include disposable gloves, disposable protective outerwear, work boots, disposable boot covers, and respirators. The respirators will be cleaned and decontaminated as discussed in the HASP (Appendix B). All equipment will be decontaminated before leaving the site to prevent off-site contamination.

3.1.6 Management of Investigation-Derived Waste

The field team may generate contaminated and potentially contaminated investigation-derived wastes that may include used PPE and disposable sampling and decontamination supplies.

Decontamination of sampling equipment will take place at the sampling site to prevent spread of contaminants to uncontaminated areas or areas that have not been sampled. Disposable equipment for one-time use and PPE materials will be appropriately disposed of as asbestos-containing materials waste at the Libby landfill.

3.2 SAMPLE HANDLING AND CUSTODY

The following subsections describe sample handling procedures, including sample identification and labeling, documentation, COC, and shipping.

3.2.1 Sample Identification System

Each wood waste pile composite sample will be assigned a unique alpha-numeric identification number (two digit prefix with five digits after the dash), “WW-XXXXX” where “WW” indicates a wood waste pile sample.

The sample numbering system allows each sample to be uniquely identified, and provides a means of tracking each sample from collection through analysis. The sample identification numbers will be compatible with the Libby Asbestos Superfund Site database. Sample collection observations and notes will be recorded on the Field Sampling Data Sheet (FSDS) and in the field log book.

3.2.2 Sample Labels

The pre-printed sample labels will be affixed to all sample bags and the they will be labeled using a permanent marker as a backup in case the pre-printed labels are damaged or become unreadable.

3.2.3 Sample Documentation

Documentation is essential to ensure proper sample identification. Field personnel will adhere to the following general guidelines for maintaining field documentation in the field logbook, on the completed FSDS, and for documenting project photographs:

- Documentation will be in permanent black ink.
- All entries will be legible.
- Errors will be corrected by crossing out with a single line and initialing the lineout.
- Unused portions of pages will be crossed out, and each page will be signed and dated.

Section 3.5.1 includes additional information on how field personnel will use logbooks to document field activities. The field team leader is responsible for ensuring that sampling activities are properly documented.

3.2.4 Chain-of-Custody

Field personnel will use standard sample custody procedures to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the following statements applies:

- The sample is in a person's physical possession or view.
- The sample is in a secure area with restricted access.
- The sample is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

COC procedures provide an accurate written record that traces the possession of individual samples from the time of collection in the field to the time of acceptance at the laboratory. The COC record will be used to document all samples collected and the analysis requested. Information that will be recorded on the COC record includes:

- EPA site number
- COC Number
- Entity that generated COC
- Destination of samples (laboratory name)
- Lab contact name
- Sample ID
- Tag
- Sample date
- Matrix
- Analysis requested
- Turn-around-time
- Total number of samples
- Revision number
- Date shipped
- Signatures of individuals involved in custody transfer, including the date and time of transfer

The field COC form be evidence of custody transfer between field personnel and the laboratory. Copies of the COC records will be retained and filed by field personnel before the sample containers are shipped.

The Tetra Tech field sample coordinator will print out a hard copy of the COC record and store it with the associated brush, bark, or manufactured wood waste samples. A hard copy of the COC record will be transferred with the samples to the analytical laboratory.

Until samples have been transferred to the laboratory, they will be securely held by Tetra Tech. Samples may be stored in storage bins in locked vehicles or in a secured (locked) area of the Tetra Tech Troy field office. All the samples, including QC samples, will be transferred to the analytical laboratory within 24 hours of collection. The analytical laboratory will provide Tetra Tech with a copy of the released COC. An example COC record is in Appendix C. Laboratory COC begins with sample receipt and continues until samples are discarded.

3.2.5 Sample Transfer

The laboratory will designate a specific individual as the sample custodian. The custodian will receive all incoming samples, sign the accompanying COC forms, and retain copies of the forms as permanent

records. The laboratory sample custodian will record all pertinent information concerning the samples, including the persons delivering the samples, the date and time received, sample condition at the time of receipt (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample identification numbers, and any unique laboratory identification numbers for the samples. Once the sample transfer process is complete, the custodian is responsible for maintaining internal logbooks, tracking reports, and other records necessary to maintain custody throughout sample preparation and analysis. The custodian will ensure that samples will be properly stored and maintained prior to analysis.

3.3 ANALYTICAL METHODS

After sample preparation, TEM examination will be done on the wood waste pile samples. Sample preparation and analytical methods are described in Section 6 of the Libby Asbestos Superfund Site SOPs in Appendix A. The laboratory will prepare three grids for TEM analysis as detailed in International Organization for Standardization (ISO) TEM method 10312, also known as ISO 10312:1995(E). The laboratory will use two grids for analysis, and archive one grid.

Samples will be delivered to the EMSL office in Libby for processing and analysis, or as instructed by the DEQ and EPA project officers. Analytical turnaround will be requested on priority basis (7-day turn-around times) and coordinated through the Libby-site EPA staff. Any problems during the analytical process will be addressed through a coordinated discussion between the EPA and the DEQ project officer.

All waste from the analytical process will be disposed of as per Section 6 of the Libby Asbestos Superfund Site SOPs.

Counting Rules

Grids will be examined using TEM in accord with ISO 10312, with all relevant Libby site-specific modifications, including using the most recent version of all relevant project specific modifications, including LB-000016, LB-000019, LB-000028, LB-000029, LB-000030, LB-000053, and LB-000066. All fibrous amphibole structures that have appropriate Selective Area Electron Diffraction (SAED) patterns and Energy Dispersive X-Ray Analysis (EDXA) spectra, and having length greater than or equal to 0.5 micrometer (µm) and an aspect ratio (length :width) greater than or equal to ($\geq$) 3:1, will be recorded on the Libby site-specific laboratory bench sheets. Data recorded for any observed chrysotile and other amphibole will also be recorded.

Bark Material Analysis Stopping Rules

The target analytical sensitivity for sample analysis will be no higher than 100,000 centimeters $(cm)^{-2}$. The analytical sensitivity is calculated using the following equation:

$$S = \frac{EFA}{GO \times Ago \times A \times F}$$

Where:

S = Sensitivity (cm^{-2})
EFA = Effective filter area (millimeters $[mm]^2$)
GO = Number of grid openings counted
Ago = Area of one gird opening (mm^2)
A = Area of tree bark sample being analyzed (cm^2)
F = Fraction of original sample deposited on the filter

Count the sample until one of the following occurs:

- The target sensitivity is achieved.
- Fifty or more LA structures are observed. In this case, counting may cease after completion of the grid opening that contains the 50th LA structure.
- One hundred grid openings are counted without reaching the target sensitivity or observing 50 LA structures. In this event, the laboratory should contact Tetra Tech and DEQ to ask for direction.

Brush and Manufactured Wood Product Materials Analysis Stopping Rules

The target analytical sensitivity for sample analysis will be no higher than 1E+07 $(grams)^{-1}$ that is likely to correspond to a mass fraction of less than about 0.005 grams (g) asbestos per g duff (dry weight). The analytical sensitivity is calculated using the following equation:

$$S = \frac{EFA}{GO \times Ago \times Mass \times F}$$

Where:

S = Sensitivity (1/g dry weight)
EFA = Effective filter area (mm^2)
GO = Number of grid openings counted
Ago = Area of one gird opening (mm^2)
Mass = Mass of the dried (but not ashed) duff sample (g)
F = Fraction of starting duff sample applied to the filter

Count the sample until one of the following occurs:

- The target sensitivity is achieved.
- Fifty or more LA structures are observed. In this case, counting may cease after completion of the grid opening that contains the 50th LA structure.
- One hundred grid openings are counted without reaching the target sensitivity or observing 50 LA structures. In this event, the laboratory should contact Tetra Tech or DEQ to ask for direction.

3.4 QUALITY ASSURANCE/QUALITY CONTROL SAMPLING

Field and laboratory QA and QC samples for this effort will consist of the following:

Field Co-Located Samples

One co-located duplicate brush wood waste material sample will be collected in addition to the eight wood waste pile samples at the Troy landfill. One co-located duplicate brush sample will also be collected from the Libby landfill site. The co-located duplicate brush wood waste samples will be collected from the same branches or wood pieces and be of approximately equal size and length. The co-located samples will be labeled with unique identifiers. The sample details will be recorded on the FSDS, including the unique identifiers of the "parent" field samples.

Laboratory Blanks

A laboratory blank is a filter that is prepared by processing a clean crucible in the same way that a brush sample is prepared. That is, a clean crucible is placed in the oven (with the sample set) at the same time that tree-bark samples are undergoing ashing. After ashing, the laboratory blank crucible is treated by addition of water and hydrochloric acid. The contents of the crucible are rinsed out, diluted to 100 milliliters (mL), and an aliquot at least as large as the highest volume aliquot for the sample set is removed and used to prepare a filter for TEM examination. This type of blank is intended to indicate if contamination is occurring at any stage of the sample preparation procedure. Laboratory blanks should be prepared at a rate of 3 percent.

Filtration Blanks

A filtration blank is a clean filter that is prepared by passing 100 mL of laboratory fiber-free deionized water (FDI) water through it. This type of blank is to ensure that the filters are not contaminated in the

laboratory, and that fluids used for diluting and processing samples are fiber free. Filtration blanks should be prepared at a rate of 2 percent.

Laboratory Duplicates

Laboratory duplicates will be prepared by applying a second aliquot of ashed residue suspension to a new filter, that is then prepared and analyzed in the same fashion as the original filter. The frequency of laboratory duplicates should be no less than 5 percent.

Recounts

The precision of TEM sample results should be evaluated by recounting selected grid openings in accord with the requirements specified in the most recent version of LB-000029.

3.5 DOCUMENTS AND RECORDS

Documentation is critical for evaluating the success of any environmental data collection. The following sections discuss the requirements for documenting field activities and for preparing laboratory data packages. All documentation will be stored in the Troy office.

3.5.1 Field Logbooks

All field sampling and field data collection will be recorded in a bound field logbook dedicated to this site. The field team leader will be responsible for recording information including the date and time of sample collection, weather conditions, field crew members, visitors to the site, samples collected, procedures used, field data collected, and deviations from this SAP. Individual field team members may be responsible for required documentation based on specific tasks assigned by the Project Manager or the field team leader.

3.5.2 Photographs

Field-sampling activities will be documented with photographs. The following information will be in the field logbook for each photograph:

- Date and location
- Direction from which photograph was taken and description of the subject photographed.

3.6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

This section outlines the testing, inspection, and maintenance procedures that will be used to keep the field equipment in good working condition.

3.6.1 Maintenance of Field Equipment

Preventive maintenance for most field equipment is carried out in accordance with procedures and schedules recommended in (1) the equipment manufacturer's literature or operating manual, or (2) SOPs that describe equipment operation associated with particular applications of the instrument. More stringent testing, inspection, and maintenance procedures and schedules may be required when field equipment is used to make critical measurements. A GPS unit is proposed for documentation of sample locations. It will be stored and maintained in the DEQ Troy Information Center in Troy, MT. Two cordless power drills will be used to collect the tree bark samples: one drill designated as the primary drill and the second as a backup. The 1-inch diameter hole saw attachment will be purchased new at a local hardware store. An electric sawzall powered by a portable generator will be used to collect brush and manufactured wood product material samples.

Any field instrument that is out of order will be segregated, clearly marked, and not used until it is repaired. The field team leader will be notified of equipment malfunctions so that prompt service can be completed or substitute equipment can be obtained. When equipment condition is suspect, unscheduled testing, inspection, and maintenance should be done. Any significant problem with field equipment will be reported in the field logbook.

4.0 QUALITY OBJECTIVES AND CRITERIA

4.1 PERFORMANCE CRITERIA

This investigation is to determine whether LA asbestos is present in the Lincoln County landfill wood waste piles before it is processed and disposed of. There are no regulatory criteria or action limits for LA asbestos that apply specifically to tree bark, brush, or manufactured wood product debris as part of the anticipated processing and disposal. For this sampling, the default performance criteria in Section 6 of *Libby Asbestos Superfund Site Standard Operating Procedure, Sampling and Analysis of Tree Bark for Asbestos*, Revision 3 (EPA 2012a) (Appendix A) will apply to the bark samples and the default performance criteria in Section 6 of *Libby Asbestos Superfund Site Standard Operating Procedure, Sampling and Analysis of Duff for Asbestos*, Revision 2 (EPA 2012b) (Appendix A) will apply to the brush and manufactured wood product debris samples.

These performance criteria are summarized in Section 3.3 and Appendix F.

4.2 PRECISION

Precision is a measure of agreement among repeated measurements of the same property under identical or substantially similar conditions. Sampling precision for this investigation will be assessed through the collection and analysis of field co-located samples, as described in Section 3.4. Analytical precision will be assessed through analysis of laboratory duplicate samples, as explained in Section 3.4 and in Section 7.2 of the applicable SOP (EPA 2012a; 2012b) (Appendix A). Analytical precision will also be assessed through laboratory recounts of selected openings, in accordance with the requirements specified in the most recent version of Request for Modification to Laboratory Activities LB-000029. The default precision goals specified in LB-000029 will apply to this investigation, but sample data will not be qualified as a result of unrealized precision goals. Precision information will, instead, be used to evaluate and improve (as needed) sampling and analytical techniques.

4.3 BIAS AND REPRESENTATIVENESS

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Representativeness is a qualitative term that expresses the degree to which data accurately and precisely represent a population or environmental condition. For this investigation, how well the perimeter samples represent the entire waste pile will be assessed iteratively once perimeter sample data become available.

The wood waste piles are expected to be quite heterogeneous, so perimeter samples are not expected to be representative of the interior portion of the piles. Additional samples may be collected from the interior of the pile once the perimeter has been removed, depending on sample results and field observations.

4.4 COMPLETENESS

Completeness refers to a measure of the amount of valid data needed from an investigation to achieve investigation objectives. Because of the anticipated heterogeneity of the waste piles, target completeness for this project is 100 percent of the samples collected.

4.5 COMPARABILITY

Comparability is a qualitative term that expresses the measure of confidence that one data set can be compared to another. Comparability of a data set depends on the use of standardized sample collection, handling, preparation, and analytical procedures. The data will be used to make a present/absent evaluation for LA asbestos. The presence/absence of LA asbestos will in turn be used to evaluate waste wood processing and disposal decisions (i.e., the waste piles will be disposed of). As this data has a defined decision point (reuse or disposal of wood waste materials) resulting in the disposal of the materials, comparability to other data sets is not essential.

4.6 METHOD SENSITIVITY

Typically, target analytical sensitivity should be lower than applicable regulatory criteria or action limits. Since there are no regulatory criteria or action limits for LA asbestos that apply specifically to tree bark, brush, or manufactured wood product debris as part of the anticipated processing and disposal, for this sampling, the default target analytical sensitivity listed in Section 6 of *Libby Asbestos Superfund Site Standard Operating Procedure, Sampling and Analysis of Tree Bark for Asbestos*, Revision 3 (EPA 2012a) (Appendix A) will apply to the bark samples and the default target analytical sensitivity listed in Section 6 of *Libby Asbestos Superfund Site Standard Operating Procedure, Sampling and Analysis of Duff for Asbestos*, Revision 2 (EPA 2012b) (Appendix A) will apply to the brush and manufactured wood product debris samples.

Analytical sensitivities are described in Section 3.3 and Appendix F.

5.0 DATA VERIFICATION AND VALIDATION

This section describes the procedures to review, verify, and validate field and laboratory data. This section also discusses procedures for verifying that the data are sufficient to meet project objectives.

5.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Verification and validation of the data generated during field and laboratory activities are essential to obtaining data of defensible and acceptable quality. Verification and validation methods for field and laboratory activities are presented below.

5.1.1 Field Data Verification

Project team personnel will verify field data through reviews of data to identify inconsistencies between reported data or potentially anomalous values. Any inconsistencies will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. All field personnel will be responsible for following the sampling and documentation procedures described in this SAP so that defensible and justifiable data are obtained.

5.1.2 Laboratory Data Verification

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any non-conformances to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any data outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package.

5.1.3 Cursory Data Validation

Tetra Tech will complete a 100 percent cursory validation on the entire summary data packages for the analytical results of the wood waste pile samples. The data reviewer may request any missing information needed from the laboratory. Elimination of the data from the validation review process is not allowed. All data will be qualified as necessary in accordance with established criteria. Data summary packages will consist of sample results and QC summaries, including calibration and internal standard data.

REFERENCES

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EPA. 2012b. Libby Asbestos Superfund Site Standard Operation Procedure, Sampling and Analysis of Duff for Asbestos (SOP No. EPA-LIBBY-2012-11). Revision 2. April.

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FIGURES

LEGEND

CURRENT EXTENT OF WOOD WASTE AND STUMP PILES

2011 BING AERIAL PHOTO

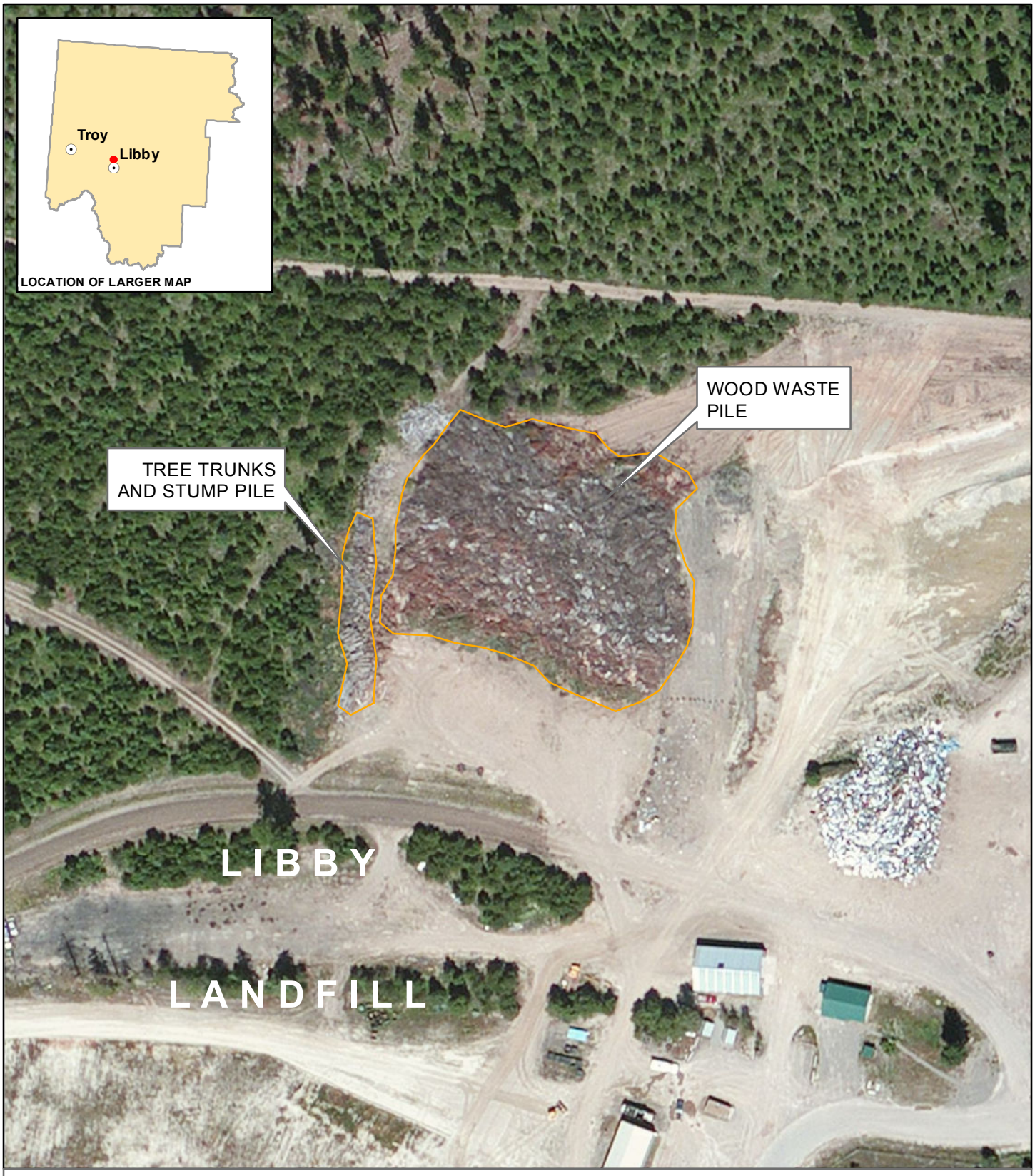
0 100 Feet

N

LIBBY ASBESTOS SUPERFUND SITE

FIGURE 1-1
TROY LANDFILL
WOOD WASTE PILES

GIS map by Ed Madej TTEMI-HE
FIG1-1_TROY_LANDFILL_042412.mxd



TETRA TECH EM, INC.

LIBBY ASBESTOS SUPERFUND SITE

2011 BING AERIAL PHOTO

0 100 Feet

N

FIGURE 1-2
LIBBY LANDFILL
WOOD WASTE PILES

GIS map by Ed Madej TTEMI-HE
FIG1-2_LIBBY_LANDFILL2_042412.mxd

APPENDIX A

STANDARD OPERATING PROCEDURES

Libby Asbestos Superfund Site SOPs
EPA-LIBBY-2012-11 - Sampling and Analysis of Duff for Asbestos
EPA-LIBBY-2012-12 - Sampling and Analysis of Tree Bark for Asbestos
EPA-Libby-2012-07 - Packaging and Shipping

Tetra Tech SOPs
002 - General Equipment Decontamination
024 - Recording of Notes in Field Logbook

Libby Asbestos Superfund Site
Standard Operating Procedure
Packaging and Shipping Environmental Samples

Prepared by: _____ Date: 4/12/12
CDM Smith

Approved by: _____ Date: 4/12/12
EPA Region 8

Revision No.	Date	Reason for Revision
0	4/12/12	--

1.0 Objective

The objective of this standard operating procedure (SOP) is to establish baseline requirements, procedures, and responsibilities for the packaging and shipping of environmental samples collected by the U.S. Environmental Protection Agency or its contractors in support of the Libby Asbestos Superfund Site (Libby Site). Sections 2.0 through 7.0 of this SOP outline requirements for the packaging and shipping of regulated environmental samples under the U.S. Department of Transportation (DOT) Hazardous Materials Regulations, the International Air Transportation Association (IATA), and International Civil Aviation Organization (ICAO) Dangerous Goods Regulations (for shipment by air) and applies only to domestic shipments.

This SOP does not cover the requirements for packaging and shipment of equipment or bulk chemicals that are regulated under the DOT, IATA, and ICAO, nor does it address shipment of hazardous materials. Hazardous material will not be shipped unless personnel have received training that meets the requirements of the governing agency and the DOT.

Additions or modifications to this SOP may be detailed in governing documents referencing this SOP.

2.0 Background

2.1 Definitions

Bottle ware – Plastic or glass bottles or jars used to contain sampled material. Their purpose is to keep sampled material from mixing with the ambient environment.

Chain-of-custody record (COC) – Used to document the custody, control, transfer, analysis, and disposition of samples.

Custody seal – An adhesive-backed seal that is applied to an individual sample or sample container to demonstrate that sample integrity has not been compromised during sample transfer.

Environmental sample – An aliquot of air, water, plant material, sediment, or soil that represents potential contaminant levels at a site. This procedure applies only to environmental samples that

contain less than reportable quantities for any foreseeable hazardous constituents according to DOT regulations promulgated in 49 CFR - Part 172.101 Appendix A.

Facility – A sample processing facility, analytical laboratory, or long-term storage area that serves as the receiver for Libby Site samples.

Excepted quantity – Excepted quantities are limits to the mass or volume of a hazardous material in the sample containers below which DOT, IATA, ICAO regulations do not apply. The excepted quantity limits are very low. Most regulated shipments will be made under limited quantity.

Libby Asbestos Superfund Site (Libby Site) – All buildings and land within the boundaries of the EPA's designated operable units (OUs), as illustrated on the most recent version of the OU boundary map.

Limited quantity – Limited quantity is the maximum amount of a hazardous material below which there are specific labeling or packaging exceptions.

Performance testing – Performance testing is the required testing of outer packaging. These tests include drop and stacking tests.

Qualified Shipper – A qualified shipper is a person who has been adequately trained to perform the functions of shipping hazardous materials.

Site – All buildings (if applicable) and land within the boundaries of the EPA's designated geounits, which may represent individual properties within the Libby Site, a collection of properties, or a larger geographical area.

2.2 Discussion

Proper packaging and shipping is necessary to ensure the integrity of environmental samples during transport. These shipments are potentially subject to regulations published by DOT, IATA, or ICAO. Failure to abide by these rules places both the governing agency and the individual employee at risk of serious fines.

3.0 Responsibilities

Successful execution of this SOP requires a clear definition of assigned roles and responsibilities. All staff responsible for packaging or shipping Libby Site environmental samples will understand and implement the requirements contained herein, as well as any additional requirements stated in governing documents referencing this SOP.

Team Leader (TL) – Responsible for overseeing sample packaging and shipping processes as described in this SOP.

Packager/Shipper – Party (typically the Field Sample Coordinator or Sampler) responsible for properly packaging and shipping samples to the designated project facility.

Qualified Shipper – Responsible for ensuring that samples undergoing shipment contain no other contaminant that meets the definition of "hazardous material" as defined by DOT, and for determining the amount of preservative in each sample so that accurate determination of quantities can be made.

4.0 Equipment

4.1 Environmental Samples without Preservatives

The following equipment will be used when packaging and shipping Libby Site samples:

- Shipping containers (e.g., insulated cooler for limited quantities, a sturdy box for air samples)
- Bubble wrap or other space filler
- Heavy-duty plastic garbage bags
- Plastic zip-top bags
- Custody seals
- Clear packaging tape
- Completed chain-of-custody record
- Duct tape
- Completed shipping label
- Completed return address label (for return of coolers)

Vermiculite, shredded paper, expanded polystyrene, or other absorbent material will not be used for packaging or shipping Libby Site samples. Plastic bubble wrap and ice (as required) is acceptable packing material.

4.2 Environmental Samples with Preservatives

In addition to the equipment listed in Section 4.1, the following additional equipment is required when packaging samples containing preservatives:

- Sample containers
- Insulated coolers
- ice packs/bags or “blue ice”
- Sample labels
- Nitrile gloves

5.0 Procedures

5.1.1 Preparation

Considerations that must be made prior to shipping samples include selecting the appropriate shipping option (e.g., overnight delivery) so that analytical holding times for the samples are not exceeded; packaging samples in time to meet courier or shipping service pick-up times; and making arrangements with the project facility regarding Saturday receipt of samples.

5.2 Operation

5.2.1 Solid Media Samples without Preservatives

The following processes will be employed by the Packager/Shipper for non-preserved, solid media samples (soil, duff, bark, bulk material), and samples collected on cassettes (air, dust). Section 5.2.2 provides procedures for packaging and shipping aqueous samples (groundwater, surface water), or samples with aqueous content (sediment, sludge). Due to the potential for cross contamination, samples collected on cassettes must not be shipped in the same container as solid media samples. Refer to the guidance document referencing this SOP for temperature control requirements (ice).

1. Verify the samples undergoing shipment meet the definition of an “environmental sample” and are not a hazardous material as defined by DOT. Professional judgment and/or consultation with qualified persons such as the Health and Safety Manager shall be observed.
2. Select a sturdy shipping container. Ensure that coolers are in good repair. Air and dust samples must be shipped in separate containers from solid media samples.
3. Place samples into the shipping container. During placement, ensure custody seals are securely in place and verify the contents of the shipping cooler against the COC. The COC shall reflect only those samples within the shipping container.
4. Fill all remaining space with bubble wrap or other appropriate space filler, to prevent the sample(s) from being jostled.
5. After the COC has been signed and dated (time included), retain the field copy of the COC. If using a cooler, place the following items into a zip-top plastic bag for inclusion in the cooler: the top two copies of the COC, an analytical parameters table (if applicable), a copy of the investigation-specific analytical requirements summary sheet (applicable to any asbestos analysis), a completed return shipping label for return of the cooler, and any additional contact, results distribution, or billing information. Tape the sealed zip-top bag to the inside of the cooler lid and securely close. If using a box, include all aforementioned documentation inside the box along with the samples.
6. Attach a completed custody seal across the opening of the shipping container on opposite sides. If using a cooler, the cooler lid shall be secured with tape by wrapping each end of the cooler a minimum of two times. The tape shall be affixed to the cooler so that only half of the custody seal is covered, preventing the cooler from being opened without breaking the seal.
7. Secure the completed shipping form to the shipping container. Schedule the container for pickup or drop off at shipper.
8. Once the container is shipped, notify the laboratory of the shipment number and anticipated arrival date/time.

5.2.2 Aqueous or Aqueous-content Samples without Preservatives

This process below will be employed by the Packager/Shipper for non-preserved, aqueous (or aqueous content) samples collected in bottle ware (water, sediment, sludge). Refer to the guidance document referencing this SOP for temperature control requirements (ice).

1. Verify the samples undergoing shipment meet the definition of an “environmental sample” and are not a hazardous material as defined by DOT. Professional judgment and/or consultation with qualified persons such as the Health and Safety Manager shall be observed.
2. Be sure the caps on all bottles are tightened to prevent leaking. Ensure custody seals are securely in place.
3. For glass containers, wrap each container in bubble wrap and secure with waterproof tape to prevent breakage.
4. Place each plastic or bubble-wrapped glass container into a zip-top bag. Smaller glass containers, such as 40-milliliter vials, may be wrapped together for the same sample.
5. Remove as much trapped air when sealing the bag.

6. Select a sturdy cooler in good repair. To control contents: duct tape closed any interior drain plugs from the inside; duct tape closed any exterior drain plugs from the outside; and line the cooler with two large heavy-duty plastic garbage bags.
7. Place the samples into the cooler with sufficient space to allow for the addition of packing material between the samples. It is preferable to place glass sample bottles and jars into the cooler vertically (glass containers are less likely to break when packed vertically rather than horizontally). During placement, verify the contents of the shipping cooler against the COC. The COC shall reflect only those samples within the cooler.
8. Fill all remaining space with bubble wrap or other appropriate space filler to prevent the sample(s) from being jostled.
9. After the COC has been signed and dated (time included), retain the field copy of the COC. Place the following items into a zip-top plastic bag for inclusion in the cooler: the top two copies of the COC, an analytical parameters table (if applicable), a copy of the Analytical Summary Sheet as provided in the governing document referencing this SOP (only applicable to asbestos analysis), a completed return shipping label for return of the cooler, and any additional contact, results distribution, or billing information. Tape the sealed zip-top bag to the inside of the cooler lid and securely close.
10. Fill all remaining space between the samples with packing material. Remove excess air from garbage bags and seal each bag by securely taping the opening closed and then applying a custody seal on the outermost bag.
11. Attach a completed custody seal across the opening of the cooler on opposite sides. The cooler lid shall be secured with tape by wrapping each end of the cooler a minimum of two times. The tape shall be affixed to the cooler so that only half of the custody seal is covered, preventing the cooler from being opened without breaking the seal.
12. Secure the completed shipping form to the shipping container. Schedule the container for pickup or drop off at shipper.
13. Once the container is shipped, notify the laboratory of the shipment number and anticipated arrival date/time.

5.2.3 Samples Requiring Temperature Controls

If temperature controls (i.e., ice) are required (refer to the guidance document referencing this SOP), in addition to the procedures listed in Section 5.2.1 (for solid media samples) or Section 5.2.2 (for aqueous samples), the Packager/Shipper will:

1. Duct tape closed any drain plugs (inside and outside) and line the cooler with two large heavy-duty plastic garbage bags. (This step will already have been performed for aqueous/aqueous-content samples.)
2. Place ice in one-gallon plastic zip-top bags and properly seal the bags.
3. Place bags of ice on top of and between the samples to ensure adequate temperature controls during transport.
4. Ensure a temperature blank is secured inside the cooler.

5.2.4 All Samples with Preservatives

Prior to shipping samples with preservatives, the Qualified Shipper will determine the amount of preservative in each sample. Excepted quantities of preservatives are provided in the following table:

Excepted Quantities of Preservatives

Preservative		Desired in Final Sample		Quantity of Preservative (ml) for Specified Container				
5 drops = 1 ml		**pH**	**Conc.**	**40 ml**	**125 ml**	**250 ml**	**500 ml**	**1 L**
NaOH	30%	>12	0.08%	--	0.25	0.5	1	2
HCl	2N	<1.96	0.04%	0.2	0.5	1	--	--
HNO_3	6N	<1.62	0.15%	--	2	4	5	8
H_2SO_4	37N	<1.15	0.35%	0.1	0.25	0.5	1	2

Conc. = concentration
ml = milliliters
% = percent
L = liter

NaOH = sodium hydroxide
HCl = hydrochloric acid
HNO_3 = nitric acid
H_2SO_4 = sulfuric acid

In addition to the steps outlined in the appropriate section above for the specific media sampled, these additional steps are to be followed when packaging limited-quantity sample shipments:

1. Nitrile gloves are to be worn by anyone handling the sampling containers.
2. All sample containers will be labeled with the sample number and what preservative is being used. Protect the labels with waterproof tape. At a minimum the sample label must contain:

   - Sample number
   - Project or Case number
   - Date and time of sample collection
   - Preservative
   - Analysis

The FSDS will be used to collect all other sample information.

3. The Packager/Shipper will ensure a trip blank(s) is secured inside the cooler(s).
4. The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.

5.3 Post-operation

Shipping documentation will be maintained by the Packager/Shipper to confirm that shipments have been delivered and accepted by the receiver.

6.0 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) for activities described in this SOP will be attained through a variety of processes, including, at a minimum, the items discussed below. Additional QA/QC requirements, such as audits or field assessments, will be addressed in the governing document referencing this SOP.

6.1 Training

Every effort will be made to ensure proper sample custody from the point of collection to final disposition. Sample custody will be maintained to the extent possible through proper training, using designated field staff, and providing TL oversight. Any deficiencies or inconsistencies in implementing this SOP noted by the TL will require staff re-training.

6.2 Field Checks

Field checks for adherence to this SOP may be performed on a daily basis by the TL (or their designate) for the first week of each investigation. These checks can be extended to once per month as investigation activities continue, and any errors noticed during the checks will be discussed with field personnel and corrected. If investigation activities continue beyond six months, the frequency of assessing sample packaging and shipping procedures will be established by the field Quality Assurance Manager or their designate.

7.0 References

Adapted from CDM Smith Technical Standard Operating Procedure 2-1, Packaging and Shipping Environmental Samples, January 2012.

Libby Asbestos Superfund Site
Standard Operating Procedure
Sampling and Analysis of Duff for Asbestos

Prepared by: _____ Date: 4/16/12
CDM Smith

Approved by: _____ Date: 4/16/12
EPA Region 8

Revision No.	Date	Reason for Revision
0	2/7/08	--
1	11/4/11	• Editorial changes. • Modify the recording rules for partially obscured structures. • Add caution about mass percent estimation. • Add Attachment to provide appropriate EDDs.
2	4/12/12	• Remove OU3 specificity. • Clarify pore size of filter used during filtration. • Re-number to be consistent with other project-specific SOPs.

1.0 Objective

Duff sampling and analysis may be required for some field activities conducted by the U.S. Environmental Protection Agency (EPA) or its contractors in support of the Libby Asbestos Superfund Site (Libby Site). The objective of this standard operating procedure (SOP) is to establish baseline requirements, procedures, and responsibilities for the sampling and analysis of duff for asbestos at the Libby Site. Additions or modifications to this SOP may be detailed in governing documents referencing this SOP.

2.0 Responsibilities

Successful execution of this SOP requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role. All staff responsible for collecting air samples will understand and implement the requirements contained herein, as well as any additional requirements stated in the governing document.

Team Leader (TL) – the TL is responsible for ensuring that all samples are collected in accordance with this SOP.

Field Team Members – Field team members performing sampling are responsible for adhering to the procedures contained in this SOP, and for communicating any sample collection issues to the TL.

Laboratory Director – the Laboratory Director is responsible for ensuring that samples provided to the laboratory for evaluation by this SOP are prepared and analyzed in accordance with the requirements of this SOP.

It is the responsibility of the TL and the Laboratory Director to communicate the need for any deviations from the SOP with the appropriate EPA Region 8 Remedial Project Manager or Regional Chemist.

3.0 Equipment

3.1 Field Equipment

The following field equipment is required for duff sampling:

- zip-top plastic bags
- sample labels
- global positioning satellite (GPS) unit
- field logbook
- field sample data sheets (FSDSs)
- indelible blue or black ink pens
- clear packaging tape

3.2 Laboratory Equipment /Reagents

The following laboratory items are required for duff analysis for asbestos:

- Large aluminum trays
- Drying oven
- Large metal tray(s) (large enough for duff sample to cover bottom up to ½ inch)
- Muffle furnace
- Glass stirring rods
- Fume hood
- High-efficiency particulate air (HEPA) filtered hood
- Reagent grade or better acetone
- Reagent grade or better hydrochloric acid (HCl)
- Fiber-free deionized (FDI) water
- Ultrasonic bath, producing a rate of energy deposition in the range of 0.08-0.12 megawatt per cubic meter (MW/m^3)
- Disposable plastic filter funnel apparatus
- Disposable filter funnels with straight sides (VWR #145-0020)
- Culture dishes (VWR #25388-581, case of 500)
- 47-millimeter (mm) mixed cellulose ester (MCE) or polycarbonate (PC) filters (≤0.22 micrometer [µm] pore size)
- Kimwipes™ or alternative paper
- zip-top plastic bags
- Glass petri dishes
- Glass microscope slides
- Low temperature plasma asher
- Vacuum evaporator (carbon coater)
- Graphite or carbon rods
- HEPA laminar flow hood
- Acetone vapor generator
- Grids
- Fine forceps
- Grid storage boxes

- Jaffe wick or sponge
- Transmission electron microscope with the following capabilities:
  - 100 Kev
  - fine probe size <250 nanometer (nm)
  - Energy Dispersive X-Ray Analysis (EDXA)
  - Selective Area Electron Diffraction (SAED)

4.0 Method Summary

A duff sample is collected by hand at a selected field location and placed in a bag or container. Duff samples are prepared for analysis by high temperature ashing to remove organic matter. The residue is then analyzed for LA by transmission electron microscopy (TEM) and/or by Polarized Light Microscopy (PLM), as specified in the governing document referencing this SOP.

5.0 Sample Collection

Duff samples should be collected from the soil sampling stations or locations specified in the governing document referencing this SOP. At each specified location, collect any fresh or partially decayed organic debris (e.g., twigs, leaves, pine needles) using a freshly-gloved hand from the soil surface within an area that is approximately 6 inches by 6 inches. Care should be taken to ensure that the top layer of soil beneath the organic debris is not included in the duff material sample. Place the duff material into a large, air-tight, re-sealable plastic bag. Label the bag with the same sample identifier as the soil field sample, and place clear packaging tape over the sample identifier label.

Record sample information on the FSDS (provided in Attachment A) for each duff sample. Note any special circumstances or conditions about the sampling location. Obtain and record the GPS coordinates of the sampling location on the FSDS form.

6.0 Sample Preparation and Analysis

6.1 Drying and Ashing

At the laboratory, weigh and record the tare weight of a clean, dry aluminum tray of approximately quart size. Fill the aluminum tray to approximately ¾ full. The sample may be split across as many trays as may be needed, providing the applicable sample number/identifier is clearly marked on each tray. In addition, for tracking purposes, each tray should possess a mark to make it unique and identifiable from the other trays (e.g., Tray A, B, C). This identifier shall be recorded in the laboratory preparation logs. Each tray will be initially tared and gravimetrically tracked through the preparation process. Place the tray(s) with the sample into a drying oven. Heat to 60 degrees Celsius (°C) and hold at this temperature until weight stabilizes (at least 10 hours). Record the total (i.e., tray + duff) dry weight and calculate the mass of the dried duff sample by difference. If the sample was dried in more than one tray, compute the total mass of the dried duff for the sample by summation across trays.

Once duff samples are dried, they shall be ashed. Weigh and record the tare weight of one or more clean metal pans capable of withstanding the heat of a 450°C oven. Working under a hood, transfer the dried duff to the tared pan(s), place a lid on the pan and move to a muffle furnace. Ramp up the furnace from a cold start to 450°C and hold at this temperature for 18 hours or until all organic matter is removed.

Allow the pan(s) to cool. Remove the lid(s), weigh and record the mass of the pan(s) plus the ashed residue. Calculate the mass of the ashed residue in each pan by difference. If the sample

was ashed in more than one pan, compute the total mass of the ashed residue for the sample by summation across pans.

Under a laminar flow hood, slowly pour the ash from each sample into individual zip-top bags. If the sample was ashed in more than one pan, all the pans for that sample should be combined into a single bag. If the ash still retains some structure, seal the bag tightly and manipulate the ash by hand to reduce it to a fine homogenous powder. Invert the bag three or four times to thoroughly mix the ash.

All information regarding sample preparation shall be recorded using the sample preparation log sheet, presented as Attachment B.

6.2 TEM Analysis

6.2.1 Acid Treatment

Remove an aliquot of approximately 0.25 grams (g) of the well-mixed ash and place into a crucible. Record the weight (measured to an accuracy of ± 0.01g on the sample preparation data sheet (see Attachment B). To the ashed residue in the crucible, add just enough FDI water (approximately 1-2 milliliters [mL]) to cover the surface of the residue. Slowly add concentrated HCl to the wetted ash (approximately 10-20 mL). Typically, a visible effervescing is observed. Add the HCl slowly to keep this reaction controlled. A small glass stirring rod is useful at this point to gently stir the ash and expose all material to the acid.

If there is no further visible reaction after 3-5 minutes, proceed to the next step. If bubbling is still occurring, continue observation and gentle stirring for up to an additional 5 minutes.

Dilute the sample by adding FDI water directly to the crucible (approximately 20 mL) using a squirt bottle. Pour the sample into an unused disposable 100 mL specimen container with lid.

Rinse out any remaining residue from the crucible into the specimen container. Do not exceed 100 mL total volume. Bring the total volume to 100 mL with DI water.

Cap the specimen cup and agitate the sample by inversion 5 or 6 times. Loosen the cap slightly and sonicate for 2 minutes. After sonication, tighten the cap and then dry the exterior of the specimen container with a laboratory wipe.

6.2.2 Filtration

Agitate the sample by inversion 5 or 6 times. Withdraw an initial aliquot of 0.1 to 1 mL of sonicated sample. Transfer this aliquot into a new disposable specimen container with lid. Bring the volume up to approximately 100 mL with FDI water. Cap and agitate by inversion (5 or 6 times).

Filter this entire volume onto a 47-mm MCE (or PC filter) with ≤0.22 µm pore size. If the filter appears overloaded (overall particulate level > 20 percent [%]), repeat the process above, selecting a smaller aliquot volume, as suggested by the degree of overloading. Conversely, if the filter looks too lightly loaded, filter a larger aliquot.

After filtration, transfer the filter membranes to individual disposable labeled Petri dishes with lids. With Petri dish covers ajar, gently air dry the filters in a HEPA-protected environment.

6.2.3 TEM Examination

Prepare three grids for TEM analysis as detailed in International Organization for Standardization (ISO) TEM method 10312, also known as ISO 10312:1995(E). Utilize two grids

for analysis, archiving the third grid in case of problems. After analysis, archive all three grids for potential future reanalysis.

Counting and Recording Rules
Examine the grids using TEM in basic accordance with ISO 10312 and all relevant Libby site-specific modifications, including the most recent version of LB-000016, LB-000029, LB-000066, LB-000067, and LB-000085.

Raw structure data should be recorded on the Libby site-specific laboratory bench sheets and electronic data deliverable (EDD) spreadsheet for TEM analysis of duff samples (see Attachment C).

Stopping Rules
Examine a minimum of two grid openings in each of two grids. Continue examining grid openings until one of the following occurs:

- The specified target analytical sensitivity is achieved.
- The specified maximum number of structures has been observed.
- The specified maximum area has been examined.

The specific stopping rules (i.e., target analytical sensitivity, maximum number of structures, and maximum area examined) for sample analysis should be specified in the governing document referencing this SOP. In the absence of an investigation-specific target analytical sensitivity, the default target analytical sensitivity should be 1E+07 (grams dry weight)$^{-1}$. The analytical sensitivity is calculated using the following equation:

$$S = \frac{EFA}{GO \cdot Ago \cdot Mass \cdot F}$$

where:

S	=	Sensitivity (1/grams dry weight)
EFA	=	Effective filter area (mm^2)
GO	=	Number of grid openings counted
Ago	=	Area of one grid opening (mm^2)
Mass	=	Mass of the dried (but not ashed) duff sample (g)
F	=	Fraction of the dried duff sample applied to the filter

TEM Data Deliverable
All data on the number, type, and size of LA structures observed during TEM analysis in the laboratory will be transmitted as an EDD using the most recent version of the spreadsheet developed for this purpose (see Attachment C). The results for each sample will be expressed in terms of Libby amphibole asbestos (LA) structures per gram duff (dry weight). If desired, the raw structure data can be utilized to calculate an estimate of mass percent (grams of LA per 100 grams of duff dry weight). However, estimates of mass percent derived using this approach

should be regarded as highly uncertain, and the true mass percent may be either higher or lower than the reported value.

6.3 PLM Analysis

If analysis by PLM is called for in the governing document referencing this SOP, the analysis will be performed on an aliquot of the ashed and homogenized residue using method PLM-VE as detailed in the most recent version of SOP SRC-LIBBY-03. PLM-VE is a semi-quantitative analytical method for asbestos that utilizes Libby-specific reference materials to allow assignment of samples into one of four mass percent “bins”, as follows:

- Bin A (ND): non-detect
- Bin B1 (Trace): LA detected at levels lower than the 0.2% reference material
- Bin B2 (<1%): LA detected at levels lower than the 1% reference material but higher than the 0.2% reference material
- Bin C: LA detected at levels greater than or equal to 1%

A potential limitation to this approach is that the site-specific reference materials are based on LA in soil, not LA in ashed residue. This may introduce additional uncertainty into the results, but no reference materials based on ashed residue are presently available.

PLM visual estimation (PLM-VE) results will be recorded using the most recent version of the Libby-specific EDD spreadsheet for PLM-VE analysis (see Attachment C).

All data on the number, type, and size of LA structures observed during TEM analysis in the laboratory will be transmitted as an electronic data deliverable (EDD) using the most recent version of the spreadsheet developed for this purpose (see Attachment B). The results for each sample will be expressed in terms of surficial loading (LA structures per square centimeter of tree bark).

7.0 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) for activities described in this SOP will be attained through a variety of processes, including, at a minimum, the items discussed below. Additional QA/QC requirements, such as audits or field assessments, will be addressed in the governing document referencing this SOP.

7.1 Field Quality Control Samples

<u>Field Duplicates</u>

Field duplicate duff samples will be collected at a frequency specified in the governing document referencing this SOP. In the absence of such specification, the rate should be no less than 5%. Each field duplicate should be collected from a location close to the primary sample, and from an area of approximately equal size. Field duplicate samples should be labeled with a unique identifier. Sample details should be recorded on the appropriate FSDS, including the unique identifier of the “parent” field sample. Field duplicates are used to evaluate the sampling and analysis variability across duff samples. Unless indicated differently in the governing document referencing this SOP, samples will not be qualified purely as a result of the difference between measured values between original and duplicate pairs.

7.2 Laboratory Quality Control Samples for TEM Analysis

Drying Blanks

For the purposes of this analysis, a drying blank will consist of one clean aluminum pan placed empty into the drying oven along with pans containing field samples of duff. After drying the duff samples, the clean tray will be removed and the surface will be rinsed with about 100 mL of FDI water into a clean container, which in turn will be filtered and prepared for TEM analysis. Detection of fibers on the drying blank filter will be taken as an indication of potential cross-contamination during drying.

Drying blanks should be prepared at a rate specified in the governing document referencing this SOP. In the absence of a project-specific specification, drying blanks should be prepared at a rate of one per day that drying of samples is occurring. Unless indicated differently in the governing document, if the drying blank reports LA fibers, all samples in that drying batch will be assigned a qualifier to indicate the potential for cross-contamination.

Laboratory Blanks

A laboratory blank is a filter that is prepared by processing a clean crucible in the same way that a duff sample is prepared. That is, a clean crucible is treated by addition of FDI water and HCl, as described above. The contents of the crucible are then rinsed out, diluted to 100 mL, and an aliquot at least as large as the highest volume aliquot for the sample set is removed and used to prepare a filter for TEM examination. This type of blank is intended to indicate if contamination is occurring at any stage of the sample preparation procedure.

Laboratory blanks should be prepared at a rate specified in the governing document referencing this SOP. In the absence of a project-specific specification, laboratory blanks should be prepared at a rate of 3% or one per preparation batch, whichever is more frequent. Unless indicated differently in the governing document, if the laboratory blank reports LA fibers, all samples in that analytical batch will require re-preparation.

Filtration Blanks

A filtration blank is a clean filter that is prepared by passing 100 mL of laboratory FDI water through it. The purpose of this type of blank is to ensure that the filters are not contaminated in the laboratory, and that fluids used for diluting and processing samples are fiber-free.

Filtration blanks should be prepared at a rate specified in the governing document referencing this SOP. In the absence of a project-specific specification, filtration blanks should be prepared at a rate of 2%. Unless indicated differently in the governing document, if the laboratory blank reports LA fibers, all samples in that analytical batch will require re-preparation.

Laboratory Duplicates

Laboratory duplicates will be prepared by applying a second aliquot of ashed residue suspension to a new filter, which is then prepared and analyzed in the same fashion as the original filter. The frequency of laboratory duplicates should be specified in the governing document referencing this SOP. In the absence of such specification, the rate should be no less than 5%. Unless indicated differently in the governing document, samples will not be qualified purely as a result of the difference between measured values between original and duplicate pairs.

Recounts

The precision of TEM sample results should be evaluated by recounting selected grid openings in accordance with the requirements specified in the most recent version of LB-000029.

7.3 Laboratory Quality Control Samples for PLM-VE Analyses

Laboratory Duplicates

Laboratory duplicate PLM-VE analyses will be prepared by examining a second aliquot of ashed and homogenized residue. The frequency of laboratory duplicates should be specified in the governing document referencing this SOP. In the absence of such specification, the rate should be no less than 5%. Unless indicated differently in the governing document, samples will not be qualified purely as a result of the difference between measured values between original and duplicate pairs.

8.0 References

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

ATTACHMENT A

FIELD SAMPLE DATA SHEET (FSDS) FOR DUFF

Sheet No.: Duff- _____

LIBBY FIELD SAMPLE DATA SHEET (FSDS) rev0
DUFF

Field Logbook No: _____ Page No: _____
Station ID: _____ Sampling Date: _____
GPS Coordinate System:_____Elevation Coordinate System:_____
X coordinate:_____ Y coordinate:_____ Elevation:_____
Sampling Team: _____ Sampler Initials: _____
Station Comments _____
_____

Data Item	Sample 1	Sample 2	Sample 3
Index ID (place pre-printed label in field provided)			
Sample Time (hh:mm)			
Sample Type (circle one):	Grab Composite # of Composites:	Grab Composite # of Composites:	Grab Composite # of Composites:
Field QC Type (circle one):	FS (field sample) FD (field duplicate) For FD, Parent ID: _____	FS (field sample) FD (field duplicate) For FD, Parent ID: _____	FS (field sample) FD (field duplicate) For FD, Parent ID: _____
Field Comments:			
Entered by (Provide initials):		**Validated by (Provide initials):**	

ATTACHMENT B

DUFF PREPERATION SAMPLE DATA SHEET (PSDS)

[provided electronically in "DUFF PSDS rev 1.xls]

LIBBY DUFF PREPARATION SAMPLE DATA SHEET (PSDS)

PAGE _____ of _____

Laboratory Name: _____ Lab Job No.: _____ Lab QC Batch No.: _____ SOP: DUFF-LIBBY-OU3 (Rev 1)

Preparation by: _____ Preparation Date: _____

Drying Oven Temp. (°C): _____ Muffle Furnace Temp. (°C): _____ HCL Reagent Tracking No: _____

	SAMPLE INFORMATION			DRYING						ASHING				FILTER PREP			
	Index ID	Lab Sample ID	Mass (g), as received	Tray ID(s) used in drying	Tray weight (g)	Mass (g), during drying [tray + sample]			Mass (g), after drying [sample only]	Pan ID(s) used in ashing	Pan weight (g)	Mass (g), after ashing [pan + sample]	Mass (g), after ashing [sample only]	Mass of ash (g) taken for analysis	Volume of HCl added (mL)	Aliquot volume (mL)	Notes
						Check 1	Check 2	Check 3									
Example	X-12345	026589	500.3	A	5.71	63.12	55.90	55.84	50.13	A	15.87	36.98	21.11	0.26	15.7	1.0	
	↓	↓	↓	B	4.99	70.56	63.02	63.11	58.12	B	16.20	44.05	27.85				
				C	5.23	89.63	71.85	72.03	66.8								

Note: All mass measurements should be recorded to an accuracy of ± 0.01 g.

QA Check by: _____ Date: _____

ATTACHMENT C

ELECTRONIC DATA DELIVERABLE (EDD) SPREADSHEETS

[contact EPA to obtain copies of the most recent version of the EDDs]

Libby Asbestos Superfund Site
Standard Operating Procedure
Sampling and Analysis of Tree Bark for Asbestos

Prepared by: _____ Date: 4/16/12
CDM Smith

Approved by: _____ Date: 4/16/12
EPA Region 8

Revision No.	Date	Reason for Revision
0	9/26/07	--
1	11/20/07	Modify procedure for sample preparation based on results of pilot-scale laboratory tests.
2	11/4/11	• Editorial changes. • Modify the recording rules for partially obscured structures. • Add Attachments to provide example FSDS and appropriate EDD.
3	4/12/12	• Remove OU3 specificity. • Clarify pore size of filter used during filtration. • Re-number SOP to be consistent with other project-specific SOPs.

1.0 Objective

Tree bark sampling and analysis may be required for some field activities conducted by the U.S. Environmental Protection Agency (EPA) or its contractors in support of the Libby Asbestos Superfund Site (Libby Site). The objective of this standard operating procedure (SOP) is to establish baseline requirements, procedures, and responsibilities for the sampling and analysis of tree bark for asbestos at the Libby Site. Additions or modifications to this SOP may be detailed in governing documents referencing this SOP.

2.0 Responsibilities

Successful execution of this SOP requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role. All staff responsible for collecting air samples will understand and implement the requirements contained herein, as well as any additional requirements stated in the governing document referencing this SOP.

Team Leader (TL) – the TL is responsible for ensuring that all samples are collected in accordance with this SOP.

Field Team Members – Field team members performing sampling are responsible for adhering to the procedures contained in this SOP, and for communicating any sample collection issues to the TL.

Laboratory Director – the Laboratory Director is responsible for ensuring that samples provided to the laboratory for evaluation by this SOP are prepared and analyzed in accordance with the requirements of this SOP.

It is the responsibility of the TL and the Laboratory Director to communicate the need for any deviations from the SOP with the appropriate EPA Region 8 Remedial Project Manager or Regional Chemist.

3.0 Equipment

3.1 Field Equipment

The following field equipment is required for bark sampling:

- hole saw (2-inch diameter)
- battery-powered drill
- ½-inch chisel
- flathead screwdriver
- aerosol hair spray
- zip-top plastic bags
- sample labels/tags
- decontamination supplies
- trash bags
- global positioning satellite (GPS) unit
- digital camera
- flagging tape or metal identification tag
- field logbook
- field sample data sheets (FSDSs)
- indelible blue or black ink pens
- increment boring device (e.g., Hagloff)
- plastic sheath for age core
- clear packaging tape

3.2 Laboratory Equipment/Reagents

The following laboratory items are required for bark sample preparation and analysis:

- Disposable Filter funnels with Straight sides. VWR # 145-0020
- Culture Dishes (e.g., VWR #25388-581, case of 500)
- 47-millimeter (mm) mixed cellulose ester (MCE) or polycarbonate (PC) filters (≤0.22 micrometer [µm] pore size)
- Glass Petri Dishes
- Glass microscope slides
- Low Temperature Plasma Asher
- Vacuum Evaporator (Carbon Coater)
- Graphite or Carbon rods
- High-efficiency particulate air (HEPA) Laminar Flow Hood
- Acetone Vapor Generator
- Grids
- Fine Forceps
- Grid Clips and Grid Storage Boxes
- Jaffe Wick or Sponge
- Kimwipes™ or alternative paper
- Transmission Electron Microscope with the following capabilities:
  - 100 Kev
  - fine probe size <250 nanometer (nm)
  - elemental Chemistry via X-Ray Detector
- Large ceramic crucibles (approximately 50 milliliter [ml] capacity or greater)
- Glass stirring rods
- Fumehood
- HEPA filtered Hood
- Ultrasonic Bath producing a rate of energy deposition in the range of 0.08-0.12 megawatt per cubic meter (MW/m^3)
- Disposable plastic filter funnel apparatus
- Reagent Grade or better Acetone
- Reagent Grade or better hydrochloric acid (HCl)

4.0 Method Summary

One or more tree bark samples are obtained from selected trees by using a 2-inch hole saw to cut a circular ring in the bark, following by cutting/prying the circular piece of bark from the tree using a sharp chisel. The area to be sampled is sprayed with hair spray prior to sample

collection in order to minimize the potential for loss of fibers from the tree bark. In some cases, a core may be obtained from the tree in order to allow verification of the age of the tree.

Tree bark samples are prepared for analysis by high temperature ashing to remove organic matter. The residue is then treated with HCl to dissolve any salts or carbonate component that may be present and applied to a filter which is examined for asbestos using transmission electron microscopy (TEM).

5.0 Sample Collection

Bark samples should be collected from the sampling stations specified in the governing document referencing this SOP. At each specified sampling location, sample collection should be performed as follows:

5.1 Select Tree

The species and size of tree selected for sampling should be specified in the governing document referencing this SOP. In the absence of this specification, the tree selected for sampling should be a Douglas fir (*Pseudotsuga menziesii*) with a diameter (caliper) of about 8-10 inches. If there are multiple trees that meet these requirements in the vicinity of the sampling location, preference should be given to trees with rough bark and trees that are in open areas.

5.2 Bark Collection

Samples should be collected on the face of the tree in the predominant downwind direction, unless otherwise specified in the governing document referencing this SOP. Collect the bark sample from a height of 4-5 feet above the ground, using the following steps:

1. Spray the bark collection area with aerosol hairspray and allow to dry.
2. Use a 2-inch diameter hole saw and a battery-powered electric drill to cut a circle in the tree bark. Continue cutting until sawdust changes from red to cream, which indicates that the cambium has been reached (about ½-inch deep).
3. Using a sharp ½-inch metal chisel or flathead screwdriver, cut or pry the circular bark sample off the tree, attempting to maintain the sample in one piece.
4. Place the bark sample in a plastic zip-top bag.
5. Label the bag with a unique sample identifier.
6. Place clear packaging tape over the sample identifier label.

5.3 Tree Age Core Collection

At locations where an age core is to be collected (as specified in the governing document referencing this SOP), collect a core from the tree using a Hagloff manual increment borer or similar device. Place the core in a plastic straw. Crimp and tape the ends of the straw, and label the straw with the same sample identifier as the bark field sample. Place the straw into a zip-top bag. Label the bag with the same sample identifier as the bark field sample, and place clear packaging tape over the sample identifier label.

5.4 Field Documentation

Complete the FSDS for tree bark (see Attachment A). Measure and record the diameter of the tree. Obtain and record the GPS coordinates of the tree on the FSDS. Mark the tree with flagging tape or a metal identification tag.

5.5 Equipment Decontamination

If dedicated sample equipment is not used, after each sample collection, manually remove any fibrous debris from the hole saw teeth. If resin or pitch is present, use WD40® to clear saw of any residue. Thoroughly clean all collection equipment with isopropyl alcohol wipes. Dry the sampling equipment using paper towels. Any spent wipes, paper towels, or other decontamination waste materials must be stored and ultimately properly disposed as investigation-derived waste.

6.0 Sample Preparation and Analysis

6.1 Tree Bark Preparation

Drying and Ashing

Measure and record the diameter and the thickness of the tree bark sample to an accuracy of ±2 mm (about 1/16 of an inch).

Weigh and record the tare weight of a clean crucible. Add the entire tree bark core to the crucible. Place the crucible with bark sample in a drying oven. Heat to 80 degrees Celsius (°C) and hold at this temperature until weight stabilizes (at least 6 hours). Record the final weight and calculate the mass of the dried tree bark sample by difference.

Place a lid on the crucible and transfer to a muffle furnace. Ramp up the furnace from a cold start to 450°C; hold at this temperature for 18 hours or until all organic matter is removed. Allow the crucible to cool. Remove crucible lid and weigh and record the mass of the crucible plus ashed residue. Calculate the mass of the ashed residue by difference.

Acid Treatment

To the ashed residue, add just enough filtered and deionized (FDI) water (approximately 1-2 mL) to cover the surface of the residue. Slowly add approximately 10-20 mL concentrated HCl to the wetted ash. Typically a visible effervescing is observed. Add the HCl slowly to keep this reaction controlled. A small glass stirring rod is useful at this point to gently stir the ash and expose all material to the acid.

If there is no further visible reaction after 3-5 minutes, proceed to the next step. If bubbling is still occurring, continue observation and gentle stirring for up to an additional 5 minutes.

Dilute the sample by adding FDI water directly to the crucible (approximately 20 mL) using a squirt bottle. Pour the sample into an unused disposable 100 mL specimen container with lid. Rinse out any remaining residue from the crucible into the specimen container. Do not exceed 100 mL total volume. Bring the total volume to 100 ml with FDI water.

Cap the specimen jar and agitate the sample by inversion 5 or 6 times. Loosen the cap slightly and sonicate for 2 minutes. After sonication, tighten the cap and then dry the exterior of the specimen container with a Kimwipe™ or alternative.

Filtration

Agitate the sample by inversion 5 or 6 times. Withdraw an initial aliquot of 5 to 20 mL of sonicated sample. Transfer this aliquot into a new disposable specimen container with lid. Bring the volume up to approximately 100 mL with FDI water. Cap and agitate by inversion (5 or 6 times).

Filter this entire volume onto a 47-mm MCE filter with (or PC filter) with ≤0.22 µm pore size.

If the filter appears overloaded (overall particulate level greater than 20 percent [%]), repeat the process above, selecting a smaller aliquot volume, as suggested by the degree of overloading. Likewise, if the filter looks too lightly loaded, remove and filter a larger aliquot.

Transfer the filter membranes to individual disposable labeled Petri dishes with lids. With the Petri dish covers ajar, dry the filters by air drying.

6.2 TEM Examination

Prepare three grids for TEM analysis as detailed in International Organization for Standardization (ISO) TEM method 10312, also known as ISO 10312:1995(E). Utilize two grids for analysis, archiving the third grid in case of problems. After analysis, archive all three grids for potential future reanalysis.

Counting and Recording Rules
Examine the grids using TEM in basic accordance with ISO 10312 and all relevant Libby site-specific modifications, including the most recent versions of LB-000016, LB-000029, LB-000066, LB-000067, and LB-000085.

Raw structure data should be recorded on the Libby site-specific laboratory bench sheets and electronic data deliverable (EDD) spreadsheet for TEM analysis of tree bark samples (see Attachment B). Data recording for chrysotile (if observed) is not required.

Stopping Rules
Examine a minimum of two grid openings in each of two grids. Continue examining grid openings until one of the following occurs:

- The specified target analytical sensitivity is achieved.
- The specified maximum number of structures has been observed.
- The specified maximum area has been examined.

The specific stopping rules (i.e., target analytical sensitivity, maximum number of structures, and maximum area examined) for sample analysis should be specified in the governing document referencing this SOP. In the absence of such specification, the target sensitivity should be no higher than 100,000 cm-2. The analytical sensitivity is calculated using the following equation:

$$S = \frac{EFA}{GO \cdot Ago \cdot A \cdot F}$$

where:

S	=	Sensitivity (per square centimeter [cm^{-2}])
EFA	=	Effective filter area (square millimeters [mm^2])
GO	=	Number of grid openings counted
Ago	=	Area of one grid opening (mm^2)

A = Area of tree bark sample being analyzed (cm^2)

F = Fraction of original sample deposited on the filter

6.3 Electronic Data Deliverable

All data on the number, type, and size of LA structures observed during TEM analysis in the laboratory will be transmitted as an EDD using the most recent version of the spreadsheet developed for this purpose (see Attachment B). The results for each sample will be expressed in terms of surficial loading (LA structures per cm^2 of tree bark).

6.4 Analysis of Core Sample

The age of the tree will be determined from the core sample in accord with the method of Phipps (1985).

7.0 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) for activities described in this SOP will be attained through a variety of processes, including, at a minimum, the items discussed below. Additional QA/QC requirements, such as audits or field assessments, will be addressed in the governing document referencing this SOP.

7.1 Field Quality Control Samples

Field Duplicates

Field duplicate tree bark samples will be collected at a frequency specified in the governing document referencing this SOP. Each field duplicate should be collected from the same tree at a location no further than 6 inches away from the original bark sample. In the absence of such specification, the rate should be no less than 5%. Field duplicate samples should be labeled with a unique identifier. Sample details should be recorded on the tree bark FSDS, including the unique identifier of the “parent” field sample.

Equipment Rinsates

If dedicated sampling equipment is not utilized, equipment rinsates should be collected after decontamination of field equipment as described above. The decontaminated equipment (hole saw, chisel) should be rinsed with about 25 mL filtered and deionized water into a glass container. The frequency of rinsate collection should be specified in the governing document referencing this SOP. In the absence of such specification, one rinsate sample should be collected per sampling team per day. Equipment rinsate samples should be labeled with a unique identifier. Sample details should be recorded on a Libby Site-specific water FSDS.

7.2 Laboratory Quality Control Samples

Laboratory Blanks

A laboratory blank is a filter that is prepared by processing a clean crucible in the same way that a bark sample is prepared. That is, a clean crucible, in place, in the oven (with the sample set) at the same times that tree-bark samples are undergoing ashing. After ashing, the blank crucible is treated by addition of water and HCl, as described above. The contents of the crucible are then rinsed out, diluted to 100 mL, and an aliquot at least as large as the highest volume aliquot for the sample set is removed and used to prepare a filter for TEM examination. This type of blank is intended to indicate if contamination is occurring at any stage of the sample preparation procedure. Laboratory blanks should be prepared at a rate specified in the project-

specific sampling and analysis plan. In the absence of a project-specific specification, laboratory blanks should be prepared at a rate of 3%.

Filtration Blanks

A filtration blank is a clean filter that is prepared by passing 100 mL of laboratory FDI water through it. The purpose of this type of blank is to ensure that the filters are not contaminated in the laboratory, and that fluids used for diluting and processing samples are fiber-free. Filtration blanks should be prepared at a rate specified in the project-specific sampling and analysis plan. In the absence of a project-specific specification, filtration blanks should be prepared at a rate of 2%.

Laboratory Duplicates

Laboratory duplicates will be prepared by applying a second aliquot of ashed residue suspension to a new filter, which is then prepared and analyzed in the same fashion as the original filter. The frequency of laboratory duplicates should be specified in the governing document referencing this SOP. In the absence of such specification, the rate should be no less than 5%. Laboratory duplicates should be recorded using the appropriate laboratory quality control field in the TEM EDD spreadsheet.

Recounts

The precision of TEM sample results should be evaluated by recounting selected grid openings in accordance with the requirements specified in the most recent version of LB-000029 (refer to the Libby Lab eRoom for the current version of this laboratory modification).

8.0 References

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

Phipps, R.L. 1985. *Collecting, Preparing, Cross-dating and Measuring Tree Increment Cores.* U.S. Geological Survey Water Resources Investigations Report 85-4148.

ATTACHMENT A

FIELD SAMPLE DATA SHEET (FSDS) FOR TREE BARK

LIBBY FIELD SAMPLE DATA SHEET (FSDS)

TREE BARK

Field Logbook No: _____ Page No: _____

Station ID: _____ Sampling Date: _____

GPS Coordinate System: _____

X coord: _____ Y coord: _____ Elevation: _____m

Sampling Team: _____ Sampler Initials: _____

Station Comments: _____
_____
_____

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):** _____	**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):** _____	**Diameter* (in):** _____	
Field Comments:				
Entered by (Provide initials):		**Validated by (Provide initials):**		

ATTACHMENT B

ELECTRONIC DATA DELIVERABLE (EDD) SPREADSHEET

[contact EPA to obtain copy of the most recent version of the EDD]

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GENERAL EQUIPMENT DECONTAMINATION

SOP NO. 002

REVISION NO. 2

Last Reviewed: December 1999

Quality Assurance Approved	*February 2, 1993* Date

1.0 BACKGROUND

All nondisposable field equipment must be decontaminated before and after each use at each sampling location to obtain representative samples and to reduce the possibility of cross-contamination.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for decontaminating equipment in the field.

1.2 SCOPE

This SOP applies to decontaminating general nondisposable field equipment. To prevent contamination of samples, all sampling equipment must be thoroughly cleaned prior to each use.

1.3 DEFINITIONS

Alconox: Nonphosphate soap

1.4 REFERENCES

U.S. Environmental Protection Agency (EPA). 1992. "RCRA Ground-Water Monitoring: Draft Technical Guidance. Office of Solid Waste. Washington, DC. EPA/530-R-93-001. November.

EPA. 1994. "Sampling Equipment Decontamination." Environmental Response Team SOP #2006 (Rev. #0.0, 08/11/94). On-Line Address: http://204.46.140.12/media_resrcs/media_resrcs.asp?Child1=

1.5 REQUIREMENTS AND RESOURCES

The equipment required to conduct decontamination is as follows:

- Scrub brushes
- Large wash tubs or buckets
- Squirt bottles

- Alconox
- Tap water
- Distilled water
- Plastic sheeting
- Aluminum foil
- Methanol or hexane
- Dilute (0.1 N) nitric acid

2.0 PROCEDURE

The procedures below discuss decontamination of personal protective equipment (PPE), drilling and monitoring well installation equipment, borehole soil sampling equipment, water level measurement equipment, and general sampling equipment.

2.1 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

Personnel working in the field are required to follow specific procedures for decontamination prior to leaving the work area so that contamination is not spread off-site or to clean areas. All used disposable protective clothing, such as Tyvek coveralls, gloves, and booties, will be containerized for later disposal. Decontamination water will be containerized in 55-gallon drums.

Personnel decontamination procedures will be as follows:

1. Wash neoprene boots (or neoprene boots with disposable booties) with Liquinox or Alconox solution and rinse with clean water. Remove booties and retain boots for subsequent reuse.

2. Wash outer gloves in Liquinox or Alconox solution and rinse in clean water. Remove outer gloves and place into plastic bag for disposal.

3. Remove Tyvek or coveralls. Containerize Tyvek for disposal and place coveralls in plastic bag for reuse.

4. Remove air purifying respirator (APR), if used, and place the spent filters into a plastic bag for disposal. Filters should be changed daily or sooner depending on use and application. Place respirator into a separate plastic bag after cleaning and disinfecting.

5. Remove disposable gloves and place them in plastic bag for disposal.

6. Thoroughly wash hands and face in clean water and soap.

2.2 DRILLING AND MONITORING WELL INSTALLATION EQUIPMENT DECONTAMINATION

All drilling equipment should be decontaminated at a designated location on-site before drilling operations begin, between borings, and at completion of the project.

Monitoring well casing, screens, and fittings are assumed to be delivered to the site in a clean condition. However, they should be steam cleaned on-site prior to placement downhole. The drilling subcontractor will typically furnish the steam cleaner and water.

After cleaning the drilling equipment, field personnel should place the drilling equipment, well casing and screens, and any other equipment that will go into the hole on clean polyethylene sheeting.

The drilling auger, bits, drill pipe, temporary casing, surface casing, and other equipment should be decontaminated by the drilling subcontractor by hosing down with a steam cleaner until thoroughly clean. Drill bits and tools that still exhibit particles of soil after the first washing should be scrubbed with a wire brush and then rinsed again with a high-pressure steam rinse.

All wastewater from decontamination procedures should be containerized.

2.3 BOREHOLE SOIL SAMPLING EQUIPMENT DECONTAMINATION

The soil sampling equipment should be decontaminated after each sample as follows:

1. Prior to sampling, scrub the split-barrel sampler and sampling tools in a bucket using a stiff, long bristle brush and Liquinox or Alconox solution.
2. Steam clean the sampling equipment over the rinsate tub and allow to air dry.
3. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
4. Containerize all water and rinsate.

5. Decontaminate all pipe placed down the hole as described for drilling equipment.

2.4 WATER LEVEL MEASUREMENT EQUIPMENT DECONTAMINATION

Field personnel should decontaminate the well sounder and interface probe before inserting and after removing them from each well. The following decontamination procedures should be used:

1. Wipe the sounding cable with a disposable soap-impregnated cloth or paper towel.
2. Rinse with deionized organic-free water.

2.5 GENERAL SAMPLING EQUIPMENT DECONTAMINATION

All nondisposable sampling equipment should be decontaminated using the following procedures:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of protection as was used for sampling.
3. To decontaminate a piece of equipment, use an Alconox wash; a tap water wash; a solvent (methanol or hexane) rinse, if applicable or dilute (0.1 N) nitric acid rinse, if applicable; a distilled water rinse; and air drying. Use a solvent (methanol or hexane) rinse for grossly contaminated equipment (for example, equipment that is not readily cleaned by the Alconox wash). The dilute nitric acid rinse may be used if metals are the analyte of concern.
4. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
5. Containerize all water and rinsate.

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

RECORDING OF NOTES IN FIELD LOGBOOK

SOP NO. 024

REVISION NO. 1

Last Reviewed: November 1999

	May 18, 1993
Quality Assurance Approved	Date

1.0 BACKGROUND

The field logbook should contain detailed records of all the field activities, interviews of people, and observations of conditions at a site. Entries should be described in as much detail as possible, so that personnel can accurately reconstruct the activities and events which have taken place during field assignments. Field logbooks are considered accountable documents in enforcement proceedings and may be subject to review. Therefore, the entries in the logbook must be accurate, detailed, and reflect the importance of the field events.

1.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide guidance to ensure that logbook documentation for any field activity is correct, complete, and adequate. Logbooks are used for identifying, locating, labeling, and tracking samples. A logbook should document any deviations from the project approach, work plans, quality assurance project plans, health and safety plans, sampling plans, and any changes in project personnel. They also serve as documentation of any photographs taken during the course of the project. In addition, the data recorded in the logbook may assist in the interpretation of analytical results. A complete and accurate logbook also aids in maintaining good quality control. Quality control is enhanced by the proper documentation of all observations, activities, and decisions.

1.2 SCOPE

This SOP establishes the general requirements and procedures for recording notes in the field logbook.

1.3 DEFINITIONS

None

1.4 REFERENCES

Compton, R.R. 1985. *Geology in the Field*. John Wiley and Sons. New York, N.Y.

1.5 REQUIREMENTS AND RESOURCES

The following items are required for field notation:

- Field logbooks
- Ballpoint pens with permanent ink
- 6-inch ruler (optional)

Field logbooks should be bound (sewn) with water resistant and acid-proof covers; they should have preprinted lines and wide columns. They should be approximately 7 1/2 by 4 1/2 inches or 8 1/2 by 11 inches in size. Loose-leaf sheets are not acceptable for field notes. If notes are taken on loose paper, they must be transcribed as soon as possible into a regular field logbook by the same person who took the notes.

Logbooks can be obtained through the Document Control Administrator (DCA) for each office. The DCA will have assigned each logbook an identification number. The DCA will make sure the pages in the logbooks are preprinted with consecutive numbers or are consecutively numbered by hand. If the numbers are written by hand, then numbers should be circled so that they are not confused with data.

2.0 PROCEDURES

The following subsections provide general guidelines and formatting requirements for field logbooks and detailed procedures for completing field logbooks.

2.1 GENERAL GUIDELINES

- A separate field logbook must be maintained for each project. If a site consists of multiple subsites, designate a separate logbook for each subsite. For special tasks, such as periodic well water-level measurements, data from multiple subsites may be entered into one logbook which contains only one type of information.
- All logbooks must be bound and contain consecutively numbered pages.
- No pages can be removed from the logbook for any purpose.

- All field activities, meetings, photographs, and names of personnel must be recorded in the site logbook.
- All logbooks pertaining to a site or subsite should be assigned a serial number based on the date the logbook is issued to the project manager. The first logbook should be assigned number 1, the next logbook issued assigned number 2, and so on. The project manager is to maintain a record of all logbooks issued under the project.
- All information must be entered with a ballpoint pen with waterproof ink. Do not use pens with "wet ink," because the ink may wash out if the paper gets wet. Pencils are not permissible for field notes because information can be erased. The entries should be written dark enough so that the logbook can be easily photocopied.
- Do not enter information in the logbook that is not related to the project. The language used in the logbook should be factual and objective.
- Begin a new page for each day's notes.
- Write notes on every line of the logbook. If a subject changes and an additional blank space is necessary to make the new subject title standout, skip one line before beginning the new subject. Do not skip any pages or parts of pages unless a day's activity ends in the middle of a page.
- Draw a diagonal line on any blank spaces of four lines or more to prevent unauthorized entries.

2.2 LOGBOOK FORMAT

The layout and organization of each field logbook should be consistent with other field logbooks.

Guidelines for the cover, spine, and internal pagination are discussed below.

2.2.1 FORMAT OF FIELD LOGBOOK COVER AND SPINE

Write the following information in clear capital letters on the front cover of each logbook.

- Logbook identification number (assigned by the DCA)
- The serial number of the logbook (assigned by the project manager)
- Name of the site, city, and state

- Name of subsite if applicable
- Type of activity
- Beginning and ending dates of activities entered into the logbook
- "Tetra Tech EM Inc." City and State
- "REWARD IF FOUND"

Some of the information listed above, such as the list of activities and ending dates, should be entered after the entire logbook has been filled or after it has been decided that the remaining blank pages in the logbook will not be filled.

The spine of the logbook should contain an abbreviated version of the information on the cover. For example: "1, Col. Ave., Hastings, 5/88 - 8/88."

2.2.2 First Page of the Field Logbook

Spaces are usually provided on the inside front cover (or the opening page in some logbooks), for the company name ("Tetra Tech EM Inc."), address, and telephone number. If preprinted spaces for this information are not provided in the logbook, write the information on the first available page.

2.3 ENTERING INFORMATION IN THE LOGBOOK

Enter the following information at the beginning of each day or whenever warranted during the course of a day:

- Date
- Starting time
- Specific location
- General weather conditions and approximate temperature

- Names of personnel present at the site. Note the affiliation(s) and designation(s) of all personnel.
- Equipment calibration and equipment models used.
- Changes in instructions or activities at the site.
- Levels of personal protective clothing and equipment.
- A general title of the first task undertaken (for example, well installation at MW-11, decon at borehole BH-11, groundwater sampling at MW-11).
- Provide an approximate scale for all diagrams. If this can't be done, write "not to scale" on the diagram. Indicate the north direction on all maps and cross-sections. Label features on each diagram.
- Corrections should be made by drawing a single line through the entry being corrected. Initial and date any corrections made in the logbook.
- The person recording notes is to initial each page after the last entry. No information will be entered in the area following these initials.
- At the end of the day, the person recording notes is to sign and date the bottom of the last page. Indicate the end of the work day by writing "Left site at (time)." A diagonal line will be drawn across any blank space to the bottom of the page.

The following information should be recorded in the logbook after taking a photograph:

- Time, date, location, direction, and if appropriate, weather conditions
- Description of the subject photographed and the reason for taking the picture
- Sequential number of the photograph and the film roll number (if applicable)
- Name of the photographer

The following information should be entered into the logbook when taking samples:

- Location description
- Names of samplers
- Collection time
- Designation of samples as a grab or composite sample
- Type of sample (water, sediment, soil gas, etc.)

- On-site measurement data (pH, temperature, specific conductivity)
- Field observations (odors, colors, weather, etc.)
- Preliminary sample description
- Type of preservative used
- Instrument readings

2.4 PRECAUTIONS

Custody of field logbooks must be maintained at all times. Field personnel must keep the logbooks in a secure place (locked car, trailer, or field office) when the logbook is not in personal possession. Logbooks are official project documents and must be treated as such.

APPENDIX B

SITE HEALTH AND SAFETY PLAN

Site Name: Asbestos in Wood Waste Piles Sampling	**Site Contact: Mark Stockwell**	**Telephone: 406-295-9238**
Location: Lincoln County Landfills- Troy and Libby, MT	**Client Contact: John Podolinsky**	**Telephone: 406-841-5040**
EPA ID No. Not Applicable	**Prepared By: M. Stockwell**	**Date Prepared: April 25, 2012**
Project No. 103DS1613097.01	**Dates of Activities: 4/30/12 to 5/30/12** (HASP is not valid for periods longer than 12 months)	**Emergency Response** ☐ Yes ☒ No

Objectives:

To inspect and sample the wood waste piles at the Lincoln County landfills in Troy and Libby, Montana for Libby amphibole (LA) asbestos. Wood waste samples will be collected using standard operating procedures developed and approved for the Libby Superfund Site Operable Unit 3 and provided as:

(1) Sampling and Analysis of Brush for Asbestos
(2) Sampling and Analysis of Bark for Asbestos
(3) Sampling and Analysis of Wood Waste debris for Asbestos.

Analytical data will be validated and a brief data report will be prepared.

Site Type: *Check as many as applicable.*

☒ Active	☒ Landfill	☐ Inner-City
☐ Inactive	☐ Railroad	☒ Rural
☐ Secured	☐ Residential	☐ Remote
☒ Unsecured	☐ Industrial	☐ Other (*specify*)

Project Scope of Work and Site Background

This project will be completed under a task order for the Montana Department of Environmental Quality (DEQ), pursuant to DEQ Contract No. 407026. The purpose of the project is for Tetra Tech to collect wood waste samples to determine whether Libby Amphibole (LA) asbestos is associated with the brush, bark, and manufactured wood product debris (wood waste piles) in the Lincoln County landfills in Troy and Libby, Montana. Tetra Tech will develop and execute a sampling and analysis plan to test wood waste piles for LA asbestos. Tetra Tech will complete technical services necessary to support data analysis, data verification, data validation, reporting requirements, and report distribution for the sampling and analysis conducted at the Libby Asbestos Superfund Site (Site).

Brush sampling and analysis:

Brush debris generally consists of tree branches, which average between ¼ inch to 4 inches diameter and foliage from various species, predominantly conifers. Five aliquots will be collected for each 1 gallon-size sample. Each aliquot will be collected from a variety of species and tree branch diameters within a 1 cubic yard location and will fill approximately 1/5th of a gallon size baggie. The field team will document the selected species in the field logs. Aliquots will consist of tree branch cross sections and foliage collected with limb saws and pruning shears. Each 5-aliqout sample will fill a 1 gallon baggie.

Continued on Next Page.

Health and Safety Plan Approver Signature: Denny Cox

Digitally signed by Denny Cox
DN: cn=Denny Cox, o=EMI, ou=Tetra Tech, email=denny.cox@tetratech.com, c=US
Date: 2012.04.29 22:35:21 -05'00'

Date:

Note: A minimum of two persons with appropriate training and medical surveillance must be on site for any fieldwork subject to Level 2 HASP requirements.

Bark sampling and analysis:

Bark debris generally consists of tree stumps and branches or trees larger than 4 inches in diameter, which has been segregated in separate sections of the wood waste piles. Five aliquots will be collected for each sample. A 2-inch hole saw will be used to cut circular rings in the bark at each of 5 aliquots locations. Aliquot will be selected from a variety of stumps, favoring stumps of at least 16 inch diameter, and the field team will document the selected species in the field logs. Following saw hole cutting each circular piece of bark will be pried from the tree stumps using a sharp chisel. Once detached from the stumps, the five bark aliquots will be transferred to a labeled gallon-size plastic recloseable bag, representing one sample.

Manufactured wood product debris sampling and analysis:

Manufactured wood product debris generally consists of dimensional lumber and plywood debris that appears to be come from building demolition projects. The debris is comingled within the wood waste piles. Five aliquots will be collected for each 1 gallon-size sample. Each aliquot will be collected from a variety of debris types within a 1 cubic yard location and will fill approximately 1/5th of a gallon size baggie. The field team will document the types of selected debris in the field logs. Aliquots will consist of 4-inch square pieces collected with Sawsall and limb saws. Each 5-aliqout sample will fill a 1 gallon baggie.

Brush, bark and manufactured wood product debris samples will be submitted to an EPA approved laboratory for preparation and analysis. The laboratory will prepare 3 grids for TEM analysis as detailed in International Organization for Standardization (ISO) TEM method 10312, also known as ISO 10312:1995(E). Two grids will be utilized for analysis and 1 grid will be archived.

Note: A detailed site sketch may be included on Page 10 of 12.

Waste Management Practices:

Used, disposable PPE will be collected in sealable containers and will be disposed of in accordance with procedures described in the project specific work plan. Personnel decontamination procedures may be modified as necessary. All non-disposable PPE such as hard hats, respirators, and any exposed clothing will be washed at the end of each workday, or as necessary depending on working conditions, to eliminate all potential for asbestos contamination.

Wind Speed and Direction (Approach from upwind)		Temperature (°F)	Relative Humidity (%)	Probability of Precipitation (%)	Weather Forecast (such as partly cloudy, snow, etc.)
A current weather forecast shall be maintained with this HASP during all outdoor field operations					
Speed (mph): <40 MPH	**From Direction:** North	20 to 90	N/A	NA	Postpone sampling if snowing.

On-Site Supplies: ☒ First Aid Kit ☒ Fire Extinguisher ☐ Air Horn ☐ Oral Thermometer ☐ Noise Dosimeter

Known or Anticipated Site Hazards or Concerns: (Hazards covered by existing Safe Work Practices are listed on the next page)

☐ Work on active roadway	☐ Overhead utilities	☐ Energized electrical systems
☐ Onsite laboratory	☐ Surface or underground storage tanks	☒ Portable hand tool use
☐ Explosion or fire hazard	☒ General slips, trips, falls	☒ Portable electrical tool use
☐ Oxygen deficiency	☒ Uneven, muddy, rugged terrain	☐ Machine guarding
☐ Inorganic chemicals	☐ Industrial truck (forklift) use	☐ Portable fire extinguisher use
☐ Organic chemicals	☐ Lift (man lift, cherry picker) use	☐ Driving commercial vehicles
☐ Chemical warfare materiel	☐ Scaffold use	☒ Driving personal vehicles
☐ Compressed Gas Cylinders	☐ Wood or metal ladder use	☐ Scientific diving operations
☒ Asbestos	☐ Dangerous goods shipped by air	☐ Injury and Illness Prevention Program (California only)
☐ Respirable particulates	☐ Elevated work (over 6' high)	☐ Ergonomics (California only)
☐ Respirable silica	☐ Construction work	☐ Client-specific safety requirements (attach to HASP)
☐ Blasting and explosives	☐ Excavation or trenching	☐ ATV use
☐ Non-ionizing radiation (lasers, radiofrequencies, UV)	☐ Benching, shoring, bracing	☐ Methamphetamine lab
☐ High Noise	☐ Work in strip or shaft mines	☐ Mold
☐ Buried Utilities	☐ Grinding operations	☐ *Other (insert)*

Explosion or Fire Potential: ☐ High ☐ Medium ☒ Low ☐ Unknown

Chemical Products Tetra Tech EM Inc. Will Use or Store On Site: (Attach a Material Safety Data Sheet [MSDS] for each item.)

- ☐ Alconox or Liquinox
- ☐ Hydrochloric acid (HCl)
- ☐ Nitric acid (HNO_3)
- ☐ Sodium hydroxide (NaOH)
- ☐ Calibration gas (Methane)
- ☐ Calibration gas (Isobutylene)
- ☐ Calibration gas (Pentane)
- ☐ Calibration gas (4-gas mixture)
- ☐ Hydrogen gas
- ☐ Household bleach (NaOCl)
- ☐ Sulfuric acid (H_2SO_4)
- ☐ Hexane
- ☐ Isopropyl alcohol
- ☐ HazCat Kit
- ☒ Other Amended Water
- ☒ Other Spray Encapsulant

WARNING: Eyewash solution shall be readily available on ALL projects where corrosives (acids or bases) are used, including sample preservatives

Applicable Safe Work Practices (SWP) Attach to HASP: *Check as many as apply*

- ☒ SWP 6-1 - General Safe Work Practices for Field Work
- ☐ SWP 6-2 - Control of Hazardous Energy (Lockout-Tagout)
- ☐ SWP 6-3 - Work Near Drill Rigs
- ☐ SWP 6-4 - Excavation Work
- ☐ SWP 6-5 - Working Over or Near Water
- ☐ SWP-6-6 - Hot Work
- ☐ SWP 6-7 - Special Site Hazards (Bears, Firearms, Remote Locations, Mines, Abandoned Buildings, and Aircraft Hazards)
- ☐ SWP 6-8 - Electrical Work
- ☐ SWP 6-9 - Fall Protection
- ☐ SWP 6-10 - Use of Portable Ladders
- ☒ SWP 6-11 - Drum and Container Handling
- ☐ SWP 6-12 - Shipping Dangerous Goods
- ☐ SWP 6-13 - Flammable Hazards and Ignition Sources
- ☐ SWP 6-14 - Accidental Spill and Discharge Controls
- ☒ SWP 6-15 - Heat Stress
- ☒ SWP 6-16 - Cold Stress
- ☐ SWP 6-17 - Various Biohazards
- ☐ SWP 6-18 - Underground Storage Tank Removal Procedures
- ☐ SWP 6-21 - Sites with Ionizing Radiation Sources
- ☐ SWP 6-22 - Data Collection on Rivers
- ☐ SWP 6-23 - Permit-Required Confined Space
- ☐ SWP 6-24 - Non-Permit-Required Confined Space
- ☐ SWP 6-25 - Oil and other Petroleum Fuel Products
- ☐ SWP 6-26 - Working Near Heavy Equipment
- ☒ SWP 6-27 - Respirator Cleaning
- ☒ SWP 6-28 - Use of Air Purifying Respirators
- ☒ SWP 6-29 - Qualitative Fit Test Procedures
- ☐ SWP 6-30 - Office Employees
- ☐ SWP 6-31 - Hurricane Affected Areas
- ☐ SWP 6-33 - UXO/MEC Field Work

Tasks Performed At Job Site that are NOT Covered by SWPs

NOTE: Many completed AHA's can be found on the Health & Safety intranet site

Attach Activity Hazard Analysis (AHA) for each non-covered task

- ☒ Wood waste asbestos sampling
- ☐ (non-covered task)
- ☐ (non-covered task)
- ☐ (non-covered task)
- ☐ (non-covered task)

Tetra Tech Employee Training and Medical Requirements:

Basic Training and Medical

- ☒ Initial 40 Hour Training
- ☒ 8-Hour Supervisor Training (one-time)
- ☒ Current 8-Hour Refresher Training
- ☒ Current Medical Clearance (including respirator use)
- ☒ Current First Aid Training (minimum 1 Tetra Tech employee on site)
- ☒ Current CPR Training (minimum 1 Tetra Tech employee on site)
- ☒ Current Respirator Fit-Test

Other Specific Training and Medical Surveillance Requirements

- ☐ Confined Space Training
- ☐ Level A Training
- ☐ Radiation Training
- ☐ OSHA 10-hour Construction Safety
- ☐ Blood Lead Level and ZPP Pre and Post-Project
- ☐ Urinary Arsenic Level Pre and Post-Project
- ☐ Other _____

Materials Present or Suspected at Site	Highest Observed Concentration (specify units and sample medium)	Exposure Limit (specify ppm or mg/m^3)	IDLH Level (specify ppm or mg/m^3)	Primary Hazards of the Material (explosive, flammable, corrosive, toxic, volatile, radioactive, biohazard, oxidizer, or other)	Symptoms and Effects of Acute Exposure	Photoionization Potential (eV)
Libby Amphibole Asbestos	Up to 1% of a suspect tree brush, bark or manufactured wood product debris sample.	PEL/REL/TLV = 0.1 fibers per cubic cm; > 5 micrometers in length NOTE: 1.0 fibers per cubic cm for 30-minute excursion level	CARC	CARC	Asbestosis (chronic exposure), dyspnea, interstitial fibrosis, restricted pulmonary function, finger clubbing, irritated eyes, CARC	N/A
		PEL = REL = TLV = [Skin] Hazard ☐				
		PEL = REL = TLV = [Skin] Hazard ☐				
		PEL = REL = TLV = [Skin] Hazard ☐				
		PEL = REL = TLV = [Skin] Hazard ☐				
		PEL = REL = TLV = [Skin] Hazard ☐				

Specify Information Sources: For example: NIOSH Pocket Guide to Hazardous Chemicals, September 2005 and American Conference of Governmental Industrial Hygienists (ACGIH). "Threshold Limit Values and Biological Exposure Indices for 2008."

Note: In the Exposure Limit column, include Ceiling (C) and Short-Term Exposure Limits (STEL) if they are available. Also, use the following short forms and abbreviations to complete the table above.

A = Air
CARC = Carcinogenic
eV = Electron volt
U = Unknown

IDLH = Immediately dangerous to life or health
mg/m^3 = Milligram per cubic meter
NA = Not available
NE = None established

PEL = Permissible exposure limit
ppm = Part per million
REL = Recommended exposure limit
S = Soil

TLV = Threshold limit value

Note: If no contingency level of protection is selected, all employees covered under this plan must evacuate the immediate site area if air contaminant levels require upgrading PPE. This information is available on the chemical hazards page of this HASP.

Field Activities Covered Under this HASP:

Task Description	Level of Protection[1] Primary	Level of Protection[1] Contingency	Date of Activities
1 Driving and walking to sample collection locations	☐ A ☐ B ☐ C ☒ D	☐ A ☐ B ☒ C ☐ D	November 3-4, 2011
2 Collecting wood waste samples.	☐ A ☐ B ☒ C ☐ D	☐ A ☐ B ☐ C ☐ D	November 3-4, 2011
3	☐ A ☐ B ☐ C ☐ D	☐ A ☐ B ☐ C ☐ D	
4	☐ A ☐ B ☐ C ☐ D	☐ A ☐ B ☐ C ☐ D	
5	☐ A ☐ B ☐ C ☐ D	☐ A ☐ B ☐ C ☐ D	

Site Personnel and Responsibilities (include subcontractors):

Employee Name and Office Code / Location	Task(s)	Responsibilities
J. Edward Surbrugg HE/Helena	PM	• Project Manager: Manages the overall project, makes site safety coordinator (SSC) aware of pertinent project developments and plans, and maintains communications with client as necessary. Additionally, For projects lasting longer than one consecutive week on-site, the PM is responsible for conducting one field audit using Form AF-1.
Mark Stockwell SA/Sacramento	1 and 2	• Field Team Leader: Directs field activities, makes site safety coordinator (SSC) aware of pertinent project developments and plans, and maintains communications with the Project Manager and the client as necessary
Mark Stockwell SA/Sacramento	1 and 2	• Site Safety Coordinator (SSC): Ensures that appropriate personal protective equipment (PPE) is available, enforces proper use of PPE by on-site personnel and subcontractors; suspends investigative work if personnel are or may be exposed to an immediate health hazard; implements and enforces the HASP; identifies and controls site hazards when possible; communicates site hazards to all personnel; and reports any deviations observed from anticipated conditions described in the health and safety plan to the health and safety representative.
None		• Alternate Site Safety Coordinator (if any)
Jay Jordan HE/Helena or John Ruth HE/Helena	1 and 2	• Field Personnel: Completes tasks as directed by the project manager, field team leader, and SSC, and follows the HASP and all SWPs and guidelines established in the Tetra Tech, Inc., Health and Safety Manual.
None		• None

Note:
1. See next page for details on levels of protection

NOTE: Contingency level of protection section should be completed only if the upgraded level of protection is immediately available at the job site. If no contingency level of protection is denoted, all employees covered under this HASP must evacuate the immediate site area if air contaminant levels would require an upgrade of PPE.

Protective Equipment: (Indicate type or material as necessary for each task.)

Task	Primary Level of Protection (A,B,C,D)	PPE Component Description (Primary)	Contingency Level of Protection (A, B, C, D)	PPE Component Description (Contingency)
1	D	Respirator type: Not needed Cartridge type (if applicable): CPC material: Not Needed Glove material(s): Nitrile, Surgical Boot material: Steel-toe, Steel-shank Other: Safety Glasses, Hard Hat, First Aid Kit, Overboots, Portable Eyewash, Ear Plugs as needed	C	Respirator type: Half or Full-face APR Cartridge type (if applicable): P-100 CPC material: Tyvek® coveralls while sampling and under dusty conditions Glove material(s): Nitrile, Surgical Boot material: Steel-Toe/Steel-Shank Other: First Aid Kit
2	C	Respirator type: Half or Full-face APR Cartridge type (if applicable): P-100 CPC material: Tyvek® coveralls for contaminated areas such as attics Glove material(s): Nitrile, Surgical Boot material: Steel-Toe/Steel-Shank Other: First Aid Kit		Respirator type: Cartridge type (if applicable): CPC material: Glove material(s): Boot material: Other:
3		Respirator type: Cartridge type (if applicable): CPC material: Glove material(s): Boot material: Other:		Respirator type: Cartridge type (if applicable): CPC material: Glove material(s): Boot material: Other:
4		Respirator type: Cartridge type (if applicable): CPC material: Glove material(s): Boot material: Other:		Respirator type: Cartridge type (if applicable): CPC material: Glove material(s): Boot material: Other:
5		Respirator type: Cartridge type (if applicable): CPC material: Glove material(s): Boot material: Other:		Respirator type: Cartridge type (if applicable): CPC material: Glove material(s): Boot material: Other:

Respirator Notes:
Respirator cartridges may only be used for a maximum time period of 8 hours or one work shift, whichever is less, and must be discarded at that time. For job sites with organic vapors, respirator cartridges may be used as described in this note as long as the concentration is less than 200 parts per million (ppm), the boiling point is greater than 70 °Celsius, and the relative humidity is less than 85 percent. If any of these levels are exceeded, a site-specific respirator cartridge change-out schedule must be developed and included in the HASP using Tetra Tech Form RP-2 (Respiratory Hazard Assessment Form)

Notes:
All levels of protection must include eye, head, and foot protection.
CPC = Chemical protective clothing
Thermoluminescent Dosimeter (TLD) Badges must be worn during all field activities on sites with radiation hazards. TLDs must be worn under CPC.

Monitoring Equipment: All monitoring equipment on site must be calibrated before and after each use and results recorded in the site logbook

Instrument (Check all required)	Task	Instrument Reading	Action Guideline	Comments
☐ Combustible gas indicator model:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	0 to 10% LEL	Monitor; evacuate if confined space	
		10 to 25% LEL	Potential explosion hazard; notify SSC	
		>25% LEL	Explosion hazard; interrupt task; evacuate site; notify SSC	
☐ Oxygen meter model:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	>23.5% Oxygen	Potential fire hazard; evacuate site	
		23.5 to 19.5% Oxygen	Oxygen level normal	
		<19.5% Oxygen	Oxygen deficiency; interrupt task; evacuate site; notify SSC	
☐ Radiation survey meter model:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Normal background	Proceed	Annual exposure not to exceed 1,250 mrem per quarter Background reading must be taken in an area known to be free of radiation sources.
		Two to three times background	Notify SSC	
		>Three times background	Radiological hazard; interrupt task; evacuate site; notify Health Physicist	
☐ Photoionization detector model: ☐ 11.7 eV ☐ 10.6 eV ☐ 10.2 eV ☐ 9.8 eV ☐ _____ eV	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Any response above background to 5 ppm above background	Level C[a] is acceptable Level B is recommended	These action levels are for unknown gases or vapors. After the contaminants are identified, action levels should be based on the specific contaminants involved.
		> 5 to 500 ppm above background	Level B	
		> 500 ppm above background	Level A	
☐ Flame ionization detector model:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Any response above background to 5 ppm above background	Level C[a] is acceptable Level B is recommended	These action levels are for unknown gases or vapors. After the contaminants are identified, action levels should be based on the specific contaminants involved.
		>5 to 500 ppm above background	Level B	
		>500 above background	Level A	
☐ Detector tube models:	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	Specify: < 1/2 the PEL > 1/2 the PEL	Specify:	The action level for upgrading the level of protection is one-half of the contaminant's PEL. If the PEL is reached, evacuate the site and notify a safety specialist

Notes:
eV= electron volt LEL=Lower explosive limit mrem=Millirem PEL=Permissible exposure limit ppm=Part per million
a. Level C may be acceptable for certain tasks in some situations. If you are uncertain whether Level C is appropriate, consult the Regional Safety Officer. Additionally, when working with unknown respiratory hazards, Level C cartridge must provide protection for organic vapors, acid gases, ammonia, amines, formaldehyde, hydrogen fluoride, and particulate aerosols.

Project-Specific Industrial Hygiene Requirements

OSHA-Regulated Chemicals:

Check any present on the job site in any medium (air, water, soil)

- ☐ No chemicals below are located on the job site
- ☒ Friable Asbestos
- ☐ alpha-Napthylamine
- ☐ Methyl chloromethyl ether
- ☐ 3,3'-Dichlorobenzidine (and its salts)
- ☐ bis-Chloromethyl ether
- ☐ beta-Napthylamine
- ☐ Benzidine
- ☐ 4-Aminodiphenyl
- ☐ Ethyleneimine
- ☐ beta-Propiolactone
- ☐ 2-Acetylaminoflourene
- ☐ 4-Dimethylaminoazobenzene
- ☐ N-nitrosomethylamine
- ☐ Vinyl chloride
- ☐ Inorganic arsenic
- ☐ Lead
- ☐ Chromium (VI)
- ☐ Cadmium
- ☐ Benzene
- ☐ Coke oven emissions
- ☐ 1,2-Dibromo-3-chloropropane
- ☐ Acrylonitrile
- ☐ Ethylene oxide
- ☐ Formaldehyde
- ☐ Methylenedianiline
- ☐ 1,3-Butadiene
- ☐ Methylene chloride

Emergency Contacts:	Telephone No.
Work Care and Incident Intervention	(800) 455-6155
Tetra Tech EMI 24-hour Anonymous Hazard Reporting Line	(866) 383-8070
U.S. Coast Guard National Response Center	(800) 424-8802
InfoTrac	(800) 535-5053
Fire department	911 or Fill in
Police department	911 or Fill in

Personnel Call-Down List:

Job Title or Position:	Name	Primary Phone:
Regional Safety Officer	Denny Cox	816-668-7464
Project Manager:	J. Edward Surbrugg	406-441-3269
Field Team Leader:	Mark Stockwell	916-715-8442
Site Safety Coordinator (SSC):		
Subcontractor SSC:		

Medical and Site Emergencies:

Signal a site or medical emergency with three blasts of a loud horn (car horn, fog horn, or similar device). Site personnel should evacuate to the area of safe refuge designated on the site map.

Hospital Name: St. John's Lutheran Hospital

Address: 350 Louisiana Avenue
Libby, MT 59923

General Phone: 406-293-0100
Emergency Phone: 911 or fill in
Ambulance Phone: 911 or fill in

Hospital called to verify emergency services are offered? YES ☒ NO ☐

1. Head **west** on **Pipe Creek Rd** toward **MT-37 S**
2. Take the 2nd right onto **MT-37 S**
3. Turn left onto **W 5th St**
4. Take the 3rd left onto **Louisiana Ave**

Destination will be on the right

Note: This page must be posted on site.

Decontamination Procedures

The site safety coordinator overseas implementation of project decontamination procedures and is responsible for ensuring they are effective.

Personnel Decontamination

Level D Decon - ☐ Wet ☒ Dry

Level C Decon - ☐ Wet ☒ Dry

Level B Decon – Briefly outline the level B decontamination methods to be used on a separate page attached to this HASP.

Level A Decon – A Level 3 HASP is required. Notify your regional health and safety representative and health and safety director.

Equipment Decontamination

All tools, equipment, and machinery from the Exclusion Zone (hot) or Contamination Reduction Zone (warm) are decontaminated in the CRZ before they are removed to the Support Zone (cold). Equipment decontamination procedures are designed to minimize the potential for hazardous skin or inhalation exposure, cross-contamination, and chemical incompatibilities.

Respirator Decontamination

Respirators are decontaminated in compliance with SWP 6-27 and should be included with this HASP.

Waste Handling for Decontamination

Procedures for decontamination waste disposal meet all applicable local, state, and federal regulations.

Decontamination Equipment

- ☐ Washtubs
- ☒ Buckets
- ☒ Scrub brushes
- ☐ Pressurized sprayer
- ☐ Detergent [Type]
- ☐ Solvent [Type]
- ☐ Household bleach solution

  Concentration/Dilution: _____
- ☐ Deionized water
- ☒ Disposable sanitizer wipes
- ☐ Facemask sanitizer powder
- ☐ Wire brush
- ☒ Spray bottle
- ☐ Tubs / pools
- ☐ Banner/barrier tape
- ☐ Plastic sheeting
- ☐ Tarps and poles
- ☒ Trash bags
- ☐ Trash cans
- ☐ Duct tape
- ☒ Paper towels
- ☐ Folding chairs
- ☐ Other

Emergency Response Planning

During the pre-work briefing and daily tailgate safety meetings, all on-site employees will be trained in the provisions of emergency response planning, site communication systems, and site evacuation routes.

In the event of an emergency that necessitates evacuation of a work task area or the site, the following procedures will take place.

- The Tetra Tech SSC will contact all nearby personnel using the on-site communications to advise the personnel of the emergency.
- The personnel will proceed along site roads to a safe distance upwind from the hazard source.
- The personnel will remain in that area until the SSC or an authorized individual provides further instructions.

In the event of a severe spill or a leak, site personnel will follow the procedures listed below.

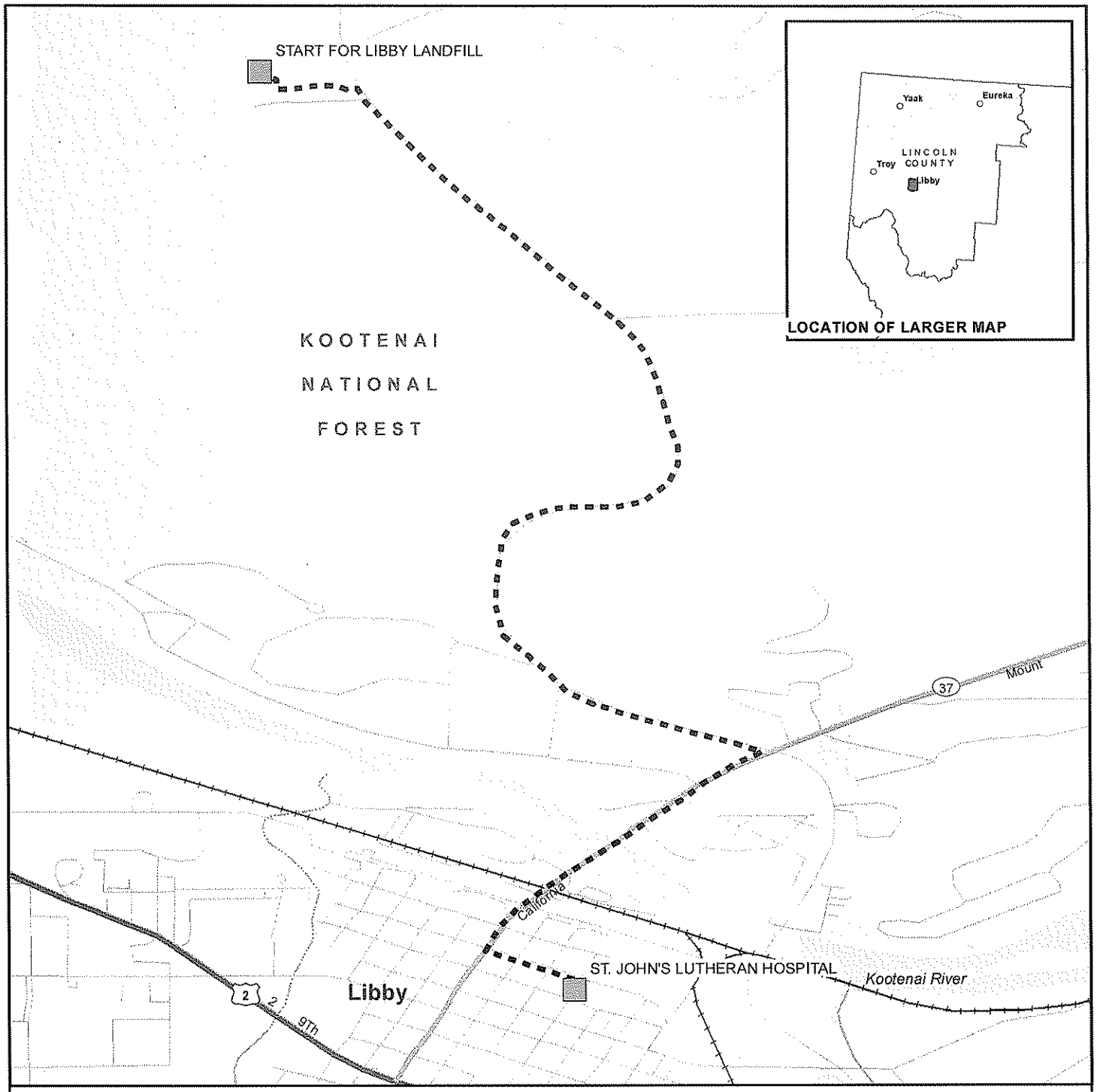
- Evacuate the affected area and relocate personnel to an upwind location.
- Inform the Tetra Tech SSC, a Tetra Tech office, and a site representative immediately.
- Locate the source of the spill or leak, and stop the flow if it is safe to do so.
- Begin containment and recovery of spilled or leaked materials.
- Notify appropriate local, state, and federal agencies.

In the event of severe weather, site personnel will follow the procedures listed below.

- Site work shall not be conducted during severe weather, including high winds and lightning.
- In the event of severe weather, stop work, lower any equipment (drill rigs) and evacuate the affected area.
- Severe weather may cause heat or cold stress. Refer to SWPs 15 and 16 for information on both.

All work-related incidents must be reported. According to TtEMI's reporting procedures, for non-emergency incidents you should:

- Notify WorkCare and Incident Intervention at (800) 455-6155
- Notify your Project Manager or Regional Safety Officer (RSO) via phone.
- Complete a "Tetra Tech Incident Report" (Form IR) within 24 hours and send it to your RSO. If an injury or illness has occurred, the Form IR-A and the WorkCare HIPAA form must be completed at the same time the Form IR is completed.



DIRECTIONS FROM THE LIBBY LANDFILL TO ST. JOHN'S LUTHERAN HOSPITAL
3.7 MILES
1. HEAD EAST ON LIBBY LANDFILL ROAD 0.25 MILES.
2. TURN RIGHT (SOUTH) ONTO PIPE CREEK ROAD AND DRIVE 2.5 MILES TO MT37.
3. TURN RIGHT (SOUTH) ONTO MT37 AND DRIVE 0.75 MILES OVER THE KOOTENAI RIVER BRIDGE TO 3RD STREET IN LIBBY.
4. TURN LEFT (EAST) ONTO 3RD STREETAND DRIVE FOUR BLOCKS (0.2 MILES) TO ST. JOHNS. HOSPITAL WILL BE ON THE RIGHT.

TETRA TECH EM, INC.

Legend

LANDFILL AND HOSPITAL POINTS

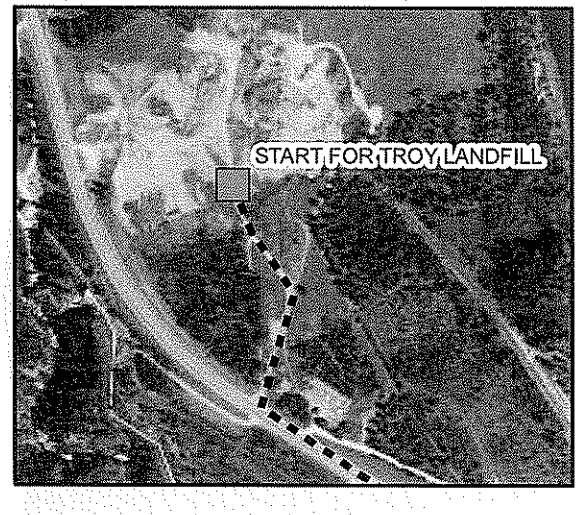
ROUTE TO HOSPITAL

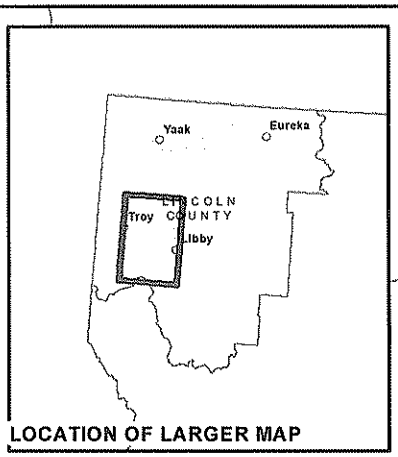
N

LIBBY LANDFILL BARK SAMPLING HSP

FIGURE 1
LIBBY LANDFILL
HOSPITAL ROUTE MAP

GIS map by Ed Madej TTEMI-HE
FIG1_LIBBY_LANDFILL_HOSPITAL_ROUTE_MAP_042612.mxd





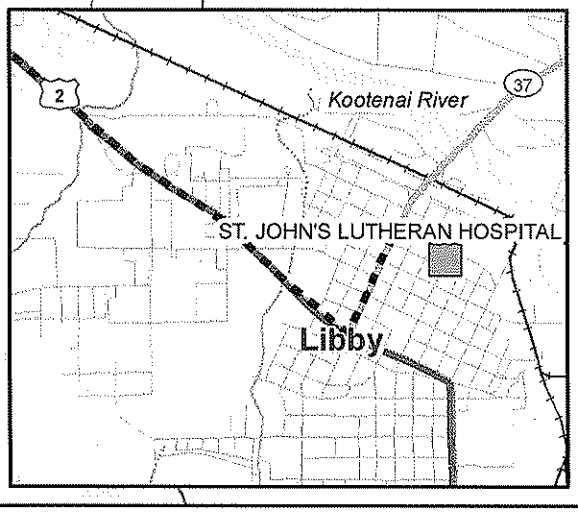
START FOR TROY LANDFILL

2

KOOTENAI NATIONAL FOREST

ST. JOHN'S LUTHERAN HOSPITAL

Libby



DIRECTIONS FROM THE TROY LANDFILL TO ST. JOHN'S LUTHERAN HOSPITAL
17.1 MILES
1. HEAD SOUTH ON LANDFILL ROAD 0.25 MILES TO US HIGHWAY 2.
2. TURN LEFT (EAST) ONTO US HIGHWAY 2 AND DRIVE 16.4 MILES TO LIBBY.
3. TURN LEFT (NORTH) ONTO MT37 AND DRIVE 0.6 MILES TO 3RD STREET IN LIBBY.
4. TURN RIGHT (EAST) ONTO 3RD STREETAND DRIVE FOUR BLOCKS (0.2 MILES) TO ST. JOHNS. HOSPITAL WILL BE ON THE RIGHT.

TETRA TECH EM, INC.

Legend

LANDFILL AND HOSPITAL POINTS

ROUTE TO HOSPITAL

N

LIBBY LANDFILL BARK SAMPLING HSP

FIGURE 2
TROY LANDFILL
HOSPITAL ROUTE MAP

GIS map by Ed Madej TTEMI-HE
FIG2_TROY_LANDFILL_HOSPITAL_ROUTE_MAP_042612.mxd

APPROVAL AND SIGN-OFF FORM

Project No.: 103DS1613097.01 Wood Waste Pile Sampling

I have read, understood, and agree with the information set forth in this Health and Safety Plan and will follow the direction of the Site Safety Coordinator (SSC) as well as procedures and guidelines established in the Tetra Tech, Inc., Health and Safety Manual. I understand the training and medical requirements for conducting field work and have met these requirements.

Name	Company / Agency / Organization	Signature	Date

I have read, understood, and agree with the information set forth in this Health and Safety Plan and comply with and will enforce this HASP, as well as procedures and guidelines established in the Tetra Tech, Inc., Health and Safety Manual.

Name	Project-Specific Position	Signature	Date
J. Edward Surbrugg	Project Manager		
Mark Stockwell	Site Safety Coordinator		
	Subcontractor SSC		

Tetra Tech has prepared this plan solely for the purpose of the health and safety protection of Tetra Tech employees. Subcontractors, visitors, and others at the site, while required to read and follow the provisions outlined in this plan at a minimum, should refer to their safety program for specific information related to their health and safety protection.

Note: Use Additional sheets as necessary to ensure that all personnel sign and affirm this document.

DEFINITIONS AND NOTES

Emergency Contacts

Work Care - For issues requiring an Occupational Health Physician; assistance is available 24 hours per day, 7 days per week.

InfoTrac — For issues related to incidents involving the transportation of hazardous chemicals; this hotline provides accident assistance 24 hours per day, 7 days per week

U.S. Coast Guard National Response Center — For issues related to spill containment, cleanup, and damage assessment; this hotline will direct spill information to the appropriate state or region

Limitations:

The Level-Two HASP is not appropriate in some cases:

- **Projects involving unexploded ordnance (UXO), radiation sources as the primary hazard, or known chemical/biological weapons site must employ the Level 3 HASP**
- **Projects of duration longer than 1 month must employ the Level 3 HASP**
- **Projects with more than five tasks must employ the Level 3 HASP**

Decontamination:

Decontamination Solutions for Chemical and Biological Warfare Agents[a]: PPE and equipment can be decontaminated using 0.5 percent bleach (1 gallon laundry bleach to 9 gallons water) for biological agents (15 minutes of contact time for anthrax spores; 3 minutes for others) followed by water rinse for chemical and biological agents. In the absence of bleach, dry powders such as soap detergents, earth, and flour can be used. The powders should be applied and then wiped off using wet tissue paper. Finally, water and water/soap solutions can be used to physically remove or dilute chemical and biological agents. Do not use bleach solution on bare skin; use soap and water instead. Protect decontamination workers from exposure to bleach.

Decontamination for Radiological and Other Chemicals: Primary decontamination should use Alconox and water unless otherwise specified in chemical specific information resources. The effectiveness of radiation decontamination should be checked using a radiation survey instrument. Decontamination procedures should be repeated until the radiation meter reads less than 100 counts per minute over a 100-square-centimeter area when the probe is held 1 centimeter from the surface and moving slower than 2.5 centimeters per second.

Decontamination Corridor: The decontamination setup can be adjusted to meet the needs of the situation. The decontamination procedures can be altered to meet the needs of the specific situation when compound- and site-specific information is available.

Decontamination Waste: All disposable equipment, clothing, and decontamination solutions will be double-bagged or containerized in an acceptable manner and disposed of with investigation-derived waste.

Decontamination Personnel: Decontamination personnel should dress in the same level of PPE or one level below the entry team PPE level.

All investigation-derived waste should be left on site with the permission of the property owner and the EPA on-scene coordinator. In some instances, another contractor will dispose of decontamination waste and investigation-derived waste. DO NOT place waste in regular trash. DO NOT dispose of waste until proper procedures are established.

Notes:

[a] Source: Jane's Information Group. 2002. *Jane's Chem-Bio Handbook*. Page 39.

TETRA TECH, INC.

DAILY TAILGATE SAFETY MEETING FORM

Date: _____ Time: _____ Project No.: _____

Client: _____ Site Location: _____

Site Activities Planned for Today: _____

Weather Conditions: _____

Safety Topics Discussed	
Protective clothing and equipment:	
Chemical and physical hazards:	
Emergency procedures:	
Equipment hazards:	
Other:	
Attendees	
Printed Name	**Signature**

Meeting Conducted by:

_____ _____

Name Signature

10/08

TETRA TECH EM INC.

HEALTH AND SAFETY PLAN AMENDMENT

Site Name: _____

Amendment Date: _____

Purpose or Reason for Amendment: _____

_____

_____

Required Additional Safe Work Practices or Activity Hazard Analyses: _____

_____

Required Changes in PPE: _____

_____

_____

_____

Action Level Changes: _____

_____

_____

_____

_____

AMENDMENT APPROVAL

RSO or Designee	_____ Name	_____ Signature	_____ Date
Site Safety Coordinator	_____ Name	_____ Signature	_____ Date

Date presented during daily site safety meeting: _____

10/08

TETRA TECH, INC.

FIELD AUDIT CHECKLIST

Project Name: _____ Project No.: _____

Field Location: _____ Completed by: _____

Project Manager: _____ Site Safety Coordinator: _____

General Items		In Compliance?		
Health and Safety Plan Requirements		Yes	No	NA
1	Approved health and safety plan (HASP) on site or available			
2	Names of on-site personnel recorded in field logbook or daily log			
3	HASP compliance agreement form signed by all on-site personnel			
4	Material Safety Data Sheets on site or available			
5	Designated site safety coordinator physically present on jobsite			
6	Daily tailgate safety meetings conducted and documented on Form HST-2			
7	Documentation available proving compliance with HASP requirements for medical examinations, fit testing, and training (including subcontractors)			
8	HASP onsite matches scope of work being conducted			
9	Emergency evacuation plan in place and hospital located			
10	Exclusion, decontamination, and support zones delineated and enforced			
11	HASP attachments present onsite (VPP sheet, audit checklist, AHA, etc.)			
12	Illness and injury prevention program reports completed (California only)			
Emergency Planning				
13	Emergency telephone numbers posted			
14	Emergency route to hospital posted			
15	Local emergency providers notified of site activities			
16	Adequate safety equipment inventory available			
17	First aid provider and supplies available			
18	Eyewash solution available when corrosive chemicals are present			
Air Monitoring				
19	Monitoring equipment specified in HASP available and in working order			
20	Monitoring equipment calibrated and calibration records available			
21	Personnel know how to operate monitoring equipment and equipment manuals available on site			
22	Environmental and personnel monitoring performed as specified in HASP			

Safety Items		In Compliance?		
Personal Protection		Yes	No	NA
23	Splash suit, if required			
24	Chemical protective clothing, if required			
25	Safety glasses or goggles (always required)			
26	Gloves, if required			
27	Overboots, if required			
28	Hard hat (always required)			
29	High visibility vest, if required			
30	Hearing protection, if required			
31	Full-face respirator, if required			
Instrumentation				
32	Combustible gas meter and calibration notes			
33	Oxygen meter and calibration notes			
34	Organic vapor analyzer and calibration notes			
Supplies				
35	Decontamination equipment and supplies			
35	Fire extinguishers			
37	Spill cleanup supplies			
Corrective Action Taken During Audit:				

Note: NA = Not applicable

Auditor's Signature

Site Safety Coordinator's Signature

Date

Tetra Tech, Inc.

ACTIVITY HAZARD ANALYSIS (AHA)

Tetra Tech EM Inc.

Wood Waste Sampling at Troy and Libby Landfill Sites

Task Description

This Activity Hazard Analysis (AHA) applies to the task listed above. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required equipment (including safety equipment), inspections, and training. The hazard controls listed below are specific to this task.

Hazards		Actions
Task Steps	**Potential Hazards**	**Critical Safety Procedures and Controls**
1. Hiking To and From Sampling Points	Slips, trips, and falls	Wear sturdy hiking/work boots, have a minimum of 2 persons on the team, wear reflective vests to be visible, and carry a cell phone for emergency situations.
2. Collecting samples of small brush, branches, tree bark, and manufactured wood wastes.	Power drill and sawsall, sharp chisel, hand saw, and exposure to asbestos in the various wood wastes.	Wear Tyvek, inner gloves, leather outer gloves, safety glasses, and respirator while collecting wood waste samples
Equipment to be Used Cordless drill Cordless sawsall Sharp chisel & hammer	**Inspection Requirements** Daily to ensure safe working conditions	**Training Requirements** Fit Tested for Respirator Approved Personnel for Respirator Use No equipment training needed as it is standard off-the-shelf tools.

	Name	Signature	Date
Assessed By	J. Edward Surbrugg	J. Edward Surbrugg	April 25, 2012
Approved By			

APPENDIX C

FIELD FORMS

FIELD SAMPLE DATA SHEET (FSDS)

BRUSH, BARK, AND MANUFACTURED WOOD WASTE SAMPLES
LINCOLN COUNTY LANDFILL WOOD WASTE PILES

Field Log Book Number: _____ Page Number _____

Sample Location ID: _____ Sample Date: _____

GPS Coordinate System: _____ Elevation Coordinate System: _____

X Coordinate: _____ Y Coordinate: _____ Elevation: _____

Sample Team: _____ Samplers' Initials: _____

Sample Location Comments: _____

Data Item	Sample 1	Sample 2	Sample 3
Index ID (place pre-printed label in field provided)			
Sample Time (hh:mm)			
Sample Type (circle one):	Bark Duff Grab Composite \# of Composites: _____	Bark Duff Grab Composite \# of Composites: _____	Bark Duff Grab Composite \# of Composites: _____
Field QC Type (circle one):	FS (field sample) FD (field duplicate) For FD, Parent ID: _____	FS (field sample) FD (field duplicate) For FD, Parent ID: _____	FS (field sample) FD (field duplicate) For FD, Parent ID: _____
Field Comments:			
Entered by (Provide initials):		**Entered by (Provide initials):**	

APPENDIX D

FIELD TEAM TRAINING CERTIFICATES

ENVIRONMENTAL RESTORATION

HEALTH, SAFETY & ENVIRONMENTAL TRAINING PROGRAM

This Certifies that

Jay Jordan

has successfully completed and passed the
course examination with a minimum score of 70 percent

Asbestos Contractor/Supervisor Refresher Training (8 hours)

in accordance with U.S. EPA under 40 CFR 763 (AHERA - TSCA Title II)
with accreditation by the Missouri Department of Natural Resources

Training Date(s) *03/24/12*

Instructor(s) _____
Mitchell Hunt - Environmental Scientist

Certificate # *ASB8-:LIB032412-07*

Expiration Date *03/24/13*

Environmental Restoration, LLC, St. Louis, MO 63026

Providing Quality Environmental Remediation, Environmental Construction, Temporary Staffing and Emergency Response Services

ENVIRONMENTAL RESTORATION

HEALTH, SAFETY & ENVIRONMENTAL TRAINING PROGRAM

This Certifies that

Jay Jordan

has successfully completed

Refresher Training for Hazardous Waste Site Workers

in accordance with OSHA in 29 CFR 1910.120(e)(8)

Training Date(s) *03/24/12*

Instructor(s) _____

Mitchell Hunt – Environmental Scientist

Certificate # *HWR8-LIB032412-08*

Expiration Date *03/24/13*

Environmental Restoration, LLC, St. Louis, MO 63026

Providing Quality Environmental Remediation, Environmental Construction, Temporary Staffing and Emergency Response Services

ENVIRONMENTAL RESTORATION

HEALTH, SAFETY & ENVIRONMENTAL TRAINING PROGRAM

This Certifies that

Mark Stockwell

has successfully completed

Refresher Training for Hazardous Waste Site Workers

in accordance with OSHA in 29 CFR 1910.120(e)(8)

Training Date(s) *03/24/12*

Instructor(s) _____

Mitchell Hunt – Environmental Scientist

Certificate # *HWR8-LIB032412-10*

Expiration Date *03/24/13*

Environmental Restoration, LLC, St. Louis, MO 63026

Providing Quality Environmental Remediation, Environmental Construction, Temporary Staffing and Emergency Response Services

APPENDIX E

SITE PHOTOGRAPHS

Photograph No. 1: Troy Landfill looking southeast across wood waste pile.

Photograph No. 2: Troy Landfill looking southwest across wood waste pile.

Photograph No. 3: Troy Landfill – close up view of manufactured wood wastes mixed with brush and trees.

Photograph No. 4: Troy Landfill looking north along perimeter of wood waste pile where sampling will occur.

Photograph No. 5: Libby Landfill looking north along perimeter of wood waste material pile from near the southeast corner of site.

Photograph No. 6: Libby Landfill looking northwest along perimeter of wood waste pile from near the southeastern corner of the site.

Photograph No. 7: Libby Landfill looking west at the wood waste pile near the northeastern corner of the site.

Photograph No. 8: Libby Landfill looking south at the variety of wood wastes in the pile.

APPENDIX F

ANALYTICAL REQUIREMENT SUMMARIES FOR BRUSH, BARK, AND MANUFACTURED WOOD WASTE MATERIALS

SAP REQUIREMENTS SUMMARY #WW-0512
SUMMARY OF PREPARATION AND ANALYTICAL REQUIREMENTS FOR ASBESTOS

Title: Asbestos in Wood Waste Piles, Sampling and Analysis Plan, Lincoln County Landfills, Troy and Libby, Montana

SAP Date (Revision): May 2012 (Revision 0)

EPA Technical Advisor: David Berry at 303-312-6358 (Berry.David@epa.gov),or Elizabeth Fagen (303-312-6095) (Fagen.Elizabeth@epa.gov)
(contact to advise on DQOs of SAP related to preparation/analytical requirements)

Sampling Program Overview: Wood waste pile debris at the Libby and Troy landfills is slated for processing and disposal. However, because recent results for bark and wood chip samples obtained from within the Libby Asbestos Superfund Site revealed detectable levels of LA asbestos, Lincoln County requested that DEQ analyze samples of the wood waste pile materials for LA asbestos prior to processing and disposal. Tetra Tech will collect composite brush, bark, and manufactured wood product debris samples from the wood waste piles at the Libby and Troy landfills. Bark samples will be collected and analyzed in accordance with *Libby Asbestos Superfund Site Standard Operating Procedure (SOP), Sampling and Analysis of Tree Bark for Asbestos*, Revision 3 (EPA 2012a) (Appendix A). Brush and manufactured wood product debris will be collected and analyzed in accordance with *Libby Asbestos Superfund Site Standard Operating Procedure (SOP), Sampling and Analysis of Duff for Asbestos*, Revision 2 (EPA 2012b) (Appendix A).

1. BARK SAMPLES

Investigative Sample ID Prefix: WW-_ _ _ _ _

Bark Preparation and Analysis Requirements:

Sample Medium (Medium Code)	Preparation Method	Analysis Method	Applicable Laboratory Modifications (current version of)
Bark (A)	Standard Operating Procedure (SOP) EPA-LIBBY-2012-12, Rev. 3 (see Section 6.1)	TEM – Modified ISO 10312: 1995(E) and SOP EPA-LIBBY-2012-12, Rev. 3 (see Section 6.2)	LB-000016, LB-000029, LB-000066, LB-000067, and LB-000085
Brush (B) and Manufactured Wood Product Debris (C)	Standard Operating Procedure SOP EPA-LIBBY-2012-11, Rev. 2 (see Section 6.1)	TEM – Modified ISO 10312: 1995(E) and SOP EPA-LIBBY-2012-11, Rev. 2 (see Section 6.2)	LB-000016, LB-000029, LB-000066, LB-000067, and LB-000085

Medium Code	Medium, Sample Type	Preparation Details				Analysis Details			Applicable Laboratory Modifications (current version of)
		Investi-gative?	Indirect Prep?		Filter Archive ?	Method	Recording Rules	Analytical Sensitivity/ Prioritized Stopping Rules	
			With Ashing	Without Ashing					
A	Bark	Yes	No	No	Yes	TEM in accordance with Modified ISO 10312: 1995(E)	All asbestos; L: >5 µm and AR: ≥ 3:1	Count a minimum of 2 grid openings in each of 2 grids, then continue counting until one is achieved: i) target sensitivity of 100,000 structures per square centimeter of bark (100,000 cm^{-2}) is achieved, ii) 50 LA structures are recorded, iii) or 100 grid openings have been examined without achieving i) or ii) above.	LB-000016, LB-000029, LB-000066, LB-000067, and LB-000085
B, C	Brush and Manufactured Wood Product Debris	Yes	No	No	Yes	TEM in accordance with Modified ISO 10312: 1995(E)	All asbestos; L: >5 µm and AR: ≥ 3:1	Count a minimum of 2 grid openings in each of 2 grids, then continue counting until one is achieved: i) target sensitivity of 10,000,000 structures per gram (dry weight) of brush or debris (1E+07 g^{-1}) is achieved, ii) 50 LA structures are recorded, iii) or 100 grid openings have been examined without achieving i) or ii) above.	LB-000016, LB-000029, LB-000066, LB-000067, and LB-000085

Laboratory Quality Control Sample Frequencies:

TEM [i]: Lab Blank – 4%
Recount Same – 1%
Recount Different – 3%
Verified Analysis – 1%
Repreparation – 1%

PCM[j]: Blind Recount – 10%

PLM[k]: Lab Duplicate (self check) – 2%
Lab Duplicate (cross check) – 8%

(i) See current version of LB-000029 for selection procedure and QC acceptance criteria
(j) See NIOSH 7400 for QC acceptance criteria
(k) See SRC-LIBBY-03 for QC acceptance criteria

Requirements Revision:

Revision #:	Effective Date:	Revision Description
0	5/4/12	N/A

Analytical Laboratory Review Sign-off: